Project Manual for:

GOVERNMENT OF CANADA
WABASCA-DESMARAIS GOVERNMENT BUILDING

PROJECT NO: 9031

VOLUME 1 OF 2
DIVISIONS 00-14

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STEPHENS KOZAK ACI
ARCHITECTS AND PLANNERS

Government of Canada | Gouvernement du Canada

Canada

PROJECT MANUAL

Government of Canada
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Canada

Wabasca- Desmarais Government Building
Project No.: 9031

OWNER
Government of Canada

ARCHITECT
Stephens Kozak - ACI Architects and Planners
17225 - 102 Avenue NW
Edmonton, Alberta, T5S 1J5
Phone: (780) 486-6400
Contact: Trish Bolen

CIVIL ENGINEER
Al-Terra Engineering Ltd.
5307 – 47 Street NW
Edmonton, Alberta, T6B 3T4
Phone: (780) 440-4411
Contact: Thomas Ziegler

LANDSCAPE ARCHITECT
Douglas Walters Landscape Architect Ltd.
130, 3075 – 4th Street
Nisku, Alberta, T9E 8L1
Phone: (780) 955-5009
Contact: Douglas Walters

STRUCTURAL
Protostatix Engineering
1100, 10117 Jasper Avenue
Edmonton, Alberta, T5J 1W8
Phone: (780) 423-5855
Contact: Lindsay Mouser

MECHANICAL
Williams Engineering Canada
200, 10065 Jasper Avenue
Edmonton, Alberta, T5J 3B1
Phone: (780) 409-5300
Contact: Bill Temple

ELECTRICAL
Williams Engineering Canada
200, 10065 Jasper Avenue
Edmonton, Alberta, T5J 3B1
Phone: (780) 409-5300
Contact: Ben Rajewski

VOLUME 1

Document 00 - Procurement and Contracting Requirements

Division 01 - General Requirements

Division 02 - Existing Conditions

Division 03 - Concrete

VOLUME 2

Division 21 - Fire Suppression

Division 22 – Plumbing

Division 23 - Heating, Ventilating and Air Conditioning (HVAC)

Division 32 - Exterior Improvements

Division 33 – Utilities

END OF SECTION

1. GENERAL

.1 Drawings listed herein and appended to this Section apply to the Work of the Contract generally and form part of Contract Documents.

2. DRAWINGS

NUMBER	NAME/TITLE
CIVIL	
C1.0	GRADING & DRAINAGE PLAN
C1.1	UNDERGOUND SERVICING PLAN
C1.2	TYPICAL DETAILS PLAN
LANDSCAPE	
L-1	LANDSCAPE PLAN
ARCHITECTURAL	
A1.0	OVERALL SITE PLAN
A1.1	PARTIAL SITE PLAN
A1.2	OUT BUILDING PLAN AND DETAILS
A1.3	SITE DETAILS
A2.1	MAIN FLOOR FIRE, SECURITY AND ACOUSTIC PLAN
A2.2	MAIN FLOOR PLAN
A2.3	ROOF PLAN
A2.4	REFLECTED CEILING PLAN
A3.1	EXTERIOR ELEVATIONS
A3.2	EXTERIOR ELEVATIONS, PATIO PLAN AND SECTIONS
A4.1	BUILDING SECTIONS
A4.2	BUILDING SECTIONS
A5.1	WALL SECTIONS
A5.2	WALL SECTIONS
A5.3	WALL SECTIONS
A5.4	WALL SECTIONS
A5.5	PARTIAL WALL SECTIONS AND DETAILS
A6.1	WASHROOM FLOOR PLANS AND INTERIOR ELEVATIONS
A6.2	ENLARGED FLOOR PLANS
A6.3	ENLARGED FLOOR PLANS INTERIOR ELEVATIONS
A6.4	MISCELLANEOUS FLOOR PLANS AND DETAILS
A6.5	ENLARGED MILLWORK PLANS, ELEVATIONS AND SECTIONS
A6.6	INTERIOR SECTIONS AND DETAILS
A7.1	INTERIOR ELEVATIONS
A7.2	INTERIOR ELEVATIONS
A7.3	INTERIOR ELEVATIONS
A7.4	RECEPTION MILLWORK PLANS AND DETAILS
A7.5	RECEPTION MILLWORK PLANS AND DETAILS
A7.6	MILLWORK SECTIONS
A8.1	PLAN DETAILS AND SECTIONS
A8.2	INTERIOR PLAN DETAILS

A8.3	ROOF DETAILS
A9.1	DOOR SCHEDULE AND DOOR AND WINDOW ELEVATIONS
A9.2	DOOR SECTIONS AND DETAILS
A9.3	WINDOW SECTIONS AND DETAILS
A9.4	DOOR AND WINDOW SECTIONS AND DETAILS
A10.1	FINISHES PLAN
A10.2	FURNITURE PLAN
A10.3	SIGNAGE DATILS

STRUCTURAL

S1.1	GENERAL NOTES
S1.2	TYPICAL FOUNDATION DETAILS
S1.3	TYPICAL FOUNDATIONS & FRAMING DETAILS
S1.4	TYPICAL STEEL FRAMING DETAILS
S1.5	TYPICAL MASONRY FRAMING DETAILS
S1.6	SCHEDULES, MASONRY COLUMNS & BASE PLATE DETAILS
S1.7	OUT BUILDING PLANS
S1.8	OUT BUILDING SECTIONS
S2.1	PILE LAYOUT PLAN
S3.1	FOUNDATION PLAN
S3.2	MAIN FLOOR SLAB & CONTROL JOINT LAYOUT PLAN
S3.3	MAIN FLOOR SLAB ELEVATION PLAN
S4.1	CONCRETE CAP PLAN AND MASONRY WALL REINFORCEMENT PLAN
S5.1	ROOF FRAMING PLANS
S5.2	CANOPY & CLERESTORY FRAMING PLANS
S5.3	SNOW PILING, WIND UPLIFT & WATER PONDING PLAN
S6.1	CONCRETE PIER DETAILS
S6.2	CONCRETE PIER DETAILS
S6.3	FOUNDATION SECTIONS
S6.4	FOUNDATION SECTIONS
S6.5	FOUNDATION SECTIONS
S7.1	FRAMING SECTIONS
S7.2	FRAMING SECTIONS
S7.3	FRAMING SECTIONS
A7.4	FRAMING SECTIONS
A7.5	FRAMING SECTIONS
A7.6	FRAMING SECTIONS
A7.7	FRAMING SECTIONS
S8.1	STRUCTURAL STEEL ELEVATIONS

MECHANICAL

M1.0	MECHANICAL SITE PLAN AND LEGEND
M2.0	FOUNDATION PLUMBING PLAN
M2.1	MAIN FLOOR PLUMBING PLAN
M3.0	MAIN FLOOR HEATING AND COOLING PLAN
M4.0	MAIN FLOOR VENTILATION PLAN
M4.1	MAIN FLOOR VENTILATION SECTIONS
M5.0	MAIN FLOOR FIRE PROTECTION
M6.0	MECHANICAL ROOM PLAN
M7.0	MECHANICAL ROOF PLAN
M8.0	MECHANICAL SCHEMATICS
M8.1	MECHANICAL SCHEMATICS

M8.2	MECHANICAL DETAILS
M8.3	MECHANICAL DETAILS
M9.0	MECHANICAL SCHEMATICS
M9.1	MECHANICAL SCHEMATICS

ELECTRICAL

E1.1	ELECTRICAL SITE PLAN
E2.0	MAIN FLOOR POWER & DATA PLAN
E2.1	ELECTRICAL ROOF PLAN
E3.0	MAIN FLOOR LIGHTING PLAN
E3.1	LUMINARE SCHEDULE
E4.0	MAIN FLOOR LIFE SAFETY PLAN
E5.0	ELECTRICAL SINGLE LINE DIAGRAM & SCHEDULES
E6.0	ELECTRICAL PANEL SCHEDULES
E6.1	ELECTRICAL PANEL SCHEDULES
E6.2	MECHANICAL EQUIPMENT & LIGHTING CONTROL SCHEDULES
E7.0	ELECTRICAL DETAILS

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Information Documents means information of any type and in any form, related to the Project and identified in this Section as such.

.2 Contractor is synonymous with Bidder.

1.2 STATUS OF INFORMATION DOCUMENTS

.1 Information Documents, or any part thereof, are not part of the Contract unless specifically incorporated into Contract Documents by means of copying, transcribing or referencing.

1.3 USE OF AND RELIANCE UPON INFORMATION DOCUMENTS

.1 Information Documents are made available to Bidder by Owner for the purpose of providing Bidder with access to information available to Owner.

.2 Information Documents shall not be considered a representation or warranty that information contained therein is accurate, complete or appropriate.

.3 Bidder shall interpret and draw its own conclusions about Information Documents and is encouraged to obtain specialist advice with respect thereto. Owner assumes no responsibility for such interpretations and conclusions.

.4 Information contained in Information Documents may be time sensitive and dates shall be considered when interpreting Information Documents. Queries/Addenda

.5 Bidder may rely upon the data contained in Information Documents, or parts thereof, which are specifically incorporated into Contract Documents by means of copying, transcribing or referencing, but shall draw his own conclusions from such data and shall not rely on opinions or interpretations contained therein.

1.4 INFORMATION DOCUMENTS INCORPORATED INTO CONTRACT DOCUMENTS

.1 Information Documents incorporated into Contract Documents, in whole or in part, consist of the following:

.1 Geotechnical Report entitled “GOVERNMENT BUILDING LOT 8, BLOCK 15, PLAN 972-3974, WABASCA-DESMARAIS, ALBERTA GEOTECHNICAL INVESTIGATION”, dated November 29, 2016, prepared by THURBER ENGINEERING LTD. and consisting of 44 PAGES. This Information Document is hereby incorporated into the Contract Documents in its entirety. This document is issued with the Bid Documents.

.2 Geotechnical Memorandum entitled “GOVERNMENT BUILDING WABASCA-DESMARAIS, ALBERTA SLAB RECOMMENDATION – ADDENDUM 1”, dated February 21, 2017, prepared by THURBER ENGINEERING LTD. and consisting of 1 PAGE. This Information

Document is hereby incorporated into the Contract Documents in its entirety. This document is issued with the Bid Documents.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises, but is not limited to, general construction of a single storey building, out-building and related site work located in the Municipal District of Opportunity No. 17.

.2 Work includes construction of an approximately 1140m^2 main building and 62m2 unheated out building. Site work includes stripping topsoil, importing new fill for grading, access routes, concrete walks, paving, out-buildings, stormwater control outlet, metal fencing with rough-ins for future operable gates, garbage and recycling enclosure, parking signs and finishes, and landscaping.

1.2 CONTRACT METHOD

.1 Construct Work under stipulated price contract.

.2 Relations and responsibilities between Contractor and subcontractors and suppliers assigned by Owner are as defined in Conditions of Contract. Assigned Subcontractors must, in addition:

.1 Furnish to Contractor, bonds covering faithful performance of subcontracted work and payment of obligations there under when Contractor is required to furnish such bonds to Owner.

.2 Purchase and maintain liability insurance to protect Contractor from claims for not less than limits of liability which Contractor is required to provide to Owner.

1.3 WORK BY OTHERS

.1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from them.

.2 Co-ordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to the Owner, in writing, any defects which may interfere with proper execution of Work.

1.4 CONTRACTOR USE OF PREMISES

.1 Contractor and sub-trades have unrestricted use of the project until Interim Acceptance/Substantial Performance.

.2 After Substantial Performance of the Work is achieved the construction site is considered a secure work site. The Contractor, sub-trades and all personnel requiring access to the secure work site, must arrange access to the building with the Detachment Commander at least 48hrs in advance and have FA-2 clearance. General Contractors - Prime, Mechanical and Electrical - will require an increased level, RRS clearance.

1.5 EXISTING SERVICES

.1 Where Work involves connecting to existing services, carry out work at times as directed by governing authorities with minimum disturbance to pedestrian and vehicular traffic.

.2 Provide alternative routes for personnel pedestrian and vehicular traffic.

.3 Establish location and extent of service lines in area of work before starting Work.

.4 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.

.5 Where unknown services are encountered, immediately advise Owner and confirm findings in writing.

.6 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

.7 Record locations of maintained, re-routed and abandoned service lines.

.8 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.6 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy each document as follows:

.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Reviewed Shop Drawings.
.5 List of Outstanding Shop Drawings.
.6 Change Orders.
.7 Other Modifications to Contract.
.8 Field Test Reports.
.9 Copy of Approved Work Schedule.
.10 Health and Safety Plan and Other Safety Related Documents.
.11 Building and work permits required to complete the Work.
.12 Other documents as specified.

1.7 SECURITY CLEARANCE

.1 Personnel employed on this project will be subject to security check. Obtain clearance, as instructed, for each individual who will require entrance to premises.

1.8 SECURITY ESCORT

.1 Personnel employed on this project must be escorted when executing work in non-public areas during normal working hours. Personnel must be escorted in all areas after normal working hours.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 Unit Price quotations shall be provided by Contractor to the appropriate spaces in the Bid Form for each Unit Price item of Work described herein.

.2 Unit Prices stated in the Agreement shall be used to compute adjustments of the Contract Sum for approved Unit Price items of Work. Such adjustments shall be made by Change Order.

.3 Unit Prices shall include all labour, materials, tools, and equipment; all other direct and indirect costs necessary to complete the item of Work and to coordinate the Unit Price Work with adjacent Work; and shall include all overhead and profit. Contractor shall accept compensation computed in accordance with the Unit Prices for work installed in place as full compensation for furnishing such Work.

.4 Compensation will be paid for those zitems of Work described in below Unit Prices.

1.2 SPECIFIED WORK

.1 Applicable sections describe the materials and methods required under the various Unit Price items of Work.

1.3 UNIT PRICES

.1 List of Unit Price Items and Description:

.1 Section 31 63 23 - Bored Concrete Piles.

.1 Supply and installation of pile casings per lineal metre.

.2 Diameter of pile casings as noted on drawings. Provide separate Unit Prices for all diameters noted.

1.4 ADVANCE COORDINATION

.1 Immediately notify Owner when conditions require the use of Unit Price items of Work.

.2 The applicability of, measurement methods for, documentation of, and the final adjustment of the Contract Sum for Unit Price items of Work shall be by the Owner.

.3 After performing Unit Price items of Work as directed by the Owner, Contractor shall take necessary measurements in the presence of Owner and shall submit calculations of quantities to Owner for approval. Contractor shall notify Owner two (2) days in advance of taking measurements.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 08 36 13.02 – Sectional Metal Doors

.2 Section 32 31 13 – Chain Link Fence

1.2 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 23-2005, A Guide to Calling Bids and Awarding Contracts.

1.3 REQUIREMENTS

.1 Referenced specification Sections stipulate pertinent requirements for products and methods to achieve Work stipulated under each Alternative.

.2 Co-ordinate affected related Work and modify surrounding Work to integrate Work under each Alternative.

1.4 AWARD/SELECTION OF ALTERNATIVES

.1 Indicate variation of Bid Price for Alternatives described below and listed in Bid Form. Note that this form requests a 'difference' in Bid Price by adding to or deducting from base Bid price.

.2 Bids will be evaluated on 'Base Bid' price. After determination of Bidder, consideration will be given to Alternatives and Bid Price adjustments.

1.5 ALTERNATIVES

.1 Alternative No. 1:

.1 Base Bid: Chainlink fences as shown as “fenced enclosure” on drawing A1.1 and as specified in Section 32 31 13 Chainlink Fences.

.2 Alternative: Engineered high tensile industrial Quonset building, X-Model, 12m wide x 18m long x 5m high, galvanized steel finish. Quonset to have opening for overhead door 3.6m wide x 3.6m high. Include overhead door as per Section 08 36 13.02 Sectional Metal Doors.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 CHANGE ORDER PROCEDURES - LUMP SUM METHOD OF VALUATION

.1 Consultant will issue a “Contemplated Change Notice” (a notice of proposed change) to the Contractor.

.2 Contractor shall submit an adjustment to the Approved Construction Budget, increase, decrease, or no change in the Contract Price on account of the proposed change in the Work and any adjustment to the Contract Time, if any for the proposed Work.

.3 Include in Contractor Proposal a detailed breakdown of lump sum increase or decrease, indicating Contractor’s, Subcontractors' and Sub-subcontractors':

.1 Material cost.

.2 Total labour cost, including a further breakdown indicating for each trade and trade classification involved, labour rate for total labour cost and number of hours.

.3 Other costs, if any, included in actual cost of material and labour**.**

.4 Overhead cost and profit.

.4 Include in Contractor’s Proposal only labour rates, in writing, for work performed during regular working hours.

.5 Upon Owner's approval and acceptance of adjustment to the Approved Construction Budget, Owner will issue a "Change Order" to Contractor.

Products

NOT USED

Part 2

Execution

2.1

Part 3

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by Owner or specified under various sections.

1.2 APPOINTMENT AND PAYMENT

.1 Owner will appoint and pay for services of testing laboratory except as follows:

.1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.

.2 Inspection and testing performed exclusively for Contractor's convenience.

.3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.

.4 Mill tests and certificates of compliance.

.5 Tests specified to be carried out by Contractor under the supervision of Contract Manager.

.6 Tests specified to be carried out by Contractor in various specifications sections.

.7 Additional tests required as follows:

.1 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, costs for additional tests or inspections as required by Contract Manager to verify acceptability of corrected work will be paid for by the Contractor.

1.3 CONTRACTOR'S RESPONSIBILITIES

.1 Provide labour, equipment and facilities to:

.1 Provide access to Work for inspection and testing.

.2 Facilitate inspections and tests.

.3 Make good Work disturbed by inspection and test.

.4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.

.2 Notify Consultant sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.

.3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.

.4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and reviewed by Contract Manager.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 Contractor will schedule and administer project meetings on a bi-weekly basis throughout the progress of the work. Additional meetings may be required, at the discretion of the Owner.

.2 Contractor will prepare agenda for meetings.

.3 Contractor will provide notice to sub-consultants of meeting dates. Contractor will provide notice to subtrades of meeting dates.

.4 Contractor to provide physical space and make arrangements for meetings.

.5 Contractor will preside at meetings.

.6 Contractor will record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.7 Contractor will reproduce and distribute copies of minutes within four (4) days after meetings and transmit to Consultant and Owner. Contractor will distribute meeting minutes to all subtrades.

.8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

.1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and clarify administrative procedures and responsibilities.

.2 Senior representatives of Owner, Prime Consultant, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.

.3 Establish time and location of meeting and notify parties concerned minimum five (5) days before meeting.

.4 Agenda to include:

.1 Appointment of official representative of participants in the Work.

.2 Schedule of Work: in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.

.3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.

.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.

.5 Delivery schedule of specified equipment in accordance with Section 01 32 16.07 - Construction Progress Schedules – Bar (GANTT) Chart.

.6 Site security in accordance with Section 01 56 00 Temporary Barriers and Enclosures.

.7 Proposed notices of change, change orders, procedures, approvals and reviews required, mark-up percentages permitted, time extensions, overtime, administrative requirements.

.8 Owner provided products.

.9 Record drawings in accordance with Section 01 78 39 Project Record Documents.

.10 Maintenance manuals in accordance with Section 01 78 23 Operation and Maintenance Data and Manuals.

.11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.

.12 Monthly progress claims, administrative procedures, photographs, holdbacks.

.13 Appointment of inspection and testing agencies or firms.

.14 Insurances, transcript of policies.

.15 Waste Management Plan in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

1.3 PROGRESS MEETINGS

.1 During course of Work and two (2) weeks prior to project completion, schedule biweekly progress meetings. Additional progress meetings may be required, at the discretion of the Owner.

.2 Owner, Prime Consultant, Sub-consultants, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance. Attendance of Subcontractors and Sub-consultants will be requested based on stages of construction requiring respective representation.

.3 Prime Consultant will record minutes of meetings and circulate to Contractor and Owner within three (3) business days after meeting. Contractor to distribute meeting minutes to subcontractors.

.4 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for affect on construction schedule and on completion date.

.12 Other business.

1.4 PRE-INSTALLATION MEETINGS

.1 During course of Work meetings are to be coordinated between Consultants, Contractors and Sub-contractors for materials and equipment prior to installation. Technical Sections will state when and what is required for the pre-installation meeting.

1.5 WARRANTY MEETINGS

.1 Warranty meetings will be held on as 'as needed' basis between Substantial Performance of the Work and Total Performance of the Work to bring to Contractor's attention Deficiencies identified during warranty period, determine action required for their correction, monitor progress of Contract Deficiency correction.

.2 Contractor will record minutes of meetings and circulate to Consultant and Owner within four (4) days after meeting. Contractor to distribute meeting minutes to subcontractors.

.3 The location of these meetings will be as agreed between the Owner, Prime Consultant and the Contractor.

.4 Contractor, major Subcontractors involved in Work and Owner and Contract Manager are to be in attendance.

.1 Owner and Prime Consultant representatives as determined by Owner and Prime Consultant.

.5 Agenda to include the following:

.1 Review of progress of Deficiency correction.

.2 Identification of problems impeding Deficiency correction.

.3 Review of outstanding Deficiencies.

.4 Review of building, assemblies, and systems for warranty repairs and corrections.

.5 Other business.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, work package, or activity), plus or minus accepted scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide five (5) day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.6 Master Plan: summary-level schedule that identifies major activities and key milestones.

.7 Milestone: significant event in project, usually completion of major deliverable.

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.9 Project Planning, Monitoring and Control System: overall system operated by Contract Manager to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

.1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately ten (10) working days, to allow for progress reporting.

.4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Acceptance and Substantial Performance as defined times of completion are of essence of this contract.

1.3 CONTRACTOR SCHEDULING

.1 The Contractor is to refer to the Contract Documents when compiling the Bar (GANTT) Chart.

.2 The Construction Milestones to be incorporated into the schedule provided by the Contractor. Time durations listed for work to be performed by the Contractor are approximate and are subject to change. Appropriate durations for all milestones listed must be included in the Contractor's schedule as a minimum.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.

.2 Submit to Owner within ten (10) working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

.3 Submit Project Schedule to Owner within five (5) working days of receipt of acceptance of Master Plan.

1.5 MASTER PLAN

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 Owner will review and return revised schedules within five (5) working days.

.3 Revise impractical schedule and resubmit within five (5) working days.

.4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.6 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:

.1 Award.
.2 Shop Drawings, Samples.
.3 Permits.
.4 Mobilization.
.5 Excavation.
.6 Backfill.
.7 Building footings.
.8 Slab on grade.
.9 Structural Steel.
.10 Siding and Roofing.
.11 Interior Architecture (Walls, Floors and Ceiling).
.12 Plumbing.
.13 Lighting.
.14 Electrical.

.15 Piping.
.16 Controls.
.17 Heating, Ventilating, and Air Conditioning.
.18 Millwork.
.19 Fire Systems.
.20 Testing and Commissioning.
.21 Paving.
.22 Supplied equipment long delivery items.
.23 Engineer supplied equipment required dates.
.24 Operation and maintenance manuals.
.25 Construction as-built drawings.

1.7 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on a monthly basis reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.8 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current accepted dates shown on baseline schedule.

Part 2 Products

.1

2.2 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 78 00 – Closeout Submittals

.2 Section 01 79 00 – Demonstration and Training

1.2 ADMINISTRATIVE

.1 Submit to Consultant submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being reviewed and considered rejected.

.6 Notify Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are co-ordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.

.10 Keep one (1) reviewed copy of each submission on site.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada. Flag poles shop drawings to be stamped and signed by professional engineer registered and licensed in Ontario, Canada.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which

adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow sufficient time, ten (10) business days minimum, for review of each submission by Consultant.

.5 Adjustments made on shop drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.6 Make changes in shop drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of revisions other than those requested.

.7 Accompany submissions with transmittal letter, electronically, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.8 Submissions include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.

.9 After Consultant's review, distribute electronic copies.

.10 Submit electronic copies of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.

.11 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Consultant.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within 3 years of date of contract award for project.

.13 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Consultant.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by Consultant.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Consultant.

.16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.17 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Consultant.

.18 Delete information not applicable to project.

.19 Supplement standard information to provide details applicable to project.

.20 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.4 SAMPLES

.1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to business address of Consultant.

.3 Notify Consultant in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

.5 Adjustments made on samples by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.6 Make changes in samples which Consultant may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.5 MOCK-UPS

.1 Erect mock-ups in accordance with 01 45 00- Quality Control.

1.6 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2008 Stipulated Price Contract.

.2 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities, Chapter 3.

.2 EPA General Construction Permit (GCP) 2012.

1.2 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

.3 Waste Management Plan: the Contractor's written comprehensive overview the Contractor and the subcontractors will follow to reduce the production of waste through processes, planning, scheduling of subcontractors and materials, reducing contamination of work materials, and other methods the Contractor can derive from the Work.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for

.1 Sediment control materials.

.2 Submit electronic copies of WHMIS MSDS in accordance with this section.

.3 Submit Volatile Organic Compound (VOC) content information in accordance with South Coast Air Quality Management District (SCAQMD) Rules 1113 and 1168 for paints, coatings, sealants, and adhesives.

.3 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and acceptance by Consultant.

.4 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.

.5 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.6 Include in Environmental Protection Plan:

.1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.

.2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.

.3 Names and qualifications of persons responsible for training site personnel.

.4 Descriptions of environmental protection personnel training program.

.5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations and EPA 832/R-92-005, Chapter 3.

.6 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.

.7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.

.1 Plans to include measures to minimize amount of material transported onto paved public roads by vehicles or runoff.

.8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.

.1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.

.9 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

.11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.

.12 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

.13 Waste Water Management Plan identifying methods and procedures for management discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

.14 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.

.15 Pesticide treatment plan to be included and updated, as required.

1.4 FIRES

.1 Fires and burning of rubbish on site is not permitted.

1.5 DRAINAGE

.1 Develop and submit erosion and Sediment Control Plan (ESC) identifying type and location of erosion and sediment controls provided. Plan to include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations EPA 832/R-92-005, Chapter 3.

.2 Storm Water Pollution Prevention Plan (SWPPP) to be substituted for erosion and sediment control plan.

.3 Provide temporary drainage and pumping required to keep excavations and site free from water.

.4 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.

.5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.6 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this Contract.

.2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.

.1 Provide temporary enclosures where directed by Consultant.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.7 NOTIFICATION

.1 Contractor will be notified in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.

.2 Contractor: after receipt of such notice, inform Owner and Consultant of proposed corrective action.

.1 Take action only after receipt of written approval by authority having jurisdiction.

.3 Owner has the authority to issue a stop order of work until satisfactory corrective action has been taken.

.4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

.2 Do not bury rubbish and waste materials on site.

.3 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.5 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES AND CODES

.1 Perform Work in accordance with Alberta Building Code (ABC) and the National Building Code of Canada (NBC), including amendments up to bid closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.2 AUTHORITY HAVING JURISDICTION

.1 For this project the Authority having Jurisdiction is the Fire Protection Engineer of Canada.

1.3 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions and municipal by-laws.

.2 No smoking is to take place within the building once the installation of exterior sheathing and roof deck has started.

.3 Designated one (1) smoke on site, provided outside of the building at least 10 m away from the building footprint.

.4 Provide temporary signage indicating smoke area.

1.4 BUILDING PERMITS

.1 The Contractor shall, within one (1) month from the date of the Contract, provide Building Permit Application to the municipal authority including required fees associated to construction value of the Work. All fees and charges associated with processing the Building Permit are the responsibility of the Contractor.

.2 The Contractor shall notify the Owner within ten (10) days of the application review whether or not the municipal authority approved the building permit.

.3 If the municipal authority did not approve the building permit, the Contractor will provide the Owner with the fees required for the Owner to apply for the building permit.

.4 For the purposes of this section, "municipal authority" means the authority which would have jurisdiction respecting permission to contract the Work if the Owner of the Work were not Canada.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSPECTIONS

.1 Allow inspectors hired by the Contractor access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or acceptance by inspectors, or instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work, at no additional cost to the Owner.

.4 Consultant may order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Owner shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by Owner for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Owner except as noted otherwise within individual specifications sections, and as noted in Section 01 29 83 Payment Procedures: Testing Laboratory Services.

.2 Provide equipment required for executing inspection and testing by appointed agencies.

.3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Consultant. Pay costs for additional testing, retesting and re-inspection.

1.3 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.4 PROCEDURES

.1 Notify appropriate agency and Consultant in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.5 REJECTED WORK

.1 Immediately remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Consultant as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in opinion of Consultant and Owner it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Consultant.

1.6 REPORTS

.1 Submit inspection and test reports to Consultant. Where hard copies are submitted to the General Contractor, the General Contractor will scan them and submit them electronically to the Consultant via CAIS.

.2 Provide copies to subcontractor of work being inspected or tested and/or manufacturer or fabricator of material being inspected or tested.

1.7 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs to Consultant.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work may be authorized by Consultant. Costs for such additional tests will be authorized as recoverable upon permission and agreement of Owner and Consultant.

1.8 MOCK-UPS

.1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.

.2 Construct in locations acceptable to Consultant as specified in specific Section.

.3 Prepare mock-ups for Consultant 's review with reasonable promptness and in orderly sequence, to not cause delays in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.9 MILL TESTS

.1 Submit mill test certificates as required of specification Sections.

1.10 EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

.2 Refer to Section 01 91 13 General Commissioning Requirements for definitive requirements.

1.11 THERMOSCAN

.1 A thermo-scan of the building may be conducted by Owner. Arrange sequencing of work to allow thermo-scan of entire building to be conducted prior to application of cladding.

.2 If thermo-scan reveals failure to achieve a satisfactory building envelope seal, the cost of the remedial work and of re-testing to verify the effectiveness of the remedial work will be borne by the Contractor.

1.12 ACOUSTIC

.1 Acoustic testing of the STC rated assemblies to be conducted by the Contractor prior to Interim Acceptance. Satisfactory performance of the acoustic assemblies is a prerequisite to Interim Acceptance. A field test acoustic rating of at least STC 46 must be achieved for each component.

.2 If acoustic testing reveals failure to achieve the specified minimum STC rating, the cost of the remedial work and of re-testing to verify the effectiveness of the remedial work will be borne by the contractor.

1.13 FIRE STOPPING

.1 Fire-rated separations as noted in documents will be reviewed by Consultant.

.2 If fire ratings are suspected to not be continuous the Consultant can request an assembly be disassembled to review Work is in accordance to the Contract Documents or to hire an independent examination. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Owner shall pay cost of examination and replacement.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

.1 Provide temporary utilities and controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.2 DEWATERING

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.3 WATER SUPPLY

.1 Provide and pay for temporary water required during construction. Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.

1.4 TEMPORARY HEATING AND VENTILATION

.1 Provide and pay for temporary heating required during construction period, including attendance, maintenance and fuel.

.2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.

.3 Provide temporary heat and ventilation in enclosed areas as required to:

- .1 Facilitate progress of Work.
- .2 Protect Work and products against dampness and cold.
- .3 Prevent moisture condensation on surfaces.
- .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
- .5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress in enclosed areas.

.5 Ventilating:

- .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
- .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.

.6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.6 Subject to prior approval from the Consultant, the permanent heating system of building, may be used when available, provided guarantees are not effected. Be responsible for damage to heating system if use is permitted.

.7 On completion of Work for which permanent heating system was permitted, clean entire system and replace all filters, immediately prior to Interim Acceptance inspection. Cleaning the system and replacing filters is a pre-requisite of Interim Acceptance.

.8 Ensure warranties for heating system do not commence until Date of Interim Acceptance.

.9 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

.10 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.5 TEMPORARY POWER AND LIGHT

.1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools.

.2 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.

.3 Power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.

.4 Provide and maintain temporary lighting throughout project. Ensure level of illumination in all areas is not less than 162 lx.

.5 Subject to prior approval of the Consultant, electrical power and lighting systems installed under this Contract may be used for construction requirements provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace all lamps prior to Interim Acceptance.

1.6 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary telephone, fax and data hook up, lines and equipment necessary for own use and use of Consultant.

1.7 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on site.

1.8 ELECTRONIC COMMUNICATION

.1 The CAISnet Communications Server (Caisnet) will be the means of electronic communication between the Owner, Consultant and Contractor on this project.

.2 Caisnet will be the method of distribution of all documentation (e.g. minutes of meetings, contemplated change notices, etc.) except original documents requiring seals.

.3 The General Contractor and the following designated Sub-Contractors shall pay for, and have an active account on CAISnet for the duration of the contract, including the warranty period: Structural Steel and Fabrications, Masonry, Millwork and Wood Doors, Roofing, Hollow Metal Doors and Frames, Windows and Glazing, Drywall and Acoustic Ceilings, Resilient Flooring, Painting and Special Coatings, Mechanical and Electrical.

.4 The General Contractor and the designated Sub-Contractors will require a computer with high speed internet capability both in their office and on site, and shall arrange for installation of, and pay for access to Caisnet for the duration of the project until Final Acceptance.

.5 All parties shall be responsible for checking Caisnet on a daily basis to ensure that they are familiar with all current communications.

.6 Failure to check Caisnet on a daily basis to ensure all parties are in receipt of, and familiar with the content of, current communications shall not be valid cause for a claim against the Owner or Consultant.

.7 Sub-contractors not designated to participate in the electronic communications method are encouraged to participate in the programme. Contact Rendek Communications Inc. For information and costs pertaining to a Caisnet account for the duration of the project and the warranty period. TEL: 780 452 0025 or toll free at 888 288 0025.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 31 19 - Project Meetings

1.2 REFERENCE STANDARDS

.1 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.

1.4 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area, temporary site sign, and details of fence installation.

.2 Identify areas which have to be gravelled to prevent tracking of mud.

.3 Indicate use of supplemental or other staging area.

.4 Provide construction facilities in order to execute work expeditiously.

.5 Remove from site all such work after use.

1.5 SCAFFOLDING

.1 Scaffolding in accordance with CAN/CSA-S269.2.

.2 Provide and maintain scaffolding, ramps, swing staging, platforms, ladders, and temporary stairs.

1.6 HOISTING

.1 Provide, operate and maintain hoist cranes required for moving of materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.

.2 Hoist cranes to be operated by qualified operator.

1.7 SITE STORAGE/LOADING

.1 Refer to CCDC 2, GC 3.12.

.2 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

.3 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.8 CONSTRUCTION PARKING

.1 Parking will be permitted on site provided it does not disrupt performance of Work.

.2 Provide and maintain adequate access to project site.

.3 Clean runways and taxi areas where used by Contractor's equipment.

1.9 SECURITY

.1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.10 OFFICES

.1 Provide office heated, lighted to 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.

.2 Provide marked and fully stocked first-aid case in a readily available location.

.3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

.4 Site office.

- .1 Provide temporary office for use by Contractor and by team as necessary.
- .2 Insulate building and provide heating system to maintain 22 degrees C inside temperature at -20 degrees C outside temperature.
- .3 Finish inside walls and ceiling with plywood, hardboard or wallboard and paint in selected colours. Finish floor with 19 mm thick plywood.
- .4 Provide private washroom facilities adjacent to office complete with chemical type toilet, lavatory and mirror and maintain supply of paper towels and toilet tissue.
- .5 Equip office with table, chairs, shelving, filing cabinet, plan rack and coat rack and shelf.
- .6 Maintain in clean condition.

1.11 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.12 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

.3 When permanent water and drain connections are completed, permanent facilities are not to be used.

1.13 CONSTRUCTION SIGNAGE

.1 Temporary project identification sign to be constructed of aluminum panel with vinyl text, provided on wood posts as per detail in section 01 52 00.01. Graphics to be provided by Owner to Contractor.

.2 Construction signs provided by Contractor, subcontractors and consultants may be fastened to temporary construction fencing.

.3 No other signs or advertisements, other than warning signs, are permitted on site.

.4 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321.

.5 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Owner.

1.14 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.2 Maintain and protect traffic on affected roads during construction period.

.3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs

.4 Protect travelling public from damage to person and property.

.5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.

.7 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

.8 Dust control: adequate to ensure safe operation at all times.

.9 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.

.10 Provide snow removal during period of Work.

1.15 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

.3 Store materials resulting from demolition activities that are salvageable.

.4 Stack stored new or salvaged material not in construction facilities.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

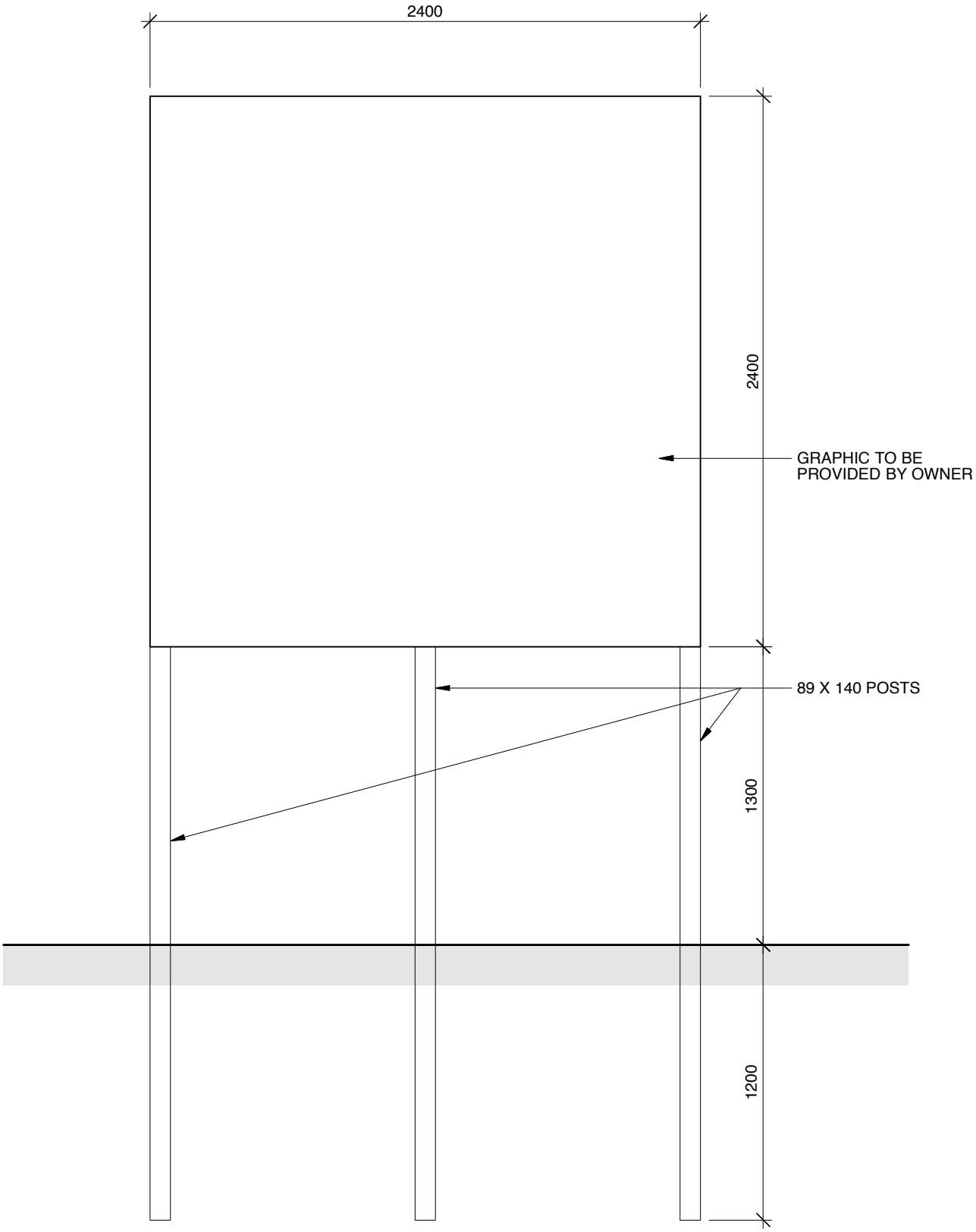
3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION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Part 1 General

1.1 INSTALLATION AND REMOVAL

.1 Provide temporary barriers and enclosures in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.2 HOARDING

.1 Erect temporary site enclosures using panelized chain link or weld-mesh fence to a minimum height of 2100mm around the perimeter of the entire site.

.2 Provide one lockable truck entrance gate and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.

.3 Maintain public side of enclosure in clean condition.

.4 Maintain fence in good repair.

1.3 GUARDRAILS AND BARRICADES

.1 Provide secure, rigid guardrails and barricades around deep excavations, open shafts, open stairwells, open edges of floors, roofs and steep slopes.

.2 Provide as required by governing authorities.

1.4 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

.3 Design enclosures to withstand wind pressure and snow loading.

1.5 DUST TIGHT SCREENS

.1 Provide dust tight screens or insulated partitions to localize dust-generating activities, and for protection of workers, finished areas of Work and public.

.2 Maintain and relocate protection as required until such work is complete.

1.6 ACCESS TO SITE

.1 Provide and maintain access roads, ramps and construction runways as may be required for access to Work.

1.7 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

1.8 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.10 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Be responsible for damage incurred due to lack of or improper protection.

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of waste material in accordance with all regulations and local bylaws, and in accordance with Section 01 74 21 Construction/Demolition Waste Management And Disposal.

.2 Conform to sustainability requirements as stipulated in Section 01 35 43 – Environmental Procedures.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 QUALITY

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality (consistent with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous site reviews. Site reviews do not relieve Contractor of responsibility, but is a precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Acceptable Products/Materials means those items named and specified by manufacturer's reference, meet the specifications in all respects and are acceptable to the Consultant.

.4 No Substitutions: all products listed as "no substitutions" in various sections shall be supplied as specified.

.5 Should disputes arise as to quality or fitness of products, decision rests strictly with Consultant based upon requirements of Contract Documents.

.6 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.7 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

.8 Only security and detention equipment approved by Protective Services is to be used. No exceptions allowed. Written confirmation of Protective Services approval of product or material is to be provided with respective shop drawings and upon the request of the Consultant.

.9 Conflicting product/material information in the drawings and specifications is to be brought to the Consultant 's attention for clarification during the tender period, otherwise the most stringent product/material requirements as determined by the Consultant, will apply.

1.2 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Consultant reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.3 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials, lumber and gypsum board on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of Consultant.

.9 Touch-up damaged factory finished surfaces to Consultant's satisfaction. Use touch-up materials to match original. Do not paint over nameplates.

1.4 TRANSPORTATION

.1 Pay costs of transportation of products required in performance of Work.

.2 Transportation cost of products supplied by Owner will be paid for by Owner. Unload, handle and store such products.

1.5 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

.2 Notify Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that Consultant will establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Consultant to require removal and re-installation at no increase in Contract Price or Contract Time.

1.6 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Consultant if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in the required duties. Consultant reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Consultant, whose decision is final.

1.7 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.8 CONCEALMENT

.1 In finished areas conceal pipes, ducts and conduit in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation inform Consultant if there is interference. Install as directed by Consultant.

1.9 REMEDIAL WORK

.1 Immediately perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.10 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Consultant of conflicting installation. Install as directed.

1.11 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

.7 All exposed fasteners in rooms 140 to 174 to be Protective Services approved Torx head security fasteners. Supply two (2) compatible tools complete with fasteners in accordance with Section 01 78 00 - Closeout Submittals.

1.12 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

.5 All exposed fasteners in rooms 140 to 174 to be Protective Services approved Torx head security fasteners. Supply two (2) compatible tools complete with fasteners in accordance with Section 01 78 00 - Closeout Submittals.

1.13 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated, without written approval of Engineer of Record.

1.14 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum disturbance to Work, and pedestrian and vehicular traffic.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Substitutions during bidding period: Instructions to Bidders.

1.2 DEFINITIONS

.1 Proprietary specification means a specification which includes one or more proprietary names of products or manufacturers, or both, and may also include descriptive, reference standard, or performance requirements, or any combination thereof.

.2 Non-proprietary specification means a specification which includes descriptive, reference standard or performance requirements, or any combination thereof, but does not include proprietary names of products or manufacturers.

.3 Substitution means a product or manufacturer not specified by proprietary name which may be acceptable in place of a product or manufacturer which is specified by proprietary name.

1.3 PRODUCT OPTIONS

.1 For products specified by non-proprietary specification:

.1 Select any product by any manufacturer, which meets requirements of Contract Documents.

.2 For products specified by proprietary specification:

.1 Select any product or manufacturer named, or

.2 Substitute an unnamed product or manufacturer in accordance with Article 1.4 of this Section.

.3 For products specified by proprietary specification and accompanied by words indicating that substitutions will not be accepted; select product or manufacturer named; substitutions are not permitted.

1.4 SUBSTITUTIONS

.1 Products and manufacturers specified in these documents for use in performance of Work of Contract shall not be changed without Consultant's written consent. Where substitute manufacturers are permitted, unnamed manufacturers will be accepted by the Consultant, subject to the following:

.1 Submit requests to change specified products and manufacturers to the Consultant in writing, including product data indicated in article 6, seven (7) days prior to the closing of tenders.

.2 Requests for acceptance shall contain sufficient data to establish the merits of the proposed materials and equipment.

.3 Acceptance shall be communicated to all bidders by addendum.

.4 Substitutions after tenders have been received will not be permitted.

.2 Substitute Products: Where substitute products are permitted, unnamed products will be accepted by the Consultant, subject to the following:

.1 Substitute products shall be the same type as, be capable of performing the same functions as, and meet or exceed the standards of quality and performance of the named product(s). Substitutions shall not require revisions to Contract Documents nor to work of the Contractor and sub-contractors.

.3 Substitute Manufacturers: Where substitute manufacturers are permitted, unnamed manufacturers will be accepted by the Consultant, subject to the following:

.1 Substitute manufacturers shall have capabilities comparable to those of the named manufacturer(s). Substitutions shall not require revisions to Contract Documents nor to work of the Contractor and sub-contractors.

.4 In making a substitution Contractor represents that:

.1 He has investigated substitute product or manufacturer, or both, and has determined that it meets the criteria specified in 1.4.1 or 1.4.2, or both, and

.2 He will make any changes to the Work necessitated by the substitution as required for the Work to be complete in all respects, and

.3 He waives claims for additional costs and time caused by substitution which may subsequently become apparent.

.5 Substitutions shall not be ordered nor installed without the Consultant's acceptance.

.6 If in the Consultant's opinion, a substitution does not meet requirements of the Contract Documents, the Contractor shall, at no extra cost to the Owner, provide a product which, in the Consultant's opinion, does meet requirements of the Contract Documents.

1.5 PROPRIETARY SPECIFICATIONS

.1 Notwithstanding specified proprietary names of either or both products or manufacturers, products provided shall meet other applicable requirements of Contract Documents. Modify products if necessary to ensure compliance with all requirements of Contract Documents.

1.6 CHANGES TO ACCEPTED PRODUCTS AND MANUFACTURERS

.1 Products and manufacturers accepted by the Consultant for use in performance of Work of Contract shall not be changed without the Consultant's written consent.

.2 Submit requests to change accepted products and manufacturers to the Consultant in writing, including product data indicated in article 1.7.

1.7 PRODUCT DATA

.1 When requested by Consultant, submit complete data substantiating compliance of a product with requirements of Contract Documents. Include the following:

.1 Product identification, including manufacturer's name and address.

.2 Manufacturer's literature providing product description, applicable reference standards, and performance and test data.

.3 Samples, as applicable.

.4 Name and address of projects on which product has been used and date of each installation.

.5 For substitutions and requests for changes to accepted products, include in addition to the above, the following:

.1 Itemized comparison of substitution with named product(s). List significant variations.

.2 Designation of availability of maintenance services and sources of replacement materials.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practice in Place of Work, acceptable to Consultant.

1.2 SURVEY REFERENCE POINTS

.1 Existing base horizontal and vertical control points are designated on drawings.

.2 Establish, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to Consultant.

.4 Report to Consultant when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.5 Require surveyor to replace control points in accordance with original survey control.

1.3 SURVEY REQUIREMENTS

.1 Establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.

.2 Establish lines and levels, locate and lay out, by instrumentation.

.3 Stake for grading, fill and topsoil placement and landscaping features.

.4 Stake slopes and berms.

.5 Establish pipe invert elevations.

.6 Stake batter boards for foundations.

.7 Establish foundation, column locations and floor elevations.

.8 Establish lines and levels for mechanical and electrical work.

.9 Immediately upon completion of the setting-out of the building and major site work provide a survey prepared by licensed Land Surveyor verifying that the building location has been accurately set out and conforms to the Contract Documents.

1.4 EXISTING SERVICES

.1 Before commencing work, establish location and extent of service lines in area of Work and notify Consultant of findings.

.2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Consultant.

1.5 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Consultant of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Consultant.

1.6 RECORDS

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 On completion of foundations and major site services, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

.3 Record locations of maintained, re-routed and abandoned service lines.

1.7 SUBMITTALS

.1 Submit name and address of Surveyor to Consultant.

.2 Submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

1.8 SUBSURFACE CONDITIONS

.1 If subsurface conditions at Place of Work differ materially from those indicated in the Geotechnical Investigation Report, or a reasonable assumption of probable conditions based thereon, immediately cease work and promptly notify Consultant in writing.

.2 After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes and Change Orders.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit written request in advance of cutting or alteration which affects:

- .1 Structural integrity of elements of project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of operational elements.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or separate contractor.

.3 Include in request:

- .1 Identification of project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on Work of Owner or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

1.2 MATERIALS

.1 Required for original installation.

.2 Change in Materials: Only specified products and materials, or products and materials accepted by the Consultant during the bid period will be accepted on this project.

1.3 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.4 EXECUTION

.1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective and non-conforming Work.

.5 Remove samples of installed Work for testing if directed by Consultant.

.6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior acceptance.

.10 Restore work with new products in accordance with requirements of Contract Documents.

.11 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.12 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00 – Fire Stopping, full thickness of the construction element.

.13 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

.14 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of waste material in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including other than that caused by Owner or other Contractors.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site.

.3 Clear snow and ice from access to building, bank/pile snow in designated areas only or remove from site.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-site containers for collection of waste materials and debris.

.6 Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.7 Remove waste materials and debris from site and deposit in waste container at end of each working day.

.8 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.

.9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 FINAL CLEANING

.1 Prior to Interim Acceptance remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.3 Prior to final review remove surplus products, tools, construction machinery and equipment.

.4 Remove waste products and debris including that caused by Owner or other Contractors.

.5 Remove waste materials from site.

.6 Make arrangements with and obtain permits from Authorities Having Jurisdiction for disposal of waste and debris.

.7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors and ceilings.

.9 Clean lighting reflectors, lenses, and other lighting surfaces.

.10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

.11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

.12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.14 Remove dirt and other disfiguration from exterior surfaces.

.15 Clean and sweep roofs, gutters, culverts, areaways, and swales.

.16 Sweep and wash clean paved areas.

.17 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.

.18 Clean roofs, downspouts, overflow drawings and drainage systems.

.19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.20 Remove snow and ice from access to building.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This section includes general requirements and procedures for compliance with Construction Waste Management:

.1 Waste Management Plan (WMP).

.2 Implementation of Construction Waste Management.

1.2 WASTE MANAGEMENT GOALS

.1 Prior to start of Work conduct a meeting to discuss how the Contractor will generate the least amount of waste possible and the processes to be used to avoid waste caused by error, poor planning, breakage, mishandling, contamination, or other factors not listed.

.2 Prior to start of Work conduct a meeting with the Owner to review and discuss the Project Waste Management Plan.

.3 Provide waste management, recycling, reuses of recyclable and reusable materials where applicable.

.4 Develop a Waste Management Plan for the Project and submit to the Consultant for review in accordance with Section 01 33 00 – Submittal Procedures.

.5 Accomplish maximum control of solid construction waste.

.6 Preserve environment and prevent pollution and environment damage on and off site.

.7 Minimize waste disposal in landfills.

.8 Specific material for consideration for diversion from landfill.

.1 Masonry and pavement.

.2 Metals.

.3 Wood.

.4 Electrical - wiring/conduits/boxes.

.5 Packaging.

.9 Minimize amount of non-hazardous solid waste generated by project and accomplish maximum source reduction, reuse and recycling of solid waste.

.10 Protect environment and prevent environmental pollution damage.

1.3 REFERENCE STANDARDS

.1 Canadian Construction Association (CCA)

.2 CCA 81-2001: A Best Practices Guide to Solid Waste Reduction.

.3 Public Works and Government Services Canada (PSPC)

.1 2002 National Construction, Renovation and Demolition Non-Hazardous Solid Waste Management Protocol.

.2 CRD Waste Management Market Research Report (available from PSPC's Environmental Services).

1.4 DEFINITIONS

.1 Definitions as written below are supplementary to all laws, statutes, and regulations effective in Alberta. Where definitions conflict, laws, statutes, and regulations take precedence over the definitions below.

.2 Approved/Authorized recycling facility: waste recycler approved by applicable provincial authority or other users of material for recycling accepted by the Consultant.

.3 Class III: non-hazardous waste - construction renovation and demolition waste.

.4 Construction, Renovation and/or Demolition (CRD) Waste: Class III solid, non-hazardous waste materials generated during construction, demolition, and/or renovation activities

.5 Inert Fill: inert waste - exclusively asphalt and concrete.

.6 Waste Source Separation Program (WSSP): implementation and co-ordination of ongoing activities to ensure designated waste materials will be sorted into pre-defined categories and sent for recycling and reuse, maximizing diversion and potential to reduce disposal costs.

.7 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.

.8 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.9 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

.10 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.

.2 Returning reusable items including pallets or unused products to vendors.

.11 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.12 Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

.13 Separate Condition: refers to waste sorted into individual types.

.14 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.

.15 Toxic: Poinsonous to humans either immediately or after a long period of exposure.

.16 Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

.17 Waste Management Plan (WMP): A Project-related plan for the collection, transportation, and final disposition of the waste generated at the construction site. The purpose of the plan is to ultimately reduce the amount of material being landfilled. The Plan involves measuring and estimating the quantity and composition of waste, and identifying reasons for waste generation including and any operational factors. Then, based on this information, address opportunities for reduction, reuse, salvaging, or recycling of materials.

.18 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating required submittal and reporting requirements.

.19 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials generated by project. Specifies diversion goals, implementation and reporting procedures, anticipated results and responsibilities.

1.5 DOCUMENTS

.1 Post and maintain in visible and accessible area at job site, one copy of following documents:

.1 Waste Management Plan (WMP).

.2 Waste Reduction Workplan (WRW).

1.6 USE OF SITE FACILITIES

.1 Execute work with least possible interference or disturbance to site.

.2 Provide temporary security measures.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Prepare and submit following prior to project start-up:

.1 1 electronic copy of completed Waste Management Plan (WMP).

.1 List landfill options in the area and what materials can be recycled.

.2 1 electronic copy of completed Waste Reduction Workplan (WRW).

.3 Prepare and submit on monthly basis, throughout project or at intervals agreed to by Consultant the following:

.1 Receipts, scale tickets, waybills, and/or waste disposal receipts that show quantities and types of materials reused, recycled, or disposed of.

.2 Updated Waste Materials Tracking.

.3 Written monthly summary report detailing cumulative amounts of waste materials reused, recycled and landfilled, and brief status of ongoing waste management activities.

.4 Submit prior to final payment the following:

.1 Waste Diversion Report, indicating final quantities by material types salvaged for reuse, recycling or disposal in landfill and recycling centres, re-use depots, landfills and other waste processors that received waste materials.

.2 Provide receipts, scale tickets, waybills, waste disposal receipts that confirm quantities and types of materials reused, recycled or disposed of and destination.

1.8 WASTE MANAGEMENT PLAN (WMP)

.1 Prepare and submit WMP at least 10 days prior to project start-up.

.2 WMP identifies strategies to optimize diversion through reduction, reuse, and recycling of materials and comply with applicable regulations, based on information acquired from WA.

.3 WMP should include but not limited to:

.1 Applicable regulations.

.2 Specific goals for waste reduction, identify existing barriers and develop strategies to overcome them.

.3 Destination of materials identified.

.4 Deconstruction/disassembly techniques and schedules.

.5 Methods to collect, separate, and reduce generated wastes.

.6 Location of waste bins on-site.

.7 Security of on-site stock piles and waste bins.

.8 Protection of personnel, sub-contractors.

.9 Clear labelling of storage areas.

.10 Training plan for contractor and sub-contractors.

.11 Methods to track and report results reliably.

.12 Details on materials handling and removal procedures.

.13 Recycler and reclaimer requirements.

.14 Quantities of materials to be salvaged for reuse or recycled and materials sent to landfill.

.15 Requirements for monitoring on-site wastes management activities.

.4 Structure WMP to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.

.5 Post WMP or summary where workers at site are able to review content.

.6 Monitor and report on waste reduction by documenting total volume, in tonnes, and cost of actual waste removed from project.

1.9 USE OF SITE AND FACILITIES

.1 Execute Work with minimal interference and disturbance to normal use of premises.

.2 Maintain security measures established by facility provide temporary security measures accepted by the Owner.

1.10 WASTE PROCESSING SITES

.1 Contractor is responsible to research and locate waste diversion resources and service providers. Salvaged materials are to be transported off site to approved and/or authorized recycling facilities within the Province of Alberta or to users of material for recycling.

1.11 QUALITY ASSURANCE

.1 After award of Contract, a mandatory site examination will be held for this Project for Contractor and/or sub-contractors responsible for construction and demolition/deconstruction waste management.

.1 Date, time and location will coincide with the on-site start-up meeting.

.2 Waste Management Meeting: Waste Management Co-ordinator is to provide an update on status of waste diversion and management activities at each meeting. Written monthly Waste Diversion Report summary to be provided by Waste Management Coordinator.

1.12 STORAGE, HANDLING AND PROTECTION

.1 Store, materials to be reused, recycled and salvaged in locations as determined on site to provide protection of materials to maintain like new conditions.

.2 Unless specified otherwise, materials for removal do not become Contractor's property.

.3 Protect, stockpile, store and catalogue salvaged materials.

.4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.5 Protect surface drainage, mechanical and electrical from damage and blockage.

.6 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.

.7 Separate and store materials produced during project in designated areas.

.8 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.

.1 On-site source separation is recommended.

.2 Remove co-mingled materials to off site processing facility for separation.

.3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.

.4 Materials reused on-site are considered to be diverted from landfill and as such are to be included in all reporting.

1.13 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of oil, mineral spirits, volatile materials, waste, paint thinner, or other manmade materials into waterways, storm, or sanitary sewers.

.3 Keep records of construction waste including:

.1 Number and size of bins.

.2 Waste type of each bin.

.3 Total tonnage generated.

.4 Tonnage reused or recycled.

.5 Reused or recycled waste destination.

.4 Remove materials on-site as Work progresses.

.5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in the waste audit.

1.14 SCHEDULING

.1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 APPLICATION

.1 Do Work in compliance with WRW and WSSP.

.2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with this Section.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

.2 Source separate materials to be reused/recycled into specified sort areas.

3.3 DIVERSION OF MATERIALS

.1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Consultant, and consistent with applicable fire regulations.

.1 Mark containers or stockpile areas.

.2 Provide instruction on disposal practices.

.2 On-site sale of recovered, recyclable, salvaged, reusable materials is not permitted.

3.4 WASTE DIVERSION REPORT

.1 At completion of Project, prepare written Waste Diversion Report indicating quantities of materials reused, recycled or disposed of as well as the following:

.1 Identify final diversion results and measure success against goals from Waste Reduction Workplan.

.2 Compare final quantities/percentages diverted with initial projections in Waste Audit and Waste Reduction Workplan and explain variances.

.1 Supporting documentation.

.2 Waybills and tracking forms.

.3 Description of issues, resolutions and lessons learned.

3.5 WASTE MANAGEMENT PLAN (WMP)

.1 WMP Packaging and Construction Waste Chart:

(1) Material Category	(2) Person(s) Respon-sible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material(s) Destina-tion
Wood and Plastics Material Description							
Warped Pallet Forms							
Plastic Packaging							
Card-board Packaging							

Wood							
Metal							
Other							

3.6 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Schedule G - Government Chief Responsibility for the Environment:

Province	Address	General Inquires	Fax
Alberta	Alberta Environmental Protection Petroleum Plaza, South Tower 9915 - 108 thStreet Edmonton AB T5K 2G8	403-427-2739	
	Alberta Special Waste Management Corporation Pacific Plaza, Suite 610 10909 Jasper Avenue NW Edmonton AB T5J 3L9	403-422-5029	403-428-9627

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 23 10 – Site Excavation, Filling and Grading.

Part 2 Products

.2 NOT USED

Part 3 Execution

3.1 GENERAL INFORMATION

.1 The information shown on the Drawings concerning type and location of underground and/or overhead utilities is not guaranteed to be accurate or all-inclusive. The Contractor is required to request the assistance of Alberta One Call for marking utilities. A copy of the One Call results shall be provided to the Engineer.

.2 Make arrangements and pay for the temporary relocation of any telephone, power, street lights, gas lines, or any other underground or overhead utilities should this be necessary as a result of Work performed under this Contract.

.3 Maintain the flow in existing water services, storm and sanitary sewers, drains, and water courses which may be encountered during the course of the Work.

.4 The Contractor is responsible for all costs associated with the protection, repair and restoration of the existing underground utilities, utility trenches, or structures to meet utility companies' or local municipality standards and other requirements, if the Contractor fails to do so.

.5 Removal and/or relocation of existing utility lines will be coordinated with the Engineer, affected utility company, Contractor and Client; to minimize disruption to the Construction Schedule.

3.2 SEWERS

.1 For a crossing over an existing sewer, if the height from underside of the proposed water or sewer pipe to top of sewer pipe is less than 800mm, excavate around the existing pipe to firm ground; place cement stabilized granular bedding around the existing pipe and up to the underside of the bedding specified for the sewer or water pipe. The top of the stabilized bedding shall extend across the full width of the trench and 500mm on either side of the sewer pipe and shall slope downward and outward at 1H:1V on both sides of the sewer pipe to firm ground.

.2 No unauthorized persons or equipment shall be allowed entry into any utility vault or manhole. If entry into such vault or manhole is necessary in connection with work under the Contract, notify the utility Client at least twenty four (24) hours before the intended entry in order to obtain permission and proper instructions and to be accompanied where necessary by a qualified representative of the utility. In addition, use proper procedures for entry into confined space as required in the Occupational Health and Safety Act and Regulations.

.3 When temporary removal of a manhole or vault lid is required for adjustment or other Work, do not leave the manhole or vault open while unattended. Provide adequate protection and cover if it becomes necessary to leave the manhole or vault unattended without its lid in place.

.4 Provide catch basins and manholes with approved temporary covers to prevent debris from entering the sewer system. If debris does enter the system, clean out immediately if sewage is flowing, or at end of work day if system is dry.

3.3 STREET FURNITURE

.1 Notify the local authority and arrange for removal or relocation of transit shelters, postal boxes, newspaper vending machines, telephone booths, parking meters, signage, and other street furniture affected by construction.

3.4 HYDRANT USE

.1 Local bylaws may require that Contractors obtain a Hydrant Use Permit in order to take water from a hydrant. If water is needed at a job site, apply for a Hydrant Use Permit from the local utility at least five (5) working days beforehand.

.2 Pay all fees, deposits, fines, water use charges, and any other charges pursuant to the requirements of the local utility and bylaws.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 Substantial Performance of the Work is achieved when there are no interior construction deficiencies and all items noted below have been completed to the satisfaction of the Consultant.

.2 Release of Project Holdback: the date of Substantial Performance of the Work shall be the date when Final Acceptance of the Work has been achieved. The Project Holdback shall be released on the 46th day after the date of Substantial Performance of the Work and upon receipt of an invoice requesting payment, accompanied by a Statutory Declaration indicating all subcontractors and suppliers have been paid in full.

1.2 CONTRACTOR'S INSPECTION OF WORK

.1 The Contractor and all Subcontractors shall conduct an inspection of the Work, identify deficiencies and defects, and submit list of deficiencies and defects to Consultant.

.2 Prior to requesting a Substantial Performance of the Work review by the Consultant, the Contractor will verify in writing that all the deficiencies and defects noted in the Contractor's inspection of the Work have been rectified.

1.3 PREREQUISITES TO FINAL ACCEPTANCE OF THE WORK

.1 Prior to requesting Consultant's review for Final Acceptance of the Work the Contractor shall confirm in writing that the following items have been completed:

.1 Review the Contract Documents and inspect the Work to confirm that prerequisites for Final Acceptance of the Work have been fulfilled and that the Work is ready for review.

.2 Obtain and submit evidence of compliance with regulatory requirements, including Occupancy Permit(s) (subject to provision of "C" Schedules by Consultant) and inspection/operating certificates.

.3 Remove from project site temporary facilities along with construction tools, equipment, mock-ups and all similar items.

.4 Systems testing and verification has been completed and documentation submitted to Consultant.

.5 Component testing and verification has been completed and documentation submitted to Consultant.

.6 Mechanical and electrical systems commissioning has been completed as specified and documentation has been submitted to Consultant.

.7 Testing, adjusting and balancing of systems and equipment has been completed as specified and documentation submitted to Consultant.

.8 Integrated systems testing has been completed as specified and documentation submitted to Consultant.

.9 Final cleaning has been completed.

.10 Project record documents have been completed and submitted to Consultant.

.11 Operations and maintenance data manuals have been completed and submitted to Consultant.

.12 Spare parts and maintenance materials have been provided to the Owner and confirmation documentation submitted to the Consultant.

.13 Installation of all architectural items and finishes is complete, as well as all mechanical and electrical covers, trims and identifications.

.14 All finish hardware is installed and adjusted.

.15 Radio antenna conduit is installed.

.16 Acoustic requirements are complete and have been verified and tested, and acceptable to the testing agent. Test results have been submitted to the Consultant.

.17 Cylinders previously turned over to the Owner for keying have been installed.

.18 Exterior site work is advanced sufficiently to allow normal operation of the facility without interference to the building users or the public, or future interruption to the normal facility use by the Contractor required to complete unfinished exterior work.

1.4 CONSULTANT REVIEW FOR FINAL ACCEPTANCE OF THE WORK

.1 When prerequisites are complete and written confirmation of such has been submitted to Consultant, Contractor is to submit a written request to Consultant for Final Acceptance of the Work. Consultant will, within ten (10) days of the request:

.1 Proceed with an inspection of the Work, or:

.2 Advise the Contractor that the prerequisites have not been adequately fulfilled.

.2 If Consultant review determines that the work is not complete, Contractor to immediately complete outstanding items and request a re-inspection. All Consultant and Owner costs for re-review to be borne by the Contractor.

1.5 DECLARATION OF SUBSTANTIAL PERFORMANCE

.1 When the Owner and Consultant determine that all deficiencies and incomplete work have been corrected and the requirements of the Contract have been substantially performed, Owner and Consultant will declare that Final Acceptance of the Work has been achieved and the Contractor may post notice of Substantial Performance of the Work in accordance with Lien Legislation.

.2 Upon issuance of the Certificate of Substantial Performance, the Owner will assume responsibility for care, custody and control of the Work, including responsibility for:

.1 Facility operation, including all systems and equipment

.2 Maintenance

.3 Security

.4 Property and liability insurance

.5 Utility costs

.3 NOTE: the Contractor will not be allowed access to the interior of the building after the issuance of the Certificate of Substantial Performance except with written approval from

the Owner for the specific warranty work requiring attention, and the duration of that work.

1.6 WARRANTY

.1 Prior to end of the warranty period, Consultant will conduct a review of the Work.

.2 Following the review, Consultant will advise the Contractor of items which are to be corrected.

.3 On receipt of the review report, immediately make access arrangements with the Owner to correct the items noted.

.4 On completion of warranty work, submit written confirmation to Consultant that all warranty items noted in the review report have been corrected.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.

.2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.3 Four (4) weeks prior to Substantial Performance of the Work, submit one (1) review copy, in English, of completed Operations and Maintenance Manuals to the Consultant.

.4 Copy will be returned with Consultant's comments.

.5 Revise content of documents as required prior to final submittal.

.6 Two (2) weeks prior to Substantial Performance of the Work, submit to the Consultant, two (2) final copies of operating and maintenance manuals in English, and one (1) scanned electronic copy of the final operating and maintenance manuals.

.7 NOTE: submission of complete Operations and Maintenance Manuals is a prerequisite to Substantial Performance.

.8 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

.9 Furnish evidence, if requested, for type, source and quality of products provided.

.10 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.11 Pay costs of transportation.

1.2 FORMAT

.1 Organize data as instructional manual, separate binders are required for architectural/structural (black); mechanical/civil (green); and electrical (blue).

.2 Binders: commercial quality, fabric coated, hard covered, 3 post extension type, attached to spine with metal piano hinges. Acco 05436-0, Expanding Barlock Catalogue Binder, available from Grand & Toy.

.3 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: identify each binder embossed title as per detail at end of this section.

.5 Arrange content by systems, under Specification Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: manufacturer's printed data, or typewritten data.

.8 Drawings: fold larger drawings and place in a punched plastic sleeve or scan and reduce to size of text pages.

.9 Place one copy of shop drawings for non-operational components such as rebar, joists, siding etc. in a separate plastic expandable file.

.10 Electronic Copy: The contractor shall provide one (1) electronic copy of the completed Manuals in the form of a DVD with the information provided in PDF Format.

1.3 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;

.1 Date of submission.

.2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

.6 Training: refer to Section 01 79 00 - Demonstration and Training.

1.4 RECORD DOCUMENTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, at site for Consultant one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for review by Consultant.

1.5 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, provided by Consultant.

.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Documents.

.7 References to related shop drawings and modifications.

.5 Specifications: legibly mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

.7 NOTE: submission of accurate and complete Record Documents is a prerequisite to Substantial Performance.

1.6 FINAL SURVEY

.1 Submit final site survey certificate in accordance with Section 01 71 00 - Examination and Preparation, certifying that elevations and locations of completed Work are in conformance with Contract Documents.

.2 Provide topographical information sufficient to verify final grades and slopes are in accordance with the Contract Documents.

.3 Final site survey is a prerequisite to Substantial Performance.

1.7 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting

conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control and 01 91 13 - General Commissioning.

.15 Additional requirements: as specified in individual specification sections.

1.8 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-Protection and Weather-Exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional Requirements: as specified in individual specifications sections.

1.9 SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site; place and store.

.4 Receive and catalogue items. Submit inventory listing to Consultant. Include accepted listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.10 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site; place and store.

.4 Receive and catalogue items. Submit inventory listing to Consultant. Include accepted listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.11 SPECIAL TOOLS

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to site; place and store.

.4 Receive and catalogue items. Submit inventory listing to Consultant. Include accepted listings in Maintenance Manual.

.5 Obtain receipt for delivered special tools and submit prior to final payment.

1.12 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to satisfaction of Consultant.

1.13 WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers and manufacturers, within ten (10) days after completion of applicable items of work.

.4 Warranty start date to be the date of Substantial Performance of the Work.

.5 Verify that warranty documents are in proper form, contain full information, are for the warranty period specified, and are notarized.

.6 Co-execute submittals where required.

.7 Retain warranties and bonds until time specified for submittal.

.8 Respond in a timely manner to oral or written notification of required construction warranty repair work.

.9 Municipal improvements:

.1 A two (2) year warranty is to be submitted for all off property municipal improvements as noted in the following specifications:

.1 Section 32 12 16 – Asphalt Paving

.2 Section 32 16 13 – Concrete Curbs, Gutters and Walks

.3 Section 33 11 00 – Water Utility Distribution Piping

.4 Section 33 31 00 – Sanitary and Storm Utility Piping

Part 2 Products

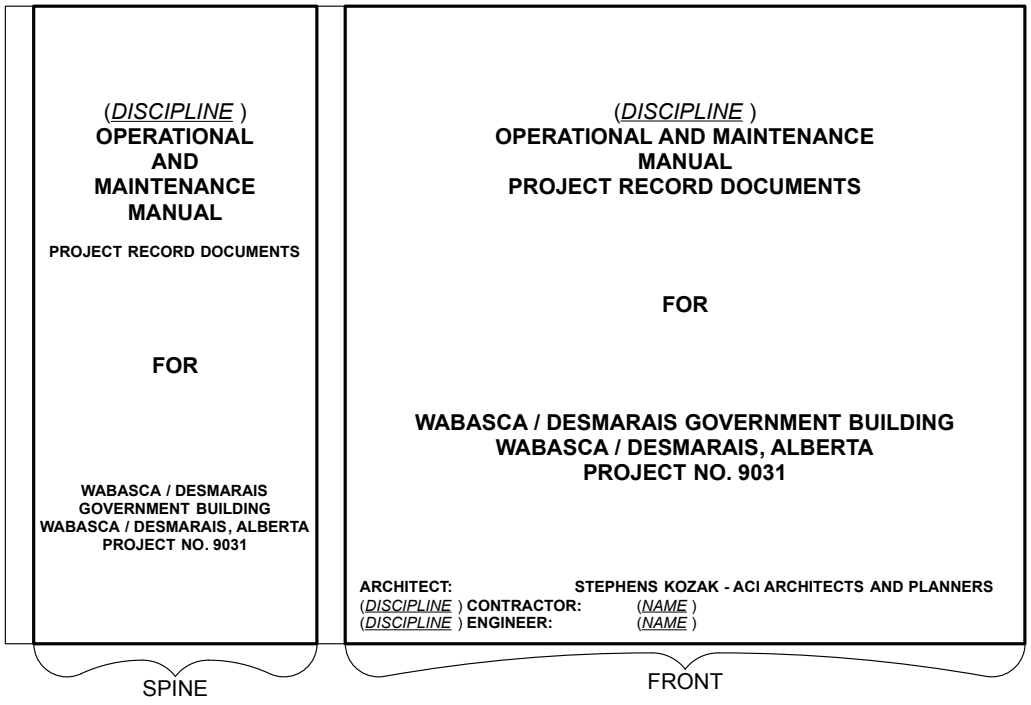
2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.



END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's designated personnel one (1) week prior to date of Substantial Performance of the Work review.

.2 Owner will provide list of personnel to receive instructions, and will co-ordinate their attendance at agreed-upon times.

1.2 QUALITY CONTROL

.1 When specified in individual Sections require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's designated personnel, and provide written report that demonstration and instructions have been completed.

1.3 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit schedule of time and date for demonstration of each item of equipment and each system two (2) weeks prior to designated dates, for Owner's and Consultant's acceptance.

.3 Submit reports within one (1) week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.4 Give time and date of each demonstration, with list of persons present.

1.4 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation in accordance with Specifications.

.2 Testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - General Commissioning and equipment and systems are fully operational.

.3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.5 PREPARATION

.1 Verify that conditions for demonstration and instructions comply with requirements.

.2 Verify that designated personnel are present.

1.6 DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled agreed upon times, at the equipment location.

.2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.

.3 Review contents of manual in detail to explain aspects of operation and maintenance.

.4 Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

1.7 TIME ALLOCATED FOR INSTRUCTIONS

.1 Ensure minimum amount of time allocated for instruction of each item of equipment or system as follows:

.1 Heating Plant: Four (4) hours of instruction.

.2 Cooling and Ventilation System: Four (4) hours of instruction.

.3 Control System: Four (4) hours of instruction.

.4 Plumbing System: One half (1/2) hour of instruction.

.5 Electrical System: Two (2) hours of instruction.

.6 Overhead Doors: One half (1/2) hour of instruction.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 PROCESS OVERVIEW

.1 The Commissioning Process follows a logical sequence, from Contractor equipment startup and testing to Component Verifications through to System Performance Verification Testing and finally Integrated System Testing.

.2 At completion of the Commissioning Process, all defined system components, each mode of systems operation, and each control sequence will have been started and tested in accordance with the Manufacturer's requirements and verified operational relative to design intent and operational requirements.

.3 Equipment Starting and Testing:

.1 Complete equipment starting and testing procedures as defined in the respective Sections of this specification.

.2 All starting, testing, adjusting, balancing and calibration activities are to be documented by the Contractor.

.3 All Contractor and Manufacturer startups and testing procedures are to be completed and approved prior to conducting the System Performance Verification Testing.

.4 The Contractor will be responsible for identifying in, the commissioning schedule, the required equipment starting and testing, including all Manufacturer's startup and field verifications.

.5 The Consultant will observe the Contractor's and the Manufacturer's equipment startups and testing on a random basis.

.4 Component Verifications:

.1 The Contractor shall be responsible for completing the Component Verification sheets in accordance with this specification.

.2 Component Verification sheets have been developed by the Consultant and have been incorporated in the respective Divisions.

.3 The respective Sub-Contractor shall be responsible for completing the component verification sheets, as outlined.

.4 The Consultant will be responsible for random verifications of the Contractor's submitted Component Verification sheets.

.5 System Performance Verification Testing:

.1 The System Performance Verification Test have been developed by the Consultant and have been incorporated in the respective Divisions.

.2 The tests provide for a functional demonstration of the system performance during the various modes of operation including, startup, operation, shutdown and various disturbance situations such as power failure and fire alarm.

.3 System Performance Verification testing comprises of a two part process, 'Contractor Proving & 'Consultant Verification'.

.1 In the 'Contractor Proving', the intent is to have the Contractor execute the tests to ensure testing criteria and operations can be achieved.

.1 The Contractor completes the 'Contractor Proving' portion of the test report.

.2 Once satisfied that the system operation meets the test requirements, the Contractor submits the completed test package to the Consultant for review.

.2 In the 'Consultant's Verification', the intent is to have the Contractor conduct the System Performance Verification Test in the presence of the Consultant.

.1 Following the Consultant's review and acceptance of the 'proving' results the Contractor schedules the Performance Verification Test for the Consultant to witness.

.2 The 'Consultant's Verification' portion of the test report shall be completed in the presence of the Consultant.

.4 All Contractor and Manufacturer's startup and proving tests are to be completed and approved prior to conducting the defined System Performance Verification Tests.

.5 All Component Verifications related to a given system shall be completed and approved prior to conducting the defined System Performance Verification Testing.

.6 The Contractor will be responsible for the coordinating, scheduling and implementation the System Performance Verification Testing.

.6 Integrated System Testing

.1 The Integrated System Tests have been developed by the Consultant and have been incorporated into this Section.

.2 Integrated Systems Testing shall be under the direction of this Division with any required support provided by the respective sub-contractors.

.3 The tests ensure that the integrated systems operations conform with the design, such that proper interaction between related systems is achieved.

.4 The tests verify performance of systems operating in conjunction with one another under various conditions and modes of operation.

.5 Systems are to be operated for as long as required to complete commissioning.

.6 Ensure reported results of testing and procedures are checked and verified correct within stated tolerances. If inconsistencies appear between reported results and demonstrated values, the relevant testing procedures are repeated and adjustments made until satisfactory results are obtained.

.7 All Contractor and manufacturers startup and proving tests are to be completed and approved prior to conducting the defined system performance verification tests.

.8 All system performance verifications related to a given system shall be completed and approved prior to conducting the defined system performance verification tests.

.7 The Commissioning Process associated with the component and systems verifications does not negate the need for the normal contractor equipment and system startup and proving and the associated training requirements.

1.2 QUALITY ASSURANCE

.1 Provide testing organization services under provisions specified in Section 01 45 00 - Quality Control, and specific trade sections.

.2 Testing organization: current member in good standing of Associated Air Balance Council, certified to perform specified services.

.3 Comply with applicable procedures and standards of the certification sponsoring association.

.4 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

1.3 SCHEDULES

.1 Prepare a schedule for implementing and conducting the Component Verifications, the System Performance Verification Testing and the Integrated System Testing.

.2 Provide sufficient notice, minimum 21 working days, prior to commencing the System Performance Verification Testing and the Integrated System Testing.

.3 Unless otherwise specified in writing by the Consultant, all Commissioning verifications, testing and related requirements specified herein, must be successfully performed and documented prior to Interim Acceptance/Occupancy Acceptance.

1.4 COORDINATION

.1 Coordinate all sub-trades, other divisions, manufacturers, suppliers and other specialists as required to ensure all phases of work shall be properly organized prior to commencement of each particular startup, testing and commissioning procedure.

.2 Coordinate the activities of this Section with the starting and testing of:

.1 Mechanical Systems an equipment.

.2 Electrical Systems and equipment

.3 Other component and systems testing specified in this and other Divisions.

.3 Where any components or systems require testing prior to starting, ensure that such work has been completed and approved prior to starting of the components and systems.

1.5 SEASONAL CONSTRAINTS

.1 Notwithstanding all inclusive requirements specified in this Section, additional separate cycles of Commissioning may be necessary at a later time for components and systems whose full operation is dependent on seasonal conditions.

.2 Seasonal commissioning activities will be subject to a deficiency holdback amount as determined by the Consultant.

1.6 COMMISSIONING MEETINGS

.1 In addition to the construction progress meetings, Commissioning progress meetings are to be held.

.2 These meetings will begin with construction and will continue on the same schedule as the Progress Meetings until the Substantial Completion is achieved as noted in Section 01 77 00 - Closeout Procedures.

.3 The Consultant is to put forward the agenda, chair the meeting as well as record and distribute the minutes.

.4 Based on the requirements of the agenda the attendees shall include but not be limited to:

.1 Contractor's Representatives: Contractor's site superintendent, mechanical and electrical subcontractors, controls subcontractor and when requested by the Consultant, subcontractors, suppliers and their parties involved in the Work. Contractor's Representatives shall be qualified and authorized to act on behalf of the party each represents.

.2 Consultant, Project Administrators and inspection and testing company Representatives.

.5 Meetings will introduce, monitor progress, and resolve any issues or deficiencies related to the Commissioning progress.

1.7 EQUIPMENT STARTING AND TESTING

.1 Prior to starting and testing, ensure all mechanical components and equipment are cleaned and free of dust.

.2 After testing, protect components and equipment from dust.

.3 Do not conceal or cover components or equipment until inspected, tested and approved by the Consultant.

.4 Contractor is responsible for all liabilities associated with the starting and testing.

.5 Contractor is responsible for all costs associated with the starting, testing, adjusting and balancing, including the supply of testing equipment.

1.8 WITNESSING EQUIPMENT STARTING AND TESTING

.1 Prior to Component Verifications, and System Performance Testing, prepare a schedule for the required verifications and tests. Review schedule and seek approval of the Consultant.

.2 Provide sufficient notice, minimum 21 working days prior to commencing tests.

.3 The Consultant may witness all or any portion of the Component Verifications and will witness all System Performance Verification Testing performed by the Contractor.

.4 Contractor to be present for all tests.

1.9 QUALITY ASSURANCE

.1 All starting, testing, adjusting and balancing procedures shall be in accordance with:

.1 These contract documents.

.2 Requirements of authorities having jurisdiction.

.3 Manufacturer's published instructions.

.4 All applicable standards, including portion of ASME, ASHRAE, AABC, NEBB, SMACNA, ASTM AND NFPA.

.2 Personnel involved in starting, testing, adjusting and balancing procedures shall have experience in Division 23 component verification and system testing and shall be able to interpret results of readings and tests and report the state of equipment and systems in a clear and concise manner.

.3 If the requirements of this or related sections conflict, notify the Consultant before proceeding with the tests and obtain written clarification.

1.10 MANUFACTURER'S STARTING RECOMMENDATIONS

.1 Prior to starting components or systems, obtain and review manufacturer's installation, operation and starting instructions. Read in conjunction with the procedures specified herein.

.2 Use manufacturer's and supplier's starting personnel where required to maintain validity of manufacturer's warranty. Confirm with manufacturer that all testing specified in these specifications will not void any warranties.

.3 Compare installation to manufacturer's published data and record discrepancies. Modify procedures detrimental to components performance prior to starting equipment.

.4 Manufacturer's Reports:

.1 Arrange for manufacturer to submit copies of all production test records required by these specifications prior to shipping.

.2 The production test records will be certified by the manufacturer, that the item meets the testing performance criteria specified.

.3 Arrange for manufacturer to submit brief step-by-step description to entire starting procedure to allow the Consultant to repeat starting at anytime.

1.11 PRESIDING AUTHORITIES

.1 Verification and testing procedures defined in this specification may duplicate verifications conducted by presiding authorities. To facilitate expedient turnover of the project, arrange for the Consultant to witness procedures in a manner that avoids unnecessary duplication of tests.

.2 Obtain certificates of approval, acceptance and comply with rules and regulations of authorities having jurisdiction. Provide copies of all certificates to the Consultant.

1.12 IMPLEMENTATION

.1 Unless otherwise specified in writing by the Consultant, all commissioning requirements specified herein, must be performed prior to Interim Acceptance/Occupancy Acceptance.

1.13 CORRECTION OF DEFICIENCIES

.1 Correct all contract deficiencies found during Commissioning and the Consultant's verifications program.

1.14 COMPLIANCE WITH DEFINED PROCEDURES

.1 Failure to follow the specific instructions defined herein pertaining to correct starting procedures may result in re-evaluation of components by an independent testing agency selected by the Consultant at the Contractor's expense. Should results reveal components have not been started in accordance with the specified requirements, components may be rejected. If rejected, remove components from site and replace. Replacement components shall also be subject to full starting procedures, using the same procedures specified on the originally installed components.

1.15 VERIFICATIONS CONDUCTED BY CONSULTANT

.1 The Consultant may select and conduct at random, component, system and/or integrated systems to be re-tested.

.2 Performance testing of any components, systems or integrated systems by the Consultant does not reduce the Contractor's obligations for complete testing and start-ups as specified.

.3 The Contractor will provide, without cost, support for these tests, including:

.1 Making all test equipment and instrumentation available to the Consultant.

.2 Operating the appropriate components and systems.

.4 Any tests duplicated by the Consultant will be conducted under the same terms of reference applied to the Contractor testing.

.5 The Contractor, as directed by the Consultant shall witness any testing conducted by the Consultant.

.6 Should any component or system fail under the Consultant's performance testing the Contractor will correct the deficiency and retest to the satisfaction of the Consultant, at the Contractor's expense.

1.16 SPECIAL TESTING AGENCIES

.1 All reports generated by special testing agencies shall be submitted by the Contractor to the Consultant.

.2 All proposed special testing agencies require the approval of the Consultant and must have acceptable facilities and qualifications.

Part 2 PRODUCTS

2.1 CONTRACTOR TESTING INSTRUMENTS

.1 Provide two-way radios, ladders and other equipment as required to complete the commissioning program as outlined in this specification.

.2 Provide all safety equipment required for personnel involved in the Commissioning program.

.3 Provide a list of equipment and instruments that will be required for the starting, testing, adjusting, balancing and commissioning, for approval and review by the Consultant.

.4 Use instruments supplied or calibrated by approved laboratory or manufacturer. Submit to the Consultant the current calibration certificates for each instrument to be used.

2.2 USE OF INSTRUMENTS SUPPLIED UNDER CONTRACT

.1 Calibrated air flow measuring stations shall be used to measure air flow during the system balancing and commissioning performance testing.

.2 Use balancing valve pressure tapping, orifice plates, annubars, etc. to measure fluid flow rates.

.3 Calibrated environmental control system, temperature, humidity and pressure sensors may be used to gather system performance data provided the Consultant confirms that the calibrations have been accepted.

.4 Instruments for testing, adjusting, balancing and commissioning supplied under contract may be used provided the Consultant is satisfied that the instrument accuracy complies with this specification and the calibration certificate has been provided with each instrument.

Part 3 EXECUTION

3.1 EQUIPMENT STARTING & TESTING

.1 Schedule and complete the equipment startup, run-ins and testing as defined in the respective Sections.

.2 Submit all startup and test reports, including Manufacturer's reports to the Consultant for approval.

.3 All startup and testing is to be done in accordance with approved Manufacturer's procedures.

3.2 COMPONENT VERIFICATIONS

.1 Complete Component Verifications and Verification testing in accordance with:

.1 Mechanical Commissioning Requirements

.2 Electrical Commissioning Requirements

3.3 INTEGRATED SYSTEM TESTING

.1 Integrated System Testing verify the performance of systems operating in conjunction with one another under various modes of operation. Each system is to be operated for as long as required to complete the Commissioning.

.2 Reported results of testing and procedures are checked and verified to be correct within stated tolerances. If inconsistencies appear between reported results and demonstrated values, the relevant testing procedures are repeated and adjustments are made until satisfactory results are obtained.

.3 The sample Integrated System Test provided at the end of this section is a representative sample and will be replaced by the project specific Integrated System Tests following contract award.

.4 Integrated Systems Testing shall be scheduled and conducted by the Contractor.

.5 The Consultant shall witness all Integrated System Testing.

.6 Coordination:

.1 Integrated System Testing shall not take place until all related system tests have been completed.

.2 Testing shall not take place until operations and maintenance manual have been reviewed and accepted by the Consultant.

.7 Responsibilities:

.1 The Consultant will do the following during the Integrated System Testing.

.1 Witness and provide instruction in during the testing.

.2 Review and verify the Contractor recorded test results.

.3 Diagnose problems and determine if they are design related or are the result of contract deficiencies.

.4 Request repeat tests as required following correction of contract deficiencies.

.5 Conduct user surveys and take environmental measurements as necessary to identify existing and potential problems.

.6 Provide direction and instruction in the fine tuning of the systems under test to satisfy the operating requirements.

.8 The Contractor will do the following during the Integrated System Testing

.1 Coordinate and conduct the Integrated System Testing.

.2 Modify operating parameters of the systems to satisfy the fine tuning requirements outlined by the Consultant so as to ensure proper system operation. For example:

.1 Make adjustments which may become apparent as testing proceeds.

.2 Undertake modifications to suit changes as equipment settles down during the `running in' period.

.3 Documentation of test results.

.4 Diagnosis of problems.

.5 Correct contract deficiencies identified during testing.

.6 Fine tuning will provide for the adjustment of the system where the Integrated Systems Testing have shown a need, such as:

.1 Temperature, relative humidity, air movement in the occupied zone, ventilation, air purity, noise, vibration, and pressure.

END OF SECTION

Part 1. General

1.1 REFERENCES

.1 American Water Works Association (AWWA)

.2 National Fire Protection Association (NFPA)

1. NFPA-13-02, Installation of Sprinkler Systems Handbook.

2. NFPA-14-02, Automatic Sprinkler Systems Handbook.

3. NFPA-20-03, Standard for the Installation of Stationary Fire Pumps for Fire Protection.

.3 Underwriters' Laboratories of Canada (ULC)

1.2 GENERAL

.1 Provide a fully functional facility:

1. Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.

2. Facility user and O&M personnel have been fully trained in aspects of installed systems.

3. Optimized life cycle costs.

4. Complete documentation relating to installed equipment and systems.

.2 Term "Cx" in this section means "Commissioning".

.3 Use this Cx Plan as master planning document for Cx:

1. Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.

2. Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.

3. Sets out deliverables relating to O&M, process and administration of Cx.

4. Describes process of verification of how built works meet Owner/Investor's requirements.

5. Produces a complete functional system prior to issuance of Certificate of Occupancy.

6. Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:

.1 Overview of Cx.

.2 General description of elements that make up Cx Plan.

.3 Process and methodology for successful Cx.

.4 Acronyms:

1. Cx - Commissioning.

2. BMM - Building Management Manual.

3. EMCS - Energy Monitoring and Control Systems.

4. MSDS - Material Safety Data Sheets.

5. O&M – Operation and Maintenance

6. PI - Product Information.

7. PV - Performance Verification.

8. TAB - Testing, Adjusting and Balancing.

9. WHMIS - Workplace Hazardous Materials Information System.

.5 Commissioning terms used in this Section:

1. Bumping: short term start-up to prove ability to start and prove correct rotation.

2. Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.3 DEVELOPMENT OF 100% CX PLAN

.1 Cx Plan to be 100% completed following award of contract to take into account:

1. Accepted shop drawings and product data.

2. Accepted changes to contract.

3. Contractor's project schedule.

4. Cx schedule.

5. Contractor's, sub-contractor's, suppliers' requirements.

6. Project construction team's and Cx team's requirements.

1.4 REFINEMENT OF CX PLAN

.1 During construction phase, revise, refine and update Cx Plan to include:

1. Changes resulting from Client program modifications.

2. Approved design and construction changes.

.2 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.5 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

.1 Owner will select Cx Team consisting of following members:

1. Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.

2. Quality Assurance Commissioning Manager: ensures Cx activities are carried out to ensure delivery of a fully operational project including:

.1 Review of Cx documentation from operational perspective.

.2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.

.3 Protection of health, safety and comfort of occupants and O&M personnel.

.4 Monitoring of Cx activities, training, development of Cx documentation.

.5 Work closely with members of Cx Team.

3. Owner/Cx Agent is responsible for:

.1 Organizing Cx.

.2 Monitoring operations Cx activities.

.3 Witnessing, certifying accuracy of reported results.

.4 Witnessing and certifying TAB and other tests.

.5 Developing BMM.

.6 Ensuring implementation of final Cx Plan.

.7 Performing verification of performance of installed systems and equipment.

.8 Implementation of Training Plan.

4. Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with contract documents, including:

.1 Testing.

.2 TAB.

.3 Performance of Cx activities.

.4 Delivery of training and Cx documentation.

.5 Assigning one person as point of contact with Cx Manager for administrative and coordination purposes.

5. Contractor's Cx agent implements specified Cx activities including:

.1 Demonstrations.

.2 Training.

.3 Testing.

.4 Preparation, submission of test reports.

1.6 CX PARTICIPANTS

.1 Employ the following Cx participants to verify performance of equipment and systems:

1. Installation contractor/subcontractor:

.1 Equipment and systems except as noted.

.2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.

1. To include performance verification.

.3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.

.4 Specialist Cx agency:

1. Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.

.5 Client: responsible for intrusion and access security systems.

.6 Ensure that Cx participant:

1. Could complete work within scheduled time frame.

2. Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel, including:

.1 Modify ventilation rates to meet changes in off-gassing.

.2 Changes to heating or cooling loads beyond scope of EMCS.

.3 Changes to EMCS control strategies beyond level of training provided to O&M personnel.

.4 Redistribution of electrical services and lighting control settings.

.5 Modifications of fire alarm systems.

.6 Modifications to voice communications systems.

.7 Provide names of participants and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.

1.7 EXTENT OF CX

.1 Cx Structural and Architectural Systems:

1. Architectural and structural:

.1 Building envelope

.2 Automatic door operators

.3 Overhead doors

2. Accessibility and Operational Safety.

.1 Automatic door operators

3. Vertical transportation systems:

.1 Passenger elevators

4. Doors, windows, related hardware:

.1 Door Hardware:

.2 Overhead doors.

.2 Cx Mechanical Systems:

1. **HVAC System Test**: It is envisaged that each piece of HVAC equipment will be initially started up, "bumper", in their 'Stand-alone" mode, i.e. without mechanical control and fire alarm interfaces being complete. During this period, pre-start checks will be completed and the relevant documentation completed. In the case of hydronic systems, after the pumps have been bumped and the pre-start checks completed, the cleaning process can commence. Items covered at this stage will be those which might have a detrimental effect on the operation of the particular item of equipment, such as noise and vibration, it is realized that the system balancing can have an effect on some parameters. Once individual pieces of equipment have been started up, the systems will be checked out in parallel with the control systems. System documentation will be completed by the Commissioning Agent before verification or training begins.

.1 Heating Systems

.1 Glycol Fill Tank & Pump

.2 Boilers

.3 Pumps

.4 Hydronic System

.5 Radiant Panels

.6 Unit Heaters

.7 Expansion Tanks

.8 Boiler Plant Control

.2 Ventilation

.1 Central supply and return air systems

.2 Stand-alone air handling systems (fan coils)

.3 Exhaust air systems

.4 Special project-related ventilation.

.5 Heat recovery systems.

.6 Air Handling Units

.7 Vehicle Bay Exhaust Systems

.3 Air Conditioning / Refrigeration System

.1 Central air cooled chiller

.2 Stand Alone A/C units

.3 Chilled Water Pumps

.4 Chilled Water Expansion Tanks

.4 Plumbing Systems:

.1 Will be started up and commissioned in a manner similar to that described for HVAC systems. The majority of the equipment will be started up in the stand-alone mode; automatic operation will be checked on a system-by-system basis in parallel with the control systems. System documentation will be completed by the Cx Agent and submitted for review before verification or training begins.

.2 Hot and cold water service systems

.3 Domestic water and fire protection system

.4 Chemical treatment and water softening system (such as water softener, feeders, chemicals, testing and controls)

.5 Sanitary sewage system

.5 Controls:

.1 Testing and commissioning is specified in the specifications, and the acceptance of the control system is well defined. It is envisaged that the contractor testing i.e. point-by-point testing will be performed in parallel with contractor start up. A complete point-by-point verification will be done as part of system verification and will be witnessed by the Consultant. Demonstration of the controls system will be witnessed by both

the EMCS Cx Agent and the Cx Agent prior to the thirty day (30) Final Acceptance test.

.2 The final Cx is considered to be performed during these two stages and the only additional testing required at the end of the "Final Operational Test" would be the off seasonal test. System documentation will be completed by the Cxg Agent and submitted for review before verification or training begins.

.6 Automation:

.1 Mechanical control systems

.2 Building control components

.3 Central plant control room components

.4 Central system programming

.5 Diversified control (such as to "smart panels" wiring in central and local air-condition plant, room condition equipment, e.g. thermostats, etc.)

.3 Cx Electrical Systems:

1. Distribution: Testing and commissioning of the main distribution system is defined within the specifications, requiring an independent testing company to perform a series of pre-energisation and post-energisation tests. Test reports are to be submitted for review before verification of system takes place. Contactor testing apart from this is restricted to "megger" testing of feeders.

2. Power Systems:

.1 MDP.

.2 Branch circuit panel boards.

.3 Generator.

.4 Transfer switch.

.5 Variable frequency drives.

.6 Parking receptacle controller.

3. Lighting Systems:

.1 Emergency lighting.

.2 Lighting controls

Low Voltage Systems: These systems, including Communication System, and low voltage lighting controls, will be checked out in accordance with the contract documents. Consultant will witness system test.

4. Life Safety System:

Sprinkler/standpipe**:** Wet and Dry pip station and sprinkler flow testing will be performed as part of the Fire Alarm System ULC 537 and 536 checks. The Designer and Commissioning Agent to witness all tests

5. Fire and Smoke Safety Systems

.1 Electrical hardware and operation

.2 Mechanical hardware and operation

.3 Fire alarm and zone isolation

.4 Integration of fire system with building system controls such as air-conditioning etc.

.5 Testing and certification

1.8 DELIVERABLES RELATING TO O&M PERSPECTIVES

.1 General requirements:

1. Compile documentation.

2. Documentation to be computer-compatible format ready for inputting for data management.

.2 Provide deliverables:

1. Warranties.

2. Project record documentation.

3. Inventory of spare parts, special tools and maintenance materials.

4. Maintenance Management System (MMS) identification system used.

5. WHMIS information.

6. MSDS data sheets.

7. Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel and lighting control relay directory.

1.9 DELIVERABLES RELATING TO THE CX PROCESS

.1 General:

1. Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.

.2 Definitions:

1. Cx as used in this section includes:

.1 Cx of components, equipment, systems, subsystems, and integrated systems.

.2 Factory inspections and performance verification tests.

.3 Deliverables: provide:

1. Cx Specifications.
2. Startup, pre-Cx activities and documentation for systems, and equipment.
3. Completed installation checklists (ICL).
4. Completed product information (PI) report forms.
5. Completed performance verification (PV) report forms.
6. Results of Performance Verification Tests and Inspections.
7. Description of Cx activities and documentation.
8. Description of Cx of integrated systems and documentation.
9. Tests performed by Owner/User.
10. Training Plans.
11. Cx Reports.
12. Prescribed activities during warranty period.

1.10 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Items listed in this Cx Plan include the following:

1. Include completed documentation with Cx report.

2. Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections.

.2 Pre-Cx activities - ARCHITECTURAL AND STRUCTURAL:

1. Slab and beam deflection test: test after removal of temporary supports and concrete has cured to ensure adequacy for raised floors.

2. Exterior walls: conduct thermographic surveys to ensure appropriate level of tightness after exterior envelope has been completed. Permanent HVAC systems are able to provide appropriate negative or positive pressure, a temperature of at 20 degrees C can be maintained between inside and outside and wind speed is less than 10 kph.

3. Doors, windows, related hardware:

.1 Overhead doors: ___.

.2 Door and window hardware: ___.

.3 Pre-Cx activities - MECHANICAL:

1. Plumbing systems:

.1 "Bump" each item of equipment in its "stand-alone" mode.

.2 Complete pre-start-up checks and complete relevant documentation.

.3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.

2. HVAC equipment and systems:

.1 "Bump" each item of equipment in its "stand-alone" mode.

.2 At this time, complete pre-start-up checks and complete relevant documentation.

.3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.

.4 Perform TAB on systems. TAB reports to be approved by Consultant.

3. EMCS:

.1 EMCS trending to be available as supporting documentation for performance verification.

.2 Perform point-by-point testing in parallel with start-up.

.3 Carry out point-by-point verification.

.4 Demonstrate performance of systems, to be witnessed by Departmental Representative prior to start of 30 day Final Acceptance Test period.

.5 Perform final Cx and operational tests during demonstration period and30 day test period.

.6 Only additional testing after foregoing have been successfully completed to be "Off-Season Tests".

.4 Pre-Cx activities - LIFE SAFETY SYSTEMS

1. Include equipment and systems identified above.

.1 ___.

2. Reports of test results to be witnessed and certified by Departmental Representative before verification.

.5 Pre-Cx activities - ELECTRICAL:

1. High voltage distribution systems over 750 V:

.1 Done by utility.

2. Low voltage distribution systems under 750 V:

.1 Requires independent testing agency to perform pre- energization and post-energization tests.

.2 ___.

3. Emergency power generation systems

.1 Transfer switches: test by simulating loss of power. Verify availability of power at equipment requiring same.

.2 ___.

.1 Uninterruptible power systems: test under full and partial load conditions.

.2 ___.

4. Lighting systems: ___.

.1 Emergency lighting systems:

.1 Tests to include verification of lighting levels and coverage, initially by disrupting normal power.

5. Fire alarm systems: test after other safety and security systems are completed. Testing to include a complete verification in accordance with ULC requirements. Cx has witnessed and certified report, demonstrate devices and zones to Consultant/Cx.

6. Low voltage systems: these include:

.1 Clock, communications, low voltage lighting control systems and data communications systems.

.2 Special systems such as Simultaneous Translation systems, MPs Call systems, Messenger Call systems, Division Bell systems, ___.

.3 Lighting control system settings and functionality.

7. Security, surveillance and intrusion alarm systems:

8. Lightning protection systems.

1.11 START-UP

.1 Start up components, equipment and systems.

.2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction, following equipment, systems:

1. ___.

.3 Consultant/Cx to monitor some of these start-up activities.

1. Rectify start-up deficiencies to satisfaction of Consultant.

2. Performance Verification (PV):

.1 Approved Cx Agent to perform.

.1 Repeat when necessary until results are acceptable to Consultant/Cx.

.2 Use procedures modified generic procedures to suit project requirements.

3. Consultant/Cx verify up to 30% of reported results at random.

4. Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.12 CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Perform Cx by specified Cx agency.

.2 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.

1.13 CX OF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION

.1 Cx to be performed by specified Cx specialist.

.2 Upon satisfactory completion, Cx specialist to prepare Cx Report, and submit for review.

.3 Consultant/Cx reserves right to verify percentage of reported results.

.4 Integrated systems to include:

1. HVAC and associated systems forming part of integrated HVAC systems:___.

2. Smoke control systems: ___.

3. Stair shaft pressurization systems: ___.

4. Indoor air quality: ___.

5. Environmental space conditions: ___.

6. Fire alarm systems: ___.

7. Fire pumps and controllers: ___.

8. Voice communications systems: ___.

9. Emergency power generator: ___.

10. Transfer switch and controllers: ___.

11. Emergency lighting systems: ___.

12. ___.

.5 Identification:

1. In later stages of Cx, before hand-over and acceptance, and Cx Manager to co-operate to complete inventory data sheets and provide assistance to in full implementation of MMS identification system of components, equipment, sub-systems, systems.

1.14 DELIVERABLES RELATING TO ADMINISTRATION OF CX

.1 .1 General:

2. Because of risk assessment, complete Cx of occupancy, weather and seasonal-sensitive equipment and systems in these areas before building is occupied.

1.15 CX SCHEDULES

.1 Prepare detailed critical path Cx Schedule and submit to Consultant for review and approval same time as project Construction Schedule. Include:

1. Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:

.1 Design criteria, design intents.

.2 Pre-TAB review: 28days after contract award, and before construction starts.

.3 Cx agents' credentials: 60 days before start of Cx.

.4 Cx procedures: 3 months after award of contract.

.5 Cx Report format: 3months after contract award.

.6 Discussion of heating/cooling loads for Cx: 3 months before start-up.

.7 Submission of list of instrumentation with relevant certificates: 21 days before start of Cx.

.8 Notification of intention to start TAB: 21 days before start of TAB.

.9 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.

.10 Notification of intention to start Cx: 14 days before start of Cx.

.11 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14days before start of integrated system Cx.

.12 Identification of deferred Cx.

.13 Implementation of training plans.

.14 Cx of smoke management/control systems: after Cx of related systems is completed and 7 days before proposed date of Cx these systems.

.15 Cx stair shaft pressurization systems: before issuance of occupancy certificate.

.16 Cx reports: immediately upon successful completion of Cx.

.17 Emergency evacuation exercises: after 80% occupancy and at same time as Cx of stair shaft pressurization systems.

2. Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Property Manager.

3. 6 months in Cx schedule for verification of performance in all seasons and wear conditions.

.2 After approval, incorporate Cx Schedule into Construction Schedule.

.3 Consultant, Contractor, Contractor's Cx agent, and owner will monitor progress of Cx against this schedule.

1.16 CX REPORTS

.1 Submit reports of tests, witnessed and certified by Cx Agent to Cx Agent who will verify reported results.

.2 Include completed and certified PV reports in properly formatted Cx Reports.

.3 Before reports are accepted, reported results to be subject to verification by Cx Agent.

1.17 PRELIMINARY AND FINAL CX

.1 ___.

1.18 ACTIVITIES DURING WARRANTY PERIOD

.1 Cx activities must be completed before issuance of Interim Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:

1. Fine tuning of HVAC systems.

2. Adjustment of ventilation rates to promote good indoor air quality and reduce deleterious effects of VOCs generated by off-gassing from construction materials and furnishings.

3. Full-scale emergency evacuation exercises.

1.19 TESTS TO BE PERFORMED BY OWNER/USER

.1 None is anticipated on this project.

1.20 FINAL SETTINGS

.1 Upon completion of Cx to satisfaction of Consultant lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

Part 2. Products

2.1 NOT USED

Part 3. Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Municipal District of Opportunity No. 17 – Landfills, Transfer Site and Waste Services. Website: www.mdopportunity.ab.ca/landfills-transfer-waste

.2 Canadian Environmental Protection Act, 1999 (CEPA 1999).

1.2 DEFINITIONS

.1 Demolition: rapid destruction of assembly materials.

.2 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, may include but not limited to: asbestos PCB's, CFC's, HCFC's poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material that can endanger human health or well being or environment if handled improperly.

.3 Waste Management Coordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.

.4 Waste Management Work Plan (WMWP): written report which addresses opportunities for reduction, reuse, or recycling of materials. WMWP is based on information acquired from WMC.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Site Meetings.

.1 Convene pre-demolition meeting one week prior to beginning work of this Section in accordance with Section 01 32 16.07- Construction Progress Schedules - Bar (GANTT) Chart to:

.1 Verify project requirements.

.2 Review installation conditions.

.3 Co-ordination with other subtrades.

.2 Arrange for site visit with Consultant to examine existing site conditions adjacent to demolition work, prior to start of Work.

.3 Hold project meetings in accordance with Section 01 31 19 Project Meetings.

.4 Ensure key personnel attend.

.5 Reporting Requirements: WMC to complete.

.2 Scheduling: meet project time lines:

.1 Notify Owner and Consultant in writing when unforeseen delays occur.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Waste Management Work Plan:

.1 Prior to beginning of Work on site submit detailed Waste Management Work Plan in accordance with Section 01 74 19 – Construction/Demolition Waste Management and Disposal and indicate:

.1 Schedule of selective demolition.

.2 Name and address of waste facilities.

.3 Certificates:

.1 Written authorization from Owner is required to deviate from receiving organizations, haulers, and facilities listed in Waste Management Work Plan.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Reduction Work Plan highlighting schedule, sub-trade and Contractor coordination plans to reduce waste generated on site.

.2 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with Section 01 35 43 Environmental Procedures.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: ensure Work is performed in compliance with applicable Provincial/Territorial regulations and CEPA.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Store and manage hazardous materials in accordance with Section 01 35 43- Environmental Procedures.

.2 Storage and Protection.

.1 Protect in accordance with Section 31 23 38 – Trench Excavation and Backfill.

.2 Protect existing items designated to remain. In event of damage to such items, immediately replace or make repairs to acceptance of Consultant and at no cost to the Work.

.3 Remove and store materials to be reused, in manner to prevent damage.

.4 Store and protect in accordance with requirements for maximum preservation of material.

.3 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section Section 01 74 19 – Construction/Demolition Waste Management and Disposal.

1.7 SITE CONDITIONS

.1 Site Environmental Requirements.

.1 Perform work in accordance with Section 01 35 43- Environmental Procedures.

.2 Ensure that selective demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.

.3 Do not dispose of waste of volatile materials including but not limited to, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.

.1 Ensure proper disposal procedures are maintained throughout the project.

.4 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.

.5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities.

.6 Protect trees, plants and foliage on site and adjacent properties where indicated.

.2 Existing Conditions.

.1 Remove contaminated or hazardous materials as defined by Authorities Having Jurisdiction from site, prior to start of demolition Work, and dispose of at designated disposal facilities in safe manner in accordance with TDGA and other applicable regulatory requirements.

Part 2 Products

2.1 EQUIPMENT

.1 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

Part 3 Execution

3.1 PREPARATION

.1 Inspect site with Consultant and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

.2 Locate and protect utilities. Preserve active utilities traversing site in operating condition except those designated for removal.

.3 Notify and obtain approval of utility companies before starting demolition.

.4 Disconnect and Cap Designated Utility Services.

3.2 REMOVAL OF HAZARDOUS WASTES

.1 Remove contaminated or dangerous materials defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.

3.3 REMOVAL OPERATIONS

.1 Remove items as indicated.

.2 Do not disturb items designated to remain in place.

.3 Excavate at least 300 mm below pipe invert, when removing pipes under existing or future pavement area.

.4 Stockpile topsoil for final grading and landscaping:

.1 Provide erosion control and seeding if not immediately used.

.5 Disposal of Material:

.1 Dispose of materials not designated for salvage or reuse on site at authorized facilities approved in Waste Management Work Plan.

.6 Backfill:

.1 Backfill in areas as indicated and in accordance with Section 31 23 38 – Trench Excavation and Backfill.

3.4 STOCKPILING

.1 Label stockpiles, indicating material type and quantity.

.2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.

.3 Locate stockpiled materials convenient for use in new construction to eliminate double handling wherever possible.

.4 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

3.5 REMOVAL FROM SITE

.1 Remove stockpiled material as directed by Consultant, when it interferes with operations of project.

.2 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.

.3 Transport material designated for alternate disposal using approved receiving organizations and haulers in accordance with applicable regulations.

.1 Written authorization from Owner is required to deviate from receiving organizations, facilities, haulers listed in Waste Management Work Plan.

.4 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.

3.6 RESTORATION

.1 Restore areas and existing works outside areas of demolition to conditions that existed prior to beginning of Work, match condition of adjacent, undisturbed areas.

.2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

.2 Remove debris, trim surfaces and leave work site clean, upon completion of Work

.3 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.3 Waste Management: remove waste materials in accordance with Section Section 01 74 19 – Construction/Demolition Waste Management and Disposal

3.8 PROTECTION

.1 Repair damage to adjacent materials or property caused by selective site demolition.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 84 00 – Fire Stopping

.2 Section 07 92 00 – Joint Sealants

.3 Section 09 91 23 – Interior Painting

1.2 REFERENCES STANDARDS

.1 Definitions:

.1 Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.

.2 Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.

.3 Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.

.2 Reference Standards:

.1 Canadian Environmental Protection Act,1999 (CEPA 1999)

.1 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).

.2 Department of Justice Canada (Jus)

.1 Transportation of Dangerous Goods Act, 1992 (TDG Act) 1992, (c. 34).

.2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).

.3 Green Seal Environmental Standards (GS)

.1 GS-11-2011, 3rd Edition, Standard for Paints and Coatings.

.2 GS-36-2013, 2ne Edition, Standard for Adhesive for Commercial Use.

.4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 National Research Council Canada Institute for Research in Construction (NRC-IRC)

.1 National Fire Code of Canada-2015.

.3 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113-A2016, Architectural Coatings.

.2 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit electronic copy of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures to Consultant for each hazardous material required prior to bringing hazardous material on site.

.3 Submit hazardous materials management plan to Consultant that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Low-Emitting Materials: submit listing of adhesives and sealants, paints and coatings used in building. Comply with VOC and chemical component limits or restrictions requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.

.4 Storage and Handling Requirements:

.1 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.

.2 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada requirements.

.3 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.

.1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.

.4 Transfer of flammable and combustible liquids is prohibited within buildings.

.5 Transfer flammable and combustible liquids away from open flames or heat-producing devices.

.6 Solvents or cleaning agents must be non-flammable or have flash point above 38 degrees C.

.7 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.

.8 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.

.9 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:

.1 Store hazardous materials and wastes in closed and sealed containers.

.2 Label containers of hazardous materials and wastes in accordance with WHMIS.

.3 Store hazardous materials and wastes in containers compatible with that material or waste.

.4 Segregate incompatible materials and wastes.

.5 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.

.6 Store hazardous materials and wastes in secure storage area with controlled access.

.7 Maintain clear egress from storage area.

.8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.

.9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.

.10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.

.11 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.

.12 Report spills or accidents immediately to Owner and Consultant. Submit a written spill report to Consultant within 24 hours of incident.

.5 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 43 – Environmental Procedures.

.6 Packaging Waste Management: remove for reuse and return pallets, crates, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Description:

.1 Bring on site only quantities hazardous material required to perform Work.

.2 Maintain MSDS in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

.3 Sustainability Characteristics:

.1 Adhesives and Sealants in accordance with Section 07 92 00 - Joint Sealants.

.1 Adhesives and Sealants: maximum VOC limit to meet SCAQMD Rule 1168 limits.

.2 Primers, Paints, and Coatings in accordance with manufacturer's recommendations for surface conditions and Section 09 91 23 - Interior Painting.

.1 Primer: maximum VOC limit to meet SCAQMD Rule 1113 limits.

.2 Paints: maximum VOC limit 50 g/L to SCAQMD Rule 1113.

.3 Coatings: maximum VOC limit to meet SCAQMD Rule 1113 limits.

Part 3 Execution

3.1 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.

.2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.

.3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.

.4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.

.5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.

.6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.

.7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.

.8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:

.1 Hazardous wastes recycled in manner constituting disposal.

.2 Lead-acid battery recycling.

.3 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

1. GENERAL

1.1 RELATED REQUIREMENTS

.1 Not Used

.2 Contract Documents apply to and govern the Work of this section.

1.2 REFERENCES

.1 ASTM C900-06 - Test Method for Pullout Strength of Hardened Concrete.

.2 CAN/CSA-O86.1-01 Consolidation - Engineering Design in Wood.

.3 CAN/CSA-S269.3-M92 (R2003) - Concrete Formwork.

.4 CSA A23.1-04/A23.2-04 - Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.5 CSA O121-08 - Douglas Fir Plywood.

.6 CSA O151-04 - Canadian Softwood Plywood.

.7 CSA S269.1-1975 (R2003) - Falsework for Construction Purposes.

1.3 COORDINATION REQUIREMENTS

.1 Coordination: Coordinate with other work and sub-trades having a direct bearing on work of this section.

1.4 DESIGN REQUIREMENTS

.1 Design of concrete formwork and adequate shoring systems are sole responsibility of the Contractor.

1.5 SUBMITTALS

.1 Shop Drawings: Submit Shop Drawings indicating placement joints, control joints, and false joint patterns for review. Include proposed tie pattern.

1.6 REGULATORY REQUIREMENTS

.1 Conform to applicable safety regulations for erection, maintenance and removal of formwork.

1.7 DELIVERY, STORAGE, AND PROTECTION

.1 Protect material and Work from damage by frost and weather.

2. PRODUCTS

2.1 MATERIALS

.1 Formwork Materials: To CSA A23.1, precoated plywood sheets.

.2 Form Oil: Colorless mineral oil, free of kerosene, with viscosity min. 70 maximum 110 seconds Saybolt Universal at 38 degrees C, flashpoint minimum 150 degrees C open cup. Form coating to be of type that will permit the application of paint or parging to the exposed concrete surfaces.

.3 Plywood:

.1 Douglas Fir, conforming to CSA O121 or Softwood conforming to CSA O151 as required to resist design loads imposed upon the forming system; regular grade select tight face; sound undamaged sheets with clean, true edges.

.2 Exposed Architectural Finished Concrete including painted or epoxy-coated concrete: Use high density overlaid one side material to CSA O121, smooth surface, undamaged sheets with clean, true edges. Re-use no more than five times.

.4 Lumber: Fir or spruce species, No. 2 Grade or better to the design requirements of CAN/CSA-O86.1 to resist applied loads required of the forming system.

.5 Anchorage Devices (including nails, bolts, spikes, and lag screws): Sized to ensure all formwork loading is adequately resisted.

.6 Steel Forms: Minimum 1.9 mm well matched, tight fitting, and adequately stiffened to support weight of concrete without deflection.

.7 Form Ties: All concrete with unexposed (non-architectural) finishes or covered by an applied architectural finish:

.1 Snap off metal ties that will break off approximately 15 mm below the surface and permit a flush finish, to resist all forces.

.2 Snap off metal ties with 50 mm length cone to resist all forces to permit a recessed finish. Pattern to approval of Consultant. Use in swimming pool forming. Fill recessed holes with cementitious waterproofing to flush with wall surface.

.8 Form Ties: All concrete exposed to view, including painted and/or epoxy-coated concrete, unless specifically exempted on the drawings or in a room finish schedule:

.1 Removable ties shall resist all forces and shall permit a recessed or flush finish. Pattern to be symmetrical to approval of Consultant.

.9 Form Release Agent: Non-staining, non-volatile type. Exposed concrete finishes use low viscosity agent to eliminate bugholes.

.10 Fillets for Chamfered Corners: Minimum 12 x 12 mm wood.

.11 Void Forms: Moisture resistant Dynavoid 40144 or approved equivalent; structurally sufficient to support weight of wet concrete until final set; minimum 100 mm thick.

3. EXECUTION

3.1 EXAMINATION

.1 Verify lines and levels before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 ERECTION

.1 Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of CAN/CSA S269.3.

.2 Arrange and assemble formwork to permit easy dismantling and stripping, so that concrete is not damaged during its removal.

.3 Align joints and make watertight, to prevent leakage of mortar and disfigured appearance of concrete. Keep form joints to a minimum. Obtain approval of Consultant for location of form joints in exposed work.

.4 Verify all elevations. Revise elevations as required to the approval of the Consultant to proper elevations. Ensure piles project into grade beams and pile caps as indicated on drawings.

.5 Remove all loose concrete from tops of piles and footings. Ensure tops of piles and footings are sound concrete.

.6 Obtain approval of Consultant for use of earth forms. When using earth forms, hand-trim sides and bottoms, and remove loose dirt prior to placing concrete.

.7 Provide bracing to ensure stability of formwork as a whole. Prop or strengthen all previously constructed parts liable to be overstressed by construction loads.

.8 Chamfer external corners of beams, columns and walls 12 mm when exposed or as noted.

.9 Construct formwork to maintain the following maximum tolerances unless closer tolerances are required for special conditions such as elevators:

.1 Horizontal and vertical lines – 10 mm in 20 m.

.2 Building dimensions indicated on drawings and position of columns, walls, partitions: 6 mm

.3 Cross sectional dimensions of columns or beams: plus or minus 3 mm.

.4 Camber, Beams: 0.2% of span unless otherwise noted.

.5 Camber, Slabs: 0.1% of span for all spans over 3 m.

.10 Apply form release agent on formwork in accordance with manufacturer's recommendations. Apply prior to placing reinforcing steel, anchoring devices, and

embedded parts. Do not apply form release agent where concrete surfaces are to receive special finishes or coverings that are affected by agent.

.11 Do not reuse formwork that contains surface defects that could impair the appearance of finished concrete. Do not patch formwork.

3.3 FORMING OF ARCHITECTURAL AND EXPOSED CONCRETE

.1 Erect formwork to result in exposed concrete surfaces free of unsightly cold joints, blemishes, bugholes, honeycombing and cracking. Acceptable symmetrical joint patterns are mandatory.

.2 Control joint and pour break spacing outlined on structural drawings are maximum allowable. More frequent spacing will likely be required to conform to architectural requirements.

.3 Horizontal reglets must be placed on both sides of all pour breaks in walls, railings, beams, and/or slabs.

.4 All V-joints or reglets in walls and railings must also extend over the top of the wall or railing.

.5 Caulk or otherwise seal all form joints including corners to prevent loss of fine material.

.6 Add V-joints and reglets to forms at all vertical and horizontal pour breaks and as noted or detailed. Caulk V-joint and reglet formwork to prevent bleeding of fines form concrete.

.7 Replace damaged forms and forms with poor surfaces with new material at direction of Consultant.

.8 Chamfer all exposed edges and corners.

.9 Fill all interior V-joints, reglets and form tie holes with approved cementitious waterproofing material. Finish to be flush and match texture of adjacent concrete.

.10 Form, cast and finish a sample panel of minimum size 3000 x 3000 mm. Include construction joint, control joint, reinforcing, water stop, and forming material to be used throughout the project.

.11 Have forming inspected before concrete placement. Place concrete as specified. Fill all reglets and form tie holes and rub finish as specified herein, to approval of Consultant.

.12 Panel to remain on site as basis for acceptability of all concrete finishes. Protect the finished work from elements.

3.4 INSERTS

.1 Set sleeves, ties, anchor bolts and other inserts and openings in concrete as required by other trades.

.2 Limit penetrating sleeves, ducts, pipes or other openings to those detailed on the structural drawings or approved by the Consultant.

.3 All sleeves, openings, etc., shown on structural drawings to be checked with the architectural and mechanical drawings. Sleeves, openings, etc., not shown on the structural drawings to be reviewed by the Consultant.

.4 See additional information also provided in the structural drawings.

3.5 FORM REMOVAL

.1 Comply with CSA S269.1 for dismantling all falsework.

.2 Do not remove forms, shores, and bracing until concrete has gained sufficient strength to carry its own weight, construction loads, and the design loads that are expected to be imposed upon it.

.3 Remove forms not directly supporting weight of concrete only after ensuring that the stripping operations will not damage concrete but not before a minimum of twenty four (24) hours from completion of concrete placement.

.4 Retain shores under structural members for a minimum of fourteen (14) days or until the concrete has attained 75% of the required 28 days strength, whichever occurs later.

.5 Verify in-place strength by field cylinders or insert pullout type tests in accordance with ASTM C900.

.6 Remove formwork progressively and in accordance with code requirements so that no shock loads or unbalanced loads are imposed on structure.

.7 Loosen forms carefully. Do not wedge pry bars, hammers, or tools against concrete surfaces.

.8 Reshore structural members as required for design or construction conditions. Construction must be reshored to carry all future anticipated construction loading unless otherwise approved in writing by the Consultant.

3.6 FINISHING FORMED SURFACES

.1 Provide finishes in accordance with CSA A23.1, and as follows:

.1 Rough Finish Concrete Surfaces Not Exposed to View: Place concrete against true and plane forms. Cut off form ties a minimum of 15 mm below concrete surfaces. Patch tie holes and defects. Remove fins exceeding 5 mm.

.2 Sack Rubbed Finish. Exterior Surfaces and Interior Surfaces Exposed to View Including Ceilings: Place concrete against medium density plywood or steel. Fill reglets, tie holes and other defects. Remove fins, grind smooth and rub with cement sand slurry, as directed in CSA A23.1.

.2 Do not parge unless approved by Consultant.

3.7 FORM CLEANING

.1 Clean forms as erection proceeds, to remove foreign matter. Remove cuttings, shavings, and debris from within forms. Flush completely with water or compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

.2 During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction proceed within a heated enclosure. Use compressed air or other means to remove foreign matter.

3.8 FIELD QUALITY CONTROL

.1 Field Services:

.1 Field Services by the Consultant consists of periodic visits to the site for generally familiarizing with the progress and quality of the Work and to determine in general if it is progressing according to the contract documents, and the necessary paperwork related to these services.

.2 Field Services by the Consultant do not in any way relieve the Contractor of responsibility to execute the Work according to contract documents and contract drawings.

.2 Damage: Make good all areas damaged in connection with the Work regardless of the limits of the contract as shown on the drawings.

3.9 CLEANING

.1 Clean up and remove from site, all rubbish and surplus material remaining from this Work.

END OF SECTION

1. GENERAL

1.1 RELATED REQUIREMENTS

.1 Not Used

.2 The Contract Documents apply to and govern the Work of this section.

1.2 REFERENCES

.1 ACI 315-99 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products, Details and detailing of concrete reinforcement.

.2 ASTM A497/A497M-07 - Steel Welded Wire Reinforcement, Deformed, for Concrete.

.3 CAN/CSA-G30.18-M92 (R2007) - Billet-Steel Bars for Concrete Reinforcement.

.4 CSA A23.1-04/A23.2-04 - Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.5 CSA A23.3-04 - Design of Concrete Structures.

.6 CSA W186-M1990 (R2007) - Welding of Reinforcing Bars in Reinforced Concrete Construction.

.7 CSA W47.1-03 - Certification of Companies for Fusion Welding of Steel.

1.3 COORDINATION REQUIREMENTS

.1 Coordination: Coordinate with other work and sub-trades having a direct bearing on work of this section.

1.4 SUBMITTALS

.1 Shop Drawings:

.1 Provide placing drawings and bar lists and include placing dimensions and necessary placing details. Use large scale details for areas of congested reinforcement.

.2 Include details of all doweling.

.3 Details in accordance with ACI 315 unless specifically detailed otherwise.

.4 Unless otherwise noted on drawings, bar splices to be 40 bar diameters or 400 mm minimum for horizontal splices and 30 bar diameters or 350 mm minimum for vertical splices.

.5 Provide corner bars at corners and intersections of grade beams and walls, in accordance with the structural drawings.

.6 Check Shop Drawings prior to submission to Consultant.

.7 Consultant's review does not relieve Contractor of his responsibility for accuracy of shop drawings.

1.5 QUALITY ASSURANCE

.1 Perform Work in accordance with CAN/CSA A23.1/A23.2.

.2 Perform welding to CSA W186.

.3 Welders: Workmen qualified under CSA W47.1.

1.6 DELIVERY, STORAGE, AND PROTECTION

.1 Store and protect reinforcing steel and welded wire fabric to prevent deterioration or contamination by foreign matter.

.2 Do not use contaminated or deteriorated material.

2. PRODUCTS

2.1 MATERIALS

.1 Reinforcing Steel: To CSA G30.18, Grade 400, 400 MPa yield grade special low alloy deformed billet steel for welding, with equivalent carbon content not exceeding 0.5 and/or for bending where bending where bending radius is smaller than recommended standards.

.2 For mortar embedded reinforcing rod between glass blocks in all cells use 10M Grade 44W steel round bars.

.3 Dimensions are in metric designation.

.4 Welded Wire Fabric: To ASTM A497/A497M-07, in flat sheets, plain finish.

.5 Chairs, Bolsters, Bar Supports, Spacers: Adequate for strength and support of reinforcing. Where concrete is exposed to elements or where rust is possible, use plastic or non-corrosive material.

.6 Tie Wire: Minimum 1.5 mm annealed type, or patented system approved by the Consultant.

.7 Galvanized Reinforcement: To ASTM A123/A123M, minimum zinc coating 610 g/m^2.

2.2 FABRICATION

.1 Shop fabricate reinforcing steel from sizes indicated, and to reviewed shop drawings.

.2 Fabricating details in accordance with CSA A23.1.

.3 Identify steel.

.4 Hooks, bends, laps, and similar details to CSA A23.1, and Metric Supplement of the Reinforcing Steel Institute of Ontario (RSIO) Manual of Standard Practice.

.5 Do bending cold unless otherwise approved by Consultant.

.6 Dowel columns and walls into foundations using same reinforcing as that in column and wall unless noted otherwise.

.7 Provide horizontal "L" shaped corner bars of same cross section and spacing as horizontal bars.

.8 Provide all additional support bars as required to support all main reinforcement indicated.

.9 Provide 10M stirrup support bars in hooks or corners of beam stirrups unless noted otherwise on drawings.

.10 Provide 10M "U" spacers at 3000 mm on centre horizontally and 1500 mm on centre vertically to hold wall reinforcing mats in position.

.11 Provide mesh over electrical conduit, ductwork, or piping buried in slabs with strips of 152 x 152 x MW13.3 x MW13.3 welded wire fabric 300 mm each side. If principal slab reinforcement is placed above conduit, then place strips under conduit. Position of reinforcing steel takes precedence over conduit, ductwork, or piping.

.12 Locate reinforcing splices, not indicated on drawings, at points of minimum stress. Location of splices is to be approved by the Consultant.

.13 Where indicated, weld reinforcing bars in accordance with the applicable requirements of CSA W186. Do not weld reinforcing at any location without written approval of the Consultant.

.14 Test all welded reinforcement splices unless noted. Such testing to be paid for by the Contractor.

3. EXECUTION

3.1 PREPARATION

.1 Clean reinforcing to CSA A23.1.

3.2 PLACEMENT

.1 Place reinforcement in accordance with reviewed shop drawings and/or contract drawings.

.2 Support and space reinforcing in alignment and position indicated and as follows:

.1 Concrete Slabs On Grade: Support reinforcement on support bars or concrete brick.

.2 Structural slabs and toppings: support reinforcement on bar chairs.

.3 The minimum concrete cover to be provided is as follows unless detailed otherwise on drawings or specified elsewhere: (dimensions in mm).

CLEAR CONCRETE COVER SCHEDULE

Exposure Condition	Exposure Class				
	N	F-1, F-2, S-1, S-2	C-XL, C-1, C-3, A-1, A-2, A-3	C-2, C-4	Epoxy-Coated Bars
Cast Against and Permanently Exposed to Earth (Footings and Piles)	3" (75mm)	3" (75mm)	3" (75mm)	-	No
Formed Surfaces Exposed to Earth (Pile Caps, Piers, Foundation Walls, Retaining walls and Grade Beams)	1 5/8" (40mm)	1 5/8" (40mm)	2 3/8" (60mm)	-	No
Interior Slab On Grade	3/4" (20mm)	-	-	-	No
Stoops (Structural or on Grade):					
-Top Steel	-	-	2 3/8" (60mm)	-	No
- Bottom Steel	-	-	1 5/8" (40mm)	-	No
Parking Slabs, Parking Ramps and Concrete Aprons Subject To Exterior Exposure, including Dowels:					
- Top Steel	-	-	2 3/8" (60mm)	-	Yes
- Bottom Steel	-	-	1 5/8" (40mm)	-	Yes
Sidewalks, Curbs and Gutters, Splash Pads and Sump Pits.	-	-	-	3/4" (20mm)	No
Interior Structural Slabs and Beams	1 1/4" (30mm)	-	-	-	No
Ratio of Cover to Nominal Diameter	1.0	1.5	2.0	1.0	
Ratio of cover to Nominal Maximum Aggregate Size	1.0	1.5	2.0	1.0	

.4 Cover and protection for reinforcement in concrete utilized in a corrosive environment shall be as per CSA A23.1.

.5 Ensure alignment of reinforcing steel as follows:

Tolerance, plus or minus Item

5 mm	Slabs
10 mm	Other structural members
50 mm	Rebar bends & ends

.6 Place reinforcing in accordance with CSA A23.1. Refer to structural drawings for minimum splices. Splices to be Class B unless noted.

.7 Use non-corrosive supports for reinforcing when concrete is exposed.

.8 Supply bar support chairs for top reinforcing bars in sufficient quantity to not exceed 1200 mm average spacing in each direction.

.9 Supply horizontal reinforcing spacers in walls to ensure reinforcing does not move during placement.

.10 Do not rebend or straighten reinforcing steel after initial fabrication unless so indicated on drawings.

.11 Ensure reinforcing is clear and free of loose scale, dirt, oil, and rust and other foreign coatings.

.12 Support slab on grade and structural slab reinforcing at 900 mm maximum on centre.

.13 Where a structural concrete members is identified on the drawings, or specifications, it is required to have a fire resistance rating providing minimum concrete cover to reinforcing steel, in accordance with Chapter 2 of the Supplement to National Building Code, "Fire Performance Ratings".

3.3 SPLICING OF REINFORCEMENT

.1 Splice reinforcement to CSA A23.3 unless indicated otherwise. Splices to be Class B unless noted.

3.4 WELDING OF REINFORCEMENT

.1 Weld reinforcing bars in accordance with CSA W186.

3.5 MINIMUM REQUIREMENTS

.1 Unless otherwise shown or specified:

.1 Minimum requirements for slabs on grade and topping to be 152 x 152 – MW 13.3 x MW 13.3.

.2 Minimum requirement for 130 mm slabs and over, 10M at 300 each way.

3.6 FIELD QUALITY CONTROL

.1 Field Services:

.1 Field Services by the Consultant or his representative consists of periodic visits to the site for generally familiarizing with the progress and quality of the Work and to determine in general if it is progressing according to the contract documents, and the necessary paperwork related to these services.

.2 Field Services by the Consultant or his representative do not in any way relieve the Contractor of his responsibility to carry out the Work per the contract documents and contract drawings.

.3 The word “Consultant” is used in this specification to mean "Consultant" or "Consultant’s Representative".

.2 Inspection:

.1 General Contractor is responsible for reinforcing size, location and proper placement.

.2 Inspection for size, location and proper placement may be made at any time at discretion of Consultant or Consultant's representative. Contractor is responsible to notify Consultant 48 hours in advance for review of the reinforcing prior to placing concrete.

.3 Remove and replace reinforcement not in accordance with the drawings.

.4 Provide adequate notice of scheduled pours to facilitate inspection.

.3 Damage:

.1 Make good all areas damaged in connection with the contract regardless of the limits of the contract as shown on the drawings.

3.7 CLEANING

.1 Clean up and remove from site, all rubbish and surplus material remaining from this Work.

END OF SECTION

1. GENERAL

1.1 RELATED REQUIREMENTS

.1 Not Used.

.2 The Contract Documents apply to and govern the Work of this section.

1.2 REFERENCES

.1 ASTM C33-08 - Concrete Aggregates.

.2 ASTM C94/C94M-09 - Ready-Mixed Concrete.

.3 ASTM C260-06 - Air-Entraining Admixtures for Concrete.

.4 ASTM C494/C494M-08a - Chemical Admixtures for Concrete.

.5 ASTM C1017/C 1017M-07 - Chemical Admixtures for Use in Producing Flowing Concrete.

.6 ASTM D1752-04a(2008) - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

.7 ASTM D2822-05 - Asphalt Roof Cement.

.8 CAN/CSA A3000-08 - Cementitious Materials Compendium.

.9 CSA A23.1-04/A23.2-04 - Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.10 CSA A23.3-04 - Design of Concrete Structures.

.11 CSA A283-06 - Qualification Code for Concrete Testing Laboratories.

.12 CSA G30.18-92 (R2007) - Billet-Steel Bars for Concrete Reinforcement.

.13 Concrete Reinforcing Steel Institute (CRSI) where noted.

.14 Alberta Building Code 2006.

.1 Provincial safety standards where applicable.

.2 Erection, Maintenance and Removal of Formwork Conform to applicable safety regulations.

1.3 DESIGN REQUIREMENTS

.1 Contractor is responsible for design of concrete formwork and adequate shoring systems.

.2 Specific concrete and reinforcing specification requirements are included on structural drawings.

1.4 COORDINATION REQUIREMENTS

.1 Coordination: Coordinate with other work and sub-trades having a direct bearing on work of this section.

.2 Scheduling: If requested, prepare and submit for review a schedule and proposal outlining the following:

.1 Time of major structural pours.

.2 Heating, curing and protection provisions.

.3 The concrete forms stripping procedures including elapsed time from concrete placement.

.4 Shoring and re-shoring procedures and timing of removal of shores.

1.5 QUALITY ASSURANCE

.1 Failure to comply with the requirements of these specifications will result in the structure being considered potentially deficient. In such a case the Consultant or his representative shall have the right to require one or more of the following:

.1 Changes in the mix proportions for the remainder of the Work.

.2 Additional curing on those portions of the structure represented by test specimens that failed to meet specified requirements.

.3 Non-destructive testing (refer to CSA A23.2, Annex A).

.4 Test cores drilled from portions of the structure in question in accordance with CSA A23.2, Test Method 14C.

.5 Load testing of structure or structural elements in accordance with CSA A23.3.

.6 Reinforce by additional construction or replace as directed by the Consultant at Contractor's expense when concrete is judged inadequate by structural analysis or be results of load tests.

.7 Such other tests as the Consultant may specify.

.8 Note: Cores should not be drilled from the tension zone of a structural member because the presence of cracks may adversely affect the measured compressive strength.

.2 Additional testing may be ordered by the Consultant at any time even though required tests indicate that strength requirements have been met. In this instance, Owner will pay for those tests that meet the specified requirements and the Contractor will pay for the test and the repair to work that does not.

.3 Contractor to Pay for all costs of evaluation tests and additional engineering analysis that are required to demonstrate the adequacy of the structure where it does not meet the requirements of this specification and drawings or where concrete has been placed before formwork and reinforcing have been inspected and approved by Consultant.

1.6 SUBMITTALS

.1 Provide submittals accordance with Division 1.

.2 Product Data:

.1 Provide data on all concrete making materials specified or proposed.

.2 Provide all proposed concrete mix designs.

.3 Provide data on all concrete accessories specified or proposed.

.3 Shop Drawings: Prepare and submit for review a location diagram and proposed details for all planned construction joints to the Engineer for approval prior to the concrete pour.

.4 Test Data: Submit test data confirming specified concrete strengths are being achieved.

.1 Tests to be performed by a testing laboratory approved by the Consultant or his representative and paid for by the Contractor.

.2 Submit two (2) copies of test results to Structural Engineer, General Contractor and Consultant immediately upon completion of testing.

.3 Compressive Strength Tests:

.1 One set of three (3) standard test specimens to be made for each class of concrete in any one days pour of more than five (5) cubic metres. For pours of more than sixty (60) cubic metres, one (1) set per each sixty (60) cubic metres.

.2 One additional standard test specimen to be made during cold weather construction. Cure this specimen on job site under same conditions as concrete it represents.

.3 Concrete to be sampled at the point of deposit of the concrete into the forms.

.4 Test specimens to be cast, cured and tested in accordance with CSA A23.2 by personnel from the designated testing laboratory.

.5 For each set of test specimens, a slump test and entrained air test is to be included (for air entrained concrete).

.4 Concrete Test Reports:

.1 Test Reports to include the following information:

.1 Project Name.

.2 Date and time of sampling.

.3 Supplier, truck number and time of concrete truck departure from concrete plant.

.4 Specified strength.

.5 Cement type.

.6 Admixtures.

.7 Exact location in structure of sampled concrete.

.8 Slump.

.9 Maximum aggregate size.

.10 Air content, if applicable.

.11 Test strength and age at test.

.12 Date specimen received in the testing laboratory.

.13 Technical identification.

.5 Concrete tests will be considered satisfactory if the average of all sets of three (3) consecutive strength tests equal or exceed the specified strength and no individual strength test is more than 3.5 MPa (500 psi) below the specified strength.

.5 Submit proposed methods of protection of concrete when air temperatures are expected to be above 25 degrees C or below 5 degrees C.

.6 Submit responses to all site review reports stating that all reported defects and deficiency items were corrected or what action taken.

1.7 DELIVERY, STORAGE, AND PROTECTION

.1 Store and protect materials and work from damage by frost and weather, and deterioration or contamination by foreign matter.

.2 Do not use contaminated or deteriorated materials.

2. PRODUCTS

2.1 MATERIALS

.1 Ready Mix Concrete: To CSA A23.1 supplemented by ASTM C94/C94M.

.2 Cement: To CSA A3001.

.3 Water: Potable, to CSA A23.1.

.4 Aggregates: to CSA A23.1 and ASTM C33. Nominal size 20 mm coarse aggregate, 10 mm for toppings. Contractor may use smaller size.

.5 Chemical Admixtures: To ASTM C494/C494M or ASTM C1017/C1017M.

.6 Air Entrainment: To ASTM C260.

.7 Concrete Curing Compound: Chlorinated liquid rubber type, membrane forming.

.8 Joint Filler: To ASTM D1752, resilient, non-extruding, non-bituminous.

.9 Non-shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents, capable of developing minimum compressive strength of 16 MPa at 2 days and 48 MPa at 28 days to CSA A23.1.

.10 Mastic Cement: To ASTM D2822, plastic cement, cutback asphalt.

.11 Bonding Agent: Polymer resin emulsion, for mixing with cement and water, similar to "Daraweld". For bonding two concretes, to CSA A23.1.

.12 Vapour Barrier: 15 mil polyolefin based resin sheet membrane. Refer to radon specification section for additional information.

2.2 CONCRETE MIXES

.1 Supply "Controlled Concrete" with the minimum compressive strengths as defined by CSA A23.1 as noted on the drawings in accordance with the following table:

3. CONCRETE STRENGTH AND MIX SPECIFICATIONS								
EXPOSURE CLASS	**USE**	**CEMENT TYPE**	**MINIMUM COMPRESSIVE STRENGTH**	**MAXIMUM WATER TO CEMENTING MATERIALS RATIO**	**AIR CONTENT (%)**	**SLUMP**	**MAXIMUM AGGREGATE SIZE**	**Fly Ash Content %** MAX
S-2	Piles, Pile Caps, and Grade Beams	HS	32 MPa at 28 days	0.45	4 - 7	80 mm ±20 mm	20 mm	22
N	Interior Structural Slabs	GU	30 MPa at 28 days	0.50	None Required	80 mm ±20 mm	20 mm	10
N	Slab-On-Grade	GU	25 MPa at 28 days	0.50	None Required	80 mm ±20 mm	20 mm	10
C-1	Stoops (Structural or On Grade)	GU	35 MPa at 28 days	0.40	5 - 8	80 mm ±20 mm	20 mm	22
C-2	Sidewalks, Curbs and Gutters, Splash Pads, Sump Pits	GU	32 MPa at 28 days	0.45	5 - 8	80 mm ±20 mm	20 mm	22
S-2	Underground Encasing for Electrical Duct Banks and Conduits and Mechanical Ducts	HS	32 MPa at 28 days	0.45	4 - 7	80 mm ±20 mm	20 mm	22

.1 Please refer to table for fly ash content.

.2 Aggregate nominal maximum size shall satisfy the requirement of CSA A23.1.

.3 Air Content: All mix types to be air-entrained in accordance with CSA A23.1.

.4 Do not change concrete mix proportions or source material for architectural concrete without written approval of the Consultant.

3.2 ADMIXTURES

.1 Use accelerating admixtures in cold weather only when approved by the Consultant. If approved, the use of admixtures will not relax cold weather placement requirements.

.2 Do not use calcium chloride or any admixtures containing chloride ion.

.3 Use set-retarding admixtures during hot weather only upon a written approval of the Consultant to prevent cold joints in concrete.

.4 Admixtures must be used in strict accordance with the manufacturer's recommendations.

.5 Non-specified admixtures would not be permitted unless approval in writing by the Consultant is obtained.

4. EXECUTION

4.1 WORKMANSHIP

.1 Maintain accurate records of poured concrete items to indicate date, location of pour, quantity, air temperature and associated concrete testing.

.2 Ensure that reinforcement and inserts are not disturbed during concrete placement.

.3 In locations where new concrete is dowelled to existing work, drill holes in existing concrete and insert steel dowels and pack solidly with non-shrink grout to positively anchor dowels.

.4 Excessive honeycomb or embedded debris in any concrete shall deem it defective. Remove and replace defective concrete.

.5 All interior slabs not designed with air entrainment are to be sufficiently protected from freezing for the duration of construction.

4.2 CONCRETE COVER OVER REINFORCEMENT

.1 Ensure alignment of reinforcing steel as follows:

Tolerance, plus or minus	Item
5 mm	Slabs
10 mm	Other structural members
50 mm	Rebar bends & ends

The minimum concrete cover to be provided is as per specification section: 03 20 00 or as shown in the drawing.

.2 The cover and protection for reinforcement in concrete utilized in a corrosive environment shall be as per CSA A23.1.

4.3 CONCRETE SUPPLY

.1 Ready mix concrete to be used.

.2 All concrete to contain a cement dispersing agent in accordance with the manufacturer's recommendations.

4.4 PLACING CONCRETE

.1 Notify Consultant a minimum of 24 hours prior to commencement of concrete placement.

.2 Place concrete in accordance with CSA A23.1 and additionally, as specified herein.

.3 Clean previously placed concrete with steel brush and dampen prior to placing the next layer. Use mild acid only on approval by the Consultant.

.4 In locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels, and set solidly with H.I.T. two (2) parts adhesive as supplied by Hilti, or approved alternative.

.5 Ensure all hardware and all other items to be cast into concrete are held securely and will not cause undue hardship in placing concrete.

.6 Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, and other critical items are not disturbed during concrete placement.

.7 Wire all waterstop to reinforcing to prevent folding during concrete placement.

.8 Revise, reseat and correct improperly positioned reinforcing hardware and other embedded items immediately before concrete placement.

.9 Place concrete in approximately horizontal layers such that each lift can be vibrated into the previous lift to that lines and levels indicated on the drawings.

.10 Place concrete directly into its final position in forms. Do not spread concrete with vibrators.

.11 Maximum vertical free fall of concrete is not to exceed 1200 mm in unexposed work or 800 mm in exposed work. Confine concrete with a suitable vertical drop pipe to prevent segregation.

.12 Use internal vibrators in all sections where the sections are sufficiently large and supplement with external vibrators in the event satisfactory surfaces cannot be obtained.

.13 Place concrete as a continuous operation, stopping only at construction joints indicated on the drawings or with the approval of the Consultant as follows:

.1 At centre of span of suspended slabs, beams, and joists.

.2 In walls and columns immediately above or below floor construction joints or directly over centroid of pile or pile cap, if applicable.

.14 Construction joints in walls and grade beams, maximum spacing 12 m or as detailed.

.15 Construction joints in walls must be watertight.

.16 Separate exterior slabs on grade from vertical surfaces with 6 mm thick joint filler from bottom of slab to within 6 mm of finished slab surface.

.17 Consolidate and screed floors, maintaining surface flatness of maximum 3 mm on 3 m. Pitch to drains 20 mm/m nominal, or as indicated on the drawings.

.18 Use cold weather concreting, curing and protection methods in accordance with CSA A23.1 when the ambient temperature falls below 5°C. When the ambient temperature rises above 25°C, use hot weather concreting, curing and protection methods.

.19 Maintain accurate records of concrete placement. Record date, location of placement, quantity, air temperature and all associated concrete testing.

.20 Ensure specified concrete cover around reinforcing is maintained.

.21 Honeycomb that exceeds 150 mm in any direction or embedded debris in concrete are not acceptable. Notify Consultant upon discovery of such defect.

.22 Remove and replace defective concrete as directed by the Consultant.

4.5 PLACING OF ARCHITECTURAL AND EXPOSED CONCRETE

.1 Place concrete in maximum horizontal lifts of 400 mm. Limit length of concrete placement to prevent cold joints.

.2 Do not place concrete form one end for full height of placement.

.3 Use sufficient vibration, consolidation and methods to ensure dense smooth concrete lines and surfaces free from bugholes, honeycomb, and cold joints.

.4 Ensure that vibrator penetrates into the layer of fresh concrete immediately below the layer being placed to prevent stratification.

.5 In hot weather, use set retarding agents to prevent cold joints, with permission of Consultants.

.6 Review methods of concrete placing with Consultant prior to placement.

.7 All concrete that is noted on drawings to receive a sandblast finish shall be rendered to a medium texture using approved equipment. Provide sample area of finish for Consultant's review and approval prior to commencing with work.

4.6 COLD WEATHER CONCRETE WORK

.1 Cold weather concreting requirements are to be met when temperature falls below 5°C or there is a probability of falling to 5°C or below during the placing period.

.2 Cold weather construction methods, curing and protection are to conform to CSA A23.1.

.3 Concrete temperature at placing to be between 15°C and 30°C.

.4 Placed concrete to be protected and maintained at a temperature of at least 10°C for not less than three (3) days or not less than 20°C for two (2) days and all concrete to be maintained above freezing for a minimum of seven (7) days.

.5 Concrete to be protected from alternate freezing and thawing for a minimum of fourteen (14) days.

.6 Protected and heated concrete to be brought gradually to ambient air temperature at a drop of not more than 15°C per 24 hour period.

.7 Coverings for heating enclosure to be clear of concrete and forming surface for air circulation.

.8 Frozen or otherwise defective concrete will be rejected.

.9 Heating and hoarding is the responsibility of the contractor. Additional heating and hoarding resulting from schedule slippage is the responsibility of the contractor.

4.7 HOT WEATHER CONCRETE WORK

.1 When the air temperature is at or above 25°C or there is a probability of it rising to that limit or above during the placing period, the temperature of the concrete when deposited is not to be more than 25°C. To accomplish this, the mixing water, and if necessary the aggregate are to be cooled.

.2 Where pours are massive, or where surfaces are to be trowel finished, or wood floated, use a retarder that will slow the initial set of the concrete.

.3 When the air temperature is at or above 25°C, exposed surface of the concrete are to be shaded from the direct rays of the sun and sheltered from direct wind. Alternatively, all placing and finishing to be done at night.

.4 Moist cure the concrete instead of using curing compounds.

4.8 TOLERANCES

.1 Concrete work to be within the tolerances listed below:

.1 Variations of the linear building lines from established position in plan: 6 mm.

.2 Variation in cross-sectional dimensions of thickness of slabs: minus 6 mm OR plus 6 mm.

.3 Variations from the level or from grades indicated for surfaces of slabs shall not exceed 3 mm under a 3 m straight edge immediately after trowelling.

.2 Remove and replace concrete that does not meet the above requirements at no cost to the Owner.

4.9 PATCHING

.1 Patch imperfections when concrete is defective as follows:

.1 Chip down edges perpendicular to surface.

.2 Wet the area and brush on 1:1 cement-sand grout.

.2 Patch with 1:2 cement-sand mortar with 10% hydrated lime.

4.10 INSERTS/EMBEDDED PARTS/OPENINGS

.1 Provide formed openings where required for pipes, conduits, sleeves, and other work to be embedded passing through concrete members.

.2 Refer to mechanical and electrical drawings for sleeves and openings required through structural components. These must not reduce the structural capacity. Locations and sizes not shown on the structural drawings are to be approved in writing by the Consultant.

.3 Maximum size of electrical conduit in structural slabs is 1/3 of solid portion of slab thickness, and where more than two are adjacent to each other, they must be spaced at least 100 mm apart. Conduit must be placed in middle third of slab unless otherwise specified or approved in writing by the Consultant.

.4 Reinforce around openings as noted on structural drawings.

.5 Accurately locate and set in place, items that are to be cast directly into concrete.

.6 Coordinate work of other sections and cooperate with the trade involved in forming and/or setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts. Do not perform work unless specifically indicated on drawings or approved prior to installation.

.7 Install all concrete accessories in accordance with drawings and manufacturer's recommendations; straight, level, and plumb. Ensure adequate support to prevent movement during concrete placement.

.8 Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close temporary ports or openings with tight fitting panels, flush with inside of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.

.9 The only application where the use of fixed pins will be acceptable is for the installation of strapping and fixing and care must be taken to do as little damage as possible to the surrounding concrete.

.10 Do not use aluminum inserts or conduits.

4.11 GROUTING

.1 Grout beneath steel base and bearing plates after the steel has been erected. This grout is to be expanding type and be mixed and used according to the manufacturer's printed instructions.30MPa minimum compressive strength.

4.12 CURING

.1 Concrete curing to CSA A23.1.

.2 Basic Curing: Keep concrete surface continuously moist until concrete temperature due to hydration has peaked and dropped several degrees, or for three days at a minimum temperature of 10oC.

.3 Additional Curing: Immediately following basic curing and before the concrete has dried, cure for an additional four days, maintaining the temperature of the air in contact with the concrete above 10°C.

.4 Acceptable curing methods:

.1 Ponding or continuous sprinkling.

.2 Absorptive mat or fabric kept continuously wet.

.3 Damp sand, earth, or similar moist material.

.4 Continuous steam vapour mist bath not exceeding 70°C.

.5 Curing compound.

.6 Waterproof paper or plastic film.

.7 Other moisture-retaining method approved by the Consultant.

.5 Do not use curing compounds on concrete surfaces, which are expected to receive topping, hardener, or other type of bonded finish unless approved by the Consultant.

.6 Protect freshly placed and consolidated concrete against damage or defacement from adverse weather conditions.

.7 Exposed concrete walking surfaces not to receive an integral hardener: Coat with curing compound or curing method that provides permanent seal.

.8 In areas with an exposed concrete floor surface, apply the hardener and dust-proofing agent strictly to the manufacturer's instructions.

.9 Submit proposed methods of protection and curing when air temperature is at or above 25°C or at or below 5°C, or likely to be so with 24 hours of placing time.

.10 Water for curing shall be clean and free from materials that will cause staining or discoloration of the concrete.

.11 For horizontal surfaces, spread 50 mm of moist sand over the entire surface and keep saturated with water.

.12 For vertical surfaces such as walls, columns, piers, loosen the forms, leave them in place and continuously apply water between the form and the concrete surface. Alternatively the forms may be removed and an absorptive woven fabric applied and kept continuously moist.

.13 If moist curing is not used, then sprayed curing compounds are to be used.

.14 Curing compounds to be of the liquid membrane type for curing concrete and shall be applied in strict accordance with the manufacturer's printed instructions.

.15 Curing compounds used for exposed concrete must not discolor the concrete, nor be such as to prohibit the subsequent application of paint, tiles, parging or other coatings.

.16 For horizontal surfaces, after the completion of finishing operations and immediately after the disappearance of surface moisture, apply the sprayed curing compound.

4.13 PROTECTION

.1 Protection for concrete to CSA A23.1.

.2 Under adverse weather conditions, make suitable arrangements to prevent damage to fresh concrete. All forms and reinforcing in contact with fresh concrete must have a surface temperature greater than 5°C.

.3 Do not place concrete on frozen ground.

.4 Do not place concrete on soil that has suffered any appreciable change in moisture until the soil has either dried out or been wetted so that its moisture content is normal and equal to that of the surrounding soil.

.5 Conveying equipment, if supported by formwork, must not impart harmful vibrations to the green concrete nor cause misalignment of forms.

.6 Protect freshly finished concrete floors from the elements and from defacement due to other construction or building operations. Provide and use tarpaulins or other protective material when necessary to cover completely or enclose all freshly finished concrete floors.

4.14 FIELD QUALITY CONTROL

.1 Field Services:

.1 Field Services by the Consultant or his representative consists of periodic visits to the site for generally familiarizing with the progress and quality of the Work and to determine in general if it is progressing according to the contract documents, and the necessary paperwork related to these services.

.2 Field Services by the Consultant or his representative do not in any way relieve the Contractor of his responsibility to carry out the Work per the contract documents and contract drawings.

.3 The word "Consultant" is used in this specification to mean "Consultant" or "Consultant's Representative".

.2 Damage:

.1 Make good all areas damaged in connection with the contract regardless of the limits of the contract as shown on the drawings.

4.15 CLEANING

.1 Clean up and remove from the site all rubbish and surplus material remaining from this work.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Floor Classifications: Classification of concrete floor slabs based on their intended use, methods of finishing and finish materials applied to flooring as denoted by the F-rating below, and as follows:

.1 Single Course Floor: Floors placed in a single course with final finishing applied to properly levelled concrete.

.2 Finish or Finishes: Materials applied to finished concrete surface, i.e.: stained or coloured concrete, carpet, resilient flooring or ceramic tile.

.3 Finishing: Methods, tools and equipment employed to achieve levelness or surface flatness for shored slabs and slabs-on-grade, and durability indicated and as follows:

.1 F1-Finishing: Floors having a straightedge value of ±8 mm over 3050 mm; similar to CSA A23.1 Class A Slab Finishing. Non-Critical or Parkade Floors: Non-critical floor slabs include electrical and mechanical rooms, non-public areas, automobile surfaces.

.2 F3-Finishing: Floors having a straightedge value of ±5 mm over 3050 mm; similar to CSA A23.1 Class C Slab Finishing. Flat Institutional or Commercial Floors: Slabs having thin set tile and resilient tile floor finish for Institutional or Commercial floors and/or office occupancies.

1.2 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-in-place Concrete

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate a meeting between Contractor, Subcontractor responsible for concrete placement, and the Consultant to determine Site Quality Control testing section borders and sample measurement line locations, method of measurement, and accuracy requirements of the measuring devices.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Action Submittals: Submit the following before starting any work of this Section:

.1 Product Data: Submit manufacturer’s product data for each materials specified including recommended application rates and methods of installation.

.3 Informational Submittals: Provide the following submittals during the course of the work:

.1 Purchase Orders: Submit copies of purchase orders and packing slips indicating the quantity of materials required for the project.

.2 Site Quality Control Submittals: Submit results for straightedge measurements to demonstrate compliance with specified tolerances. Record the following information on a drawing indicating floor slab layout, column locations and slab penetrations:

.1 Layout of test section borders with an identification number for each test section.

.2 Indicate number and direction of sample measurement lines used in each test section, the starting and stopping locations and identification number that relates to the test section number.

.3 Indicate elevations of all sample reading points.

.4 Indicate profile curvature between all reading points separated by 600 mm.

.5 Indicate variance from specified straightedge measurements as a + or - value.

.6 Indicate variance from estimated flatness and levelness at each measuring point tolerances using associated 90% confidence interval in parentheses, i.e.: F_F 24.5 (23.0 – 26.0), and as follows:

.1 F_F estimate for each test sample.

.2 F_F composite for each test section.

.3 F_L estimate for each test sample.

.4 F_L composite for each test section (combined test samples).

.5 List calculated overall *F*-Number results for the entire test surface as a whole number not containing a confidence interval.

.7 Failed tests in excess of 50% of the straightedge will require the Contractor to flash patch floor to achieve specified tolerance; example of tolerance failure:

.1 Slabs-On-Grade: Measurement of 2.5 mm or greater than ± 5 mm measurement will be considered as a failed test and will require flash patching.

.8 Work that is found to be below the minimum acceptable standards established by CSA A23.1 and this specification shall be demolished and rebuilt, or repaired as directed by the Consultant at no additional cost to the Owner.

1.5 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit detailed cleaning and maintenance instructions for floor stain and concrete densifier products, and instruct Owner in proper care and maintenance of specified floor finishes, including a complete list of floor care products that will be required for on-going maintenance.

.2 Maintenance Materials: Leave a minimum of one (1) 18.9 L container of maintenance coating, and remaining portion of coating from first treatment, stored on site at location directed by Owner.

1.6 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Installers: Use skilled workmen experienced in concrete finishing methods similar in complexity and extent to that required for the Work of the Contract.

Part 2 Products

2.1 MATERIALS

.1 Concrete Formwork: Specified on Structural Drawings.

.2 Concrete Materials and Reinforcement: Specified on Structural Drawings.

2.2 LEVELLING MATERIALS

.1 Overlayment: Cementitious, self levelling, single component, polymer modified overlayment, for application thicknesses to a minimum of 13 mm to 25 mm; acceptable materials as follows:

.1 Sika Canada Ltd., Sikafloor Level 25

.2 W.R. Meadows of Canada, Sure-Flo FT 100

.2 Cementitious Moisture Reduction Barrier Materials: Two-component, polymer-modified, cementitious based waterproofing slurry topping; formulated to reduce water infiltration; applicable from 2 mm to 4 mm; acceptable materials as follows:

.1 MAPEI Canada Inc., Planiseal MRB

.2 Sika Canada Ltd., Epocem 81

Part 3 Execution

3.1 FINISHING FLOORS AND SLABS

.1 Finish floors and slabs in accordance with CSA A23.1 and ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces; do not wet concrete surfaces.

.2 Float (Initial) Finishing:

.1 Consolidate surface with power driven floats or by hand floating if area is small or inaccessible to power driven floats.

.2 Re-straighten, cut down high spots, and fill low spots.

.3 Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

.4 Apply float finishing to surfaces receiving trowel finishing.

.3 Trowel (Final) Finishing:

.1 Commence trowel finishing after all bleed water has disappeared and when the concrete has stiffened sufficiently to prevent the working of excess mortar to the surface.

.2 Apply first trowelling and consolidate concrete by hand or power-driven trowel after applying float finishing; continue trowelling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance; repair or smooth any surface defects that would telegraph through applied coatings or floor coverings.

.3 Apply a trowel finishing to surfaces exposed to view or to be covered with resilient flooring, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

.4 Finish surfaces to the tolerances indicated in item 1.1.3 above.

.4 Trowel and Fine Broom Finishing:

.1 Apply trowel finishing to surfaces where large format tile is scheduled for installation by either thickset method.

.2 Slightly scarify surface with a fine broom While concrete is still plastic.

.3 Finish surfaces to the tolerances indicated in item 1.1.3 above.

.5 Broom Finishing:

.1 Apply a broom finishing to exterior concrete platforms, steps, and ramps, and elsewhere as indicated:

.2 Slightly roughen trafficked surface by brooming with fibre bristle broom perpendicular to main traffic route immediately after float finishing.

.3 Coordinate required final finishing with Consultant before application.

.6 Moisture Reducing Finish:

.1 Prepare floor to ICRI CRP 3 or 4 as directed by manufacturer's written instructions

3.2 SITE QUALITY CONTROL

.1 Testing and Measurements:

.1 Straightedge Measurement: Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 3050 mm long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed values indicated in item 1.1.3 above.

.2 CSA A23.1 has no measurement standard for unshored suspended slabs on steel structure; make straightedge measurements in accordance with CSA A23.1 with the following additional requirements:

.1 Layout measurement lines at 45° to the framing direction; to avoid taking measurements at points where anticipated deflections are similar.

.2 Offset measurement lines a minimum of 600 mm from column locations, and no portion of the measurement line shall fall within 600 mm of the boundary line, except where 25% of test section would be excluded from this measurement criteria.

.3 Measurement of F_L for suspended slab tolerances shall be within 80% of the values for slabs-on-grade.

.4 Measure and record elevation points at every 600 mm along length of test line.

.2 Non-Conforming Work: Repair concrete floor slabs where they exceed the tolerances listed in this Section as follows:

.1 Floor Level Excess (High Spots): Grind and smooth surface areas that are higher than listed tolerances.

.2 Floor Level Deficiency (Bird Baths):

.1 Saw-cut perimeter of surface areas that are lower than listed tolerances to a minimum depth of 6 mm.

.2 Grind perimeter to a minimum of 6 mm to allow for flush flash patching.

.3 Roughen surface of flash patch area to a minimum ICRI CSP 5 – Medium Shotblast.

.4 Clean flash patch area and trowel in floor levelling mortar in accordance with manufacturers written instructions.

.5 Smooth and level surface of flash patch to match adjacent floor surfaces.

.3 Leave floors in ready for floor finishes supplied and installed by other sections.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 – Concrete Finishings

.2 Section 04 05 12 – Masonry Mortar and Grout

.3 Section 04 21 13 – Brick Masonry

.4 Section 04 22 00 – Concrete Unit Masonry

.5 Section 04 23 00 – Glass Unit Masonry

1.2 REFERENCES STANDARDS

.1 Brick Industry Association (BIA)

.1 Technical Note No. 18A-2006, Accommodating Expansion of Brickwork

.2 Canadian Standards Association (CSA International)

.1 CSA-A165 Series-04 (R2014), CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).

.2 CSA A179-04 (R2014), Mortar and Grout for Unit Masonry.

.3 CSA-A371-04 (R2014), Masonry Construction for Buildings.

.3 International Masonry Industry All-Weather Council (IMIAC)

.1 Recommended Practices and Guide Specification for Hot and Cold Weather Masonry Construction.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation meetings: comply with Section 01 31 19 - Project Meetings. Conduct pre-installation meeting one week prior to commencing work of this Section to:

.1 Verify project requirements, including mock-up requirements.

.2 Verify substrate conditions.

.3 Co-ordinate products, installation methods and techniques.

.4 Sequence work of related sections.

.5 Co-ordinate with other building subtrades.

.6 Review manufacturer's installation instructions.

.7 Review masonry cutting operations, methods and tools and determine worker safety and protection from dust during cutting operations.

.8 Review warranty requirements.

.2 Sequencing: sequence with other work in accordance with Construction Progress Schedules - Bar (GANTT) Chart. Comply with manufacturer's written recommendations for sequencing construction operations.

.3 Scheduling: schedule with other work in accordance with Construction Progress Schedules - Bar (GANTT) Chart.

1.4 ACTION AND INFORMATION SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, limitations and colours.

.2 Submit electronic copy of Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS) in accordance with Section 01 35 43 - Environmental Procedures.

.3 Samples:

.1 Submit samples as follows:

.1 Two (2) glass block, brick and concrete block units specified, including special shapes, supplemented with specific requirements.

1.5 QUALITY ASSURANCE

.1 Certificates: submit manufacturer's product certificates certifying materials comply with specified performance characteristics and criteria and physical requirements.

.2 Test and Evaluation Reports:

.1 Provide certified test reports in accordance with Section 01 29 83 - Payment Procedures for Testing Laboratory Services.

.2 Test reports to certify compliance of masonry units and mortar ingredients with specified performance characteristics and physical properties.

.3 Provide data for masonry units, in addition to requirements set out in referenced CSA and ASTM Standards, indicating initial rates of absorption.

.3 Installer Instructions: provide manufacturer's installation instructions, including storage, handling, safety and cleaning.

.4 Qualifications:

.1 Manufacturer: capable of providing field service representation during construction and approving application method.

.2 Installer: experienced in performing work and specialized in installation of work similar to that required for this project.

.3 Masons: company or person specializing in masonry installations with five (5) years experience with masonry work similar to this project.

.1 Masons employed on this project must demonstrate ability to reproduce mock-up standards.

.5 Mock-ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Construct mock-up panel of exterior and interior concrete unit, brick, and glass masonry wall, construction showing masonry colours and textures, use of reinforcement, ties, through-wall flashing, weep holes, jointing, coursing, mortar and workmanship. Sizes of mock-ups as specified in respective specification sections.

.3 Mock-up used:

.1 To judge workmanship, substrate preparation, operation of equipment and material application.

.4 Construct mock-up where directed by Consultant.

.5 Allow 24 hours for inspection of mock-up by Consultant before proceeding with work.

.6 When accepted by Consultant, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect masonry from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Keep materials dry until use.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 43 – Environmental Procedures.

.5 Packaging Waste Management: remove for reuse of pallets, in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

.6 Storage and Handling Protection:

1.7 SITE CONDITIONS

.1 Ambient Conditions: assemble and erect components when temperatures are above 4 degrees C.

.2 Weather Requirements: to CSA-A371 and to IMIAC - Recommended Practices and Guide Specifications for Hot and Cold Weather Masonry Construction.

.3 Cold weather requirements:

.1 To CSA-A371 and to IMIAC with following requirements.

.1 Maintain temperature of mortar between 5 degrees C and 32 degrees C until batch is used or becomes stable.

.2 Maintain ambient temperature of masonry work and it's constituent materials between 5 degrees C and 32 degrees C and protect site from wind chill.

.3 Maintain temperature of masonry above 0 degrees C for minimum of 28 days, after mortar is installed.

.4 Preheat unheated wall sections in enclosure for minimum 72 hours above 10 degrees C, before applying mortar.

.2 Hot weather requirements:

.1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

.2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.

.3 Spray mortar surface at intervals and keep moist for maximum of three (3) days after installation.

1.8 CLOSEOUT SUBMITTALS

.1 Provide manufacturer's instructions for care, cleaning and maintenance of prefaced masonry units for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.9 WARRANTY

.1 For Work in this Section 04 05 00 - Common Work Results for Masonry, 12 months.

Part 2 Products

2.1 MANUFACTURERS

.1 Ensure manufacturer has minimum five (5) years experience in manufacturing components similar to or exceeding requirements of project.

2.2 MATERIALS

.1 Masonry materials are specified elsewhere in related Sections:

.1 Section 04 21 13 – Brick Masonry.

.2 Section 04 22 00 – Concrete Unit Masonry.

.3 Section 04 23 00 – Glass Unit Masonry.

Part 3 Execution

3.1 INSTALLERS

.1 Experienced and qualified masons to carry out erection, assembly and installation of masonry work.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 EXAMINATION

.1 Examine conditions, substrates and work to receive work of this Section.

.1 Co-ordinate with Section 01 71 00 - Examination and Preparation.

.2 Examine openings to receive masonry units. Verify opening size, location, and that opening is square and plumb, and ready to receive work of this Section.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation after unacceptable conditions have been remedied and after receipt of written approval from Consultant.

.3 Verification of Conditions:

.1 Verify that:

.1 Substrate conditions which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of brick, concrete, and glass unit masonry.

.2 Field conditions are acceptable and are ready to receive work.

.3 Built-in items are in proper location, and ready for roughing into masonry work.

.2 Commencing installation means acceptance of substrates.

3.4 PREPARATION

.1 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations and co-ordinate with Section 01 71 00 - Examination and Preparation.

.2 Establish and protect lines, levels, and coursing.

.3 Protect adjacent materials from damage and disfiguration.

3.5 INSTALLATION

.1 Do masonry work in accordance with CSA-A371 except where specified otherwise.

.2 Build masonry plumb, level, and true to line, with vertical joints in alignment, respecting construction tolerances permitted by CSA-A371.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.6 CONSTRUCTION

.1 Exposed masonry:

.1 Remove chipped, cracked, and otherwise damaged units, in accordance with CSA A-165, in exposed masonry and replace with undamaged units.

.2 Jointing:

.1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, joints true to line, compressed, uniformly concave joints where concave joints are indicated.

.2 Strike flush joints concealed in walls and joints in walls to receive plaster, tile, sheet membrane air and vapour seal, insulation, or other applied material except paint or similar thin finish coating.

.3 Cutting:

.1 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects.

.2 Make cuts straight, clean, and free from uneven edges.

.4 Building-In:

.1 Build in items required to be built into masonry.

.2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

.3 Brace door jambs to maintain plumb. Fill jambs with mortar in interior walls and doors 143A, 143B, and 149A. Other exterior door jambs filled with insulation.

.5 Support of loads:

.1 Use 25 MPa concrete to Section 03 30 00 - Cast-in-Place Concrete, where concrete fill is used in lieu of solid units.

.2 Install air and vapour seals below voids to be filled with concrete or grout; keep membrane 25 mm back from faces of units.

.6 Provision for movement:

.1 Leave 3 mm space below shelf angles.

.2 Leave 6 mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.

.3 Built masonry to tie in with stabilizers, with provision for vertical movement.

.7 Loose steel lintels:

.1 Install loose steel lintels. Centre over opening width.

.8 Control joints:

.1 Construct continuous control joints with maximum spacing as noted in structural documents.

.9 Movement joints:

.1 Build-in continuous movement joints as indicated on drawings and in Technical Note 18A.

3.7 SITE TOLERANCES

.1 Tolerances in notes to CSA-A371 apply.

3.8 FIELD QUALITY CONTROL

.1 Site Tests, Inspection:

.1 Perform field inspection and testing in accordance with Section 01 45 00 - Quality Control.

.2 Notify inspection agency minimum of 24 hours in advance of requirement for tests.

.2 Acoustic Inspections:

.1 Inspection and testing of acoustic application will be carried out by a third party inspection agency certified to perform inspections to confirm Sound Transmission Class (STC) ratings of designated acoustic rooms.

.2 Contractor will pay for inspections at completion of acoustic rooms, prior to Substantial Completion. Inspection costs to include travel, living allowance, site inspections, testing and reports.

.3 If acoustic rooms perform lower than the noted STC ratings, Contractor to pay for all remediation to construction and retesting by the same inspection agency until STC levels are met.

.4 Rooms 105, 107, 109, 110, 141, 142, and 144 are to be testing to STC 50. Rooms 141 and 142 are considered one room.

3.9 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.2 Progress Cleaning: in accordance with related masonry sections.

.3 Final Cleaning:

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Upon completion of installation and verification of performance of installation, remove surplus materials, rubbish, tools and equipment barriers.

.4 Waste Management:

.1 Divert unused or damaged masonry units and glass block from landfill as specified in Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

3.10 PROTECTION

.1 Temporary Bracing:

.1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

.2 Contractor to have bracing engineered.

.3 Brace masonry walls as necessary to resist wind pressure and lateral forces during construction.

.2 Moisture Protection:

.1 Keep masonry dry using waterproof, nonstaining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed and protected by flashing or other permanent construction.

.2 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

.3 Air Temperature Protection: protect completed masonry as recommended in 1.7 SITE CONDITIONS.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 05 00 – Common Work Results for Masonry

.2 Section 04 22 00 – Concrete Masonry Units

.3 Section 04 23 00 – Glass Unit Masonry

1.2 REFERENCES STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA A179-04 (R2014), Mortar and Grout for Unit Masonry.

.3 CAN/CSA A371-04 (R2014), Masonry Construction for Buildings.

.4 CAN/CSA-A3000-13, Cementitious Materials Compendium; CAN/CSA-A3002-13, Masonry and Mortar Cement.

.2 International Masonry Industry All-Weather Council (IMIAC)

.1 Recommended Practices and Guide Specification for Hot and Cold Weather Masonry Construction.

.3 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)

.1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for brick masonry and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit electronic copies of Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS) in accordance with Section 01 35 43 - Environmental Procedures. Indicate VOC's mortar, grout, parging, colour additives and admixtures. Expressed as grams per litre (g/L).

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of recycled content materials and products, showing their percentages of post-consumer, post-industrial content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates regional materials.

1.4 QUALITY ASSURANCE

.1 Certificates: provide in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00- Common Work Results for Masonry.

.3 Pre-Installation Meetings: conduct pre-installation meeting in accordance with Section 04 05 00 - Common Work Results for Masonry to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

.4 Mock-ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control and requirements of Section 04 05 00 - Common Work Results for Masonry supplemented as follows:

.1 Construct mock-up panel of exterior and interior concrete unit and brick masonry construction 1200 x 1800 mm.

.2 Construct mock-up strip of glass block masonry construction 1200 x 200 mm.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handles masonry mortar and grout materials in accordance with Section 01 61 00 - Common Product Requirements, supplemented as follows:

.1 Deliver pre-packaged, dry-blended mortar mix to project site in labelled plastic-lined bags each bearing name and address of manufacturer, production codes or batch numbers, and colour or formula numbers.

.2 Maintain mortar, grout and packaged materials clean, dry, and protected against dampness, freezing, traffic and contamination by foreign materials.

.2 Packaging Waste Management: remove for reuse of pallets in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 SITE CONDITIONS

.1 Provide in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Ambient Conditions: maintain materials and surrounding air temperature to:

.1 Minimum 5 degrees C prior to, during, and 48 hours after completion of masonry work.

.2 Maximum 32 degrees C prior to, during, and 48 hours after completion of masonry work.

.3 Weather Requirements: CAN/CSA A371 International Masonry Industry All-Weather Council (IMIAC) - Recommended Practices and Guide Specifications for Hot and Cold Weather Masonry Construction.

1.7 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: provide in accordance with Section 04 05 00 – Common Work Results for Masonry.

.2 Warranty Documentation: submit warranty documents specified.

Part 2 Products

2.1 MATERIALS

.1 Use same brands of materials and source of aggregate for entire project.

.2 Cement:

.1 Portland Cement: to CAN/CSA-A3000, Type GU - General use hydraulic cement (Type 10)

.3 Water: clean and potable.

.4 Lime:

.1 Quick Lime: to CAN/CSA A179, Type S.

.2 Hydrated Lime: to CAN/CSA A179, Type S.

2.2 MORTAR MIXES

.1 Mortar for exterior and interior masonry above grade is to be Type S.

.2 Mortar For Glass Block Masonry: CAN/CSA A179, Type S, using the property specification.

2.3 MORTAR MIXING

.1 Mix mortar ingredients in accordance with CAN/CSA A179 in quantities needed for immediate use.

.2 Maintain sand uniformly damp immediately before mixing process.

.3 Do not use anti-freeze compounds including calcium chloride or chloride based compounds.

.4 Do not add air entraining admixture to mortar mix.

.5 Use a batch type mixer in accordance with CAN/CSA A179.

.6 Re-temper mortar only within two (2) hours of mixing, when water is lost by evaporation.

.7 Use mortar within two (2) hours after mixing at temperatures of 32 degrees C, or 2-1/2 hours at temperatures under 5 degrees C.

2.4 GROUT MIXES

.1 Grout: Minimum compressive strength of 20 MPa at 28 days. Maximum aggregate size and grout slump: CAN/CSA A179.

2.5 GROUT MIXING

.1 Mix batched and delivered grout in accordance with CAN/CSA-A23.1 transit mixed.

.2 Mix grout ingredients in quantities needed for immediate use in accordance with CAN/CSA A179 coarse grout.

.3 Do not use calcium chloride or chloride based admixtures.

2.6 MIX TESTS

.1 Testing Mortar Mix:

.1 Test mortar to requirements of Section 01 45 00 - Quality Control, and in accordance with CAN/CSA A179, for proportion specification. Test during construction for:

.1 Compressive strength.

.2 Consistency.

.3 Mortar aggregate ratio.

.4 Sand/cement ratio.

.5 Water content and water/cement ratio.

.6 Air content.

.2 Testing Grout Mix:

.1 Test grout to requirements of Section 01 45 00 - Quality Control, and in accordance with CAN/CSA A179, for proportion specification. Test during construction for:

.1 Compressive strength.

.2 Slump.

Part 3 Execution

3.1 EXAMINATION

.1 Request inspection of spaces to be grouted.

3.2 PREPARATION

.1 Plug clean-out holes with block masonry units. Brace masonry for wet grout pressure.

3.3 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.4 CONSTRUCTION

.1 Do masonry mortar and grout work in accordance with CAN/CSA A179 except where specified otherwise.

3.5 MIXING

.1 All pointing mortar can be mixed using a regular paddle mixer. Only electric motor mixers are permissible. Mixers run on hydrocarbons are not permitted, due to fumes.

.2 Clean all mechanical mixing machine between batches.

3.6 MORTAR PLACEMENT

.1 Install mortar to requirements of CAN/CSA A179.

.2 Remove excess mortar from grout spaces.

3.7 GROUT PLACEMENT

.1 Install grout in accordance with CAN/CSA A179.

.2 Work grout into masonry cores and cavities to eliminate voids.

.3 Do not install grout in lifts greater than 400mm, without consolidating grout by rodding.

.4 Do not displace reinforcement while placing grout.

3.8 FIELD QUALITY CONTROL

.1 Site Tests, Inspection: in accordance with Section 04 05 00 - Common Work Results for Masonry supplemented as follows:

.1 Test and evaluate mortar during construction in accordance with CAN/CSA A179.

.2 Test and evaluate grout during construction to CAN/CSA A179; test in conjunction with masonry unit sections specified.

.2 Manufacturer's Instructions: in accordance with Section 04 05 00 - Common Work Results for Masonry.

3.9 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

.2 Remove droppings and splashings using clean sponge and water.

.3 Clean masonry with low pressure clean water and soft natural bristle brush.

.4 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

3.10 PROTECTION OF COMPLETED WORK

.1 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 05 00 – Common Work Results for Masonry

.2 Section 04 21 13 – Brick Masonry

.3 Section 04 22 00 – Concrete Unit Masonry

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A36/A36M-14, Standard Specification for Carbon Structural Steel.

.2 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

.3 ASTM A167-99(R2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.4 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

.5 ASTM A580/A580M-16, Standard Specification for Stainless Steel Wire.

.6 ASTM A641/A641M-09a(2014), Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

.7 ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

.2 CSA Group

.1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A179-04(R2009), Mortar and Grout for Unit Masonry.

.3 CAN/CSA-A370-14, Connectors for Masonry.

.4 CAN/CSA-A371-04(R2009), Masonry Construction for Buildings.

.5 CSA G30.18-09(R2014), Carbon Steel Bars for Concrete Reinforcement.

.6 CSA S304.1-04(R2010), Design of Masonry Structures.

.7 CSA W186-M1990(R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.3 National Research Council Canada (NRC)

.1 National Building Code of Canada 2015(NBC).

.4 Reinforcing Steel Institute of Canada (RSIC)

.1 Reinforcing Steel Manual of Standard Practice, 2004.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for [anchorage and reinforcing materials]and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.

.2 Submit drawings detailing bar bending details, anchorage details, lists and placement drawings

.3 On placement drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

.4 Manufacturers' Instructions: submit manufacturer's installation instructions.

.5 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that construction wastes were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-industrial and post-consumer content of materials for project.

.3 Regional Materials: submit evidence that project incorporates regional materials.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00- Common Work Results for Masonry.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Mock-ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control and requirements of Section 04 05 00 - Common Work Results for Masonry.

1.5 SITE MEASUREMENTS

.1 Make site measurements necessary to ensure proper fit of members.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and 01 61 00- Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect anchorage and reinforcing materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 43 – Environmental Procedures.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of crates, packaging materials, padding, pallets, as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Bar reinforcement: Steel to CAN/CSA-A371 and CSA G30.18.

.2 Connectors: to CAN/CSA-A370 and CSA S304.1.

.3 Corrosion protection: to CSA S304.1, galvanized to CSA S304.1 and CAN/CSA-A370.

.4 Ties: hot dip galvanized to CAN/CSA-A370 Table 5.2 steel finish.

.1 Unit ties, to CAN/CSA-A370: ladder or truss, fabricated cold drawn steel with corrosion resistant finish, size to suit application.

.2 Joint Reinforcement Ties: to CAN/CSA-A370:

.1 Single Wythe Joint Reinforcement: ladder type:

.1 Steel wire, hot dip galvanized: to ASTM A641, Class 3 after fabrication, 3.66 mm diameter.

2.2 FABRICATION

.1 Fabricate reinforcing in accordance with CSA A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Fabricate connectors in accordance with CAN/CSA-A370.

.3 Obtain Consultant's acceptance for locations of reinforcement splices other than shown on placing drawings.

.4 Upon acceptance of Consultant, weld reinforcement in accordance with CSA W186.

.5 Ship reinforcement and connectors, clearly identified in accordance with drawings.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Consultant with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis, minimum five (5) weeks prior to commencing reinforcement work.

.2 Upon request inform Consultant of proposed source of material to be supplied.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for anchorage and reinforcing materials installation in accordance with manufacturer's written instructions.

.1 Visually review substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Direct and coordinate placement of metal anchors for masonry supplied to other Sections.

3.3 INSTALLATION

.1 Supply and install masonry connectors and reinforcement in accordance with CAN/CSA-A370, CAN/CSA-A371, CSA A23.1/A23.2 and CSA S304.1 unless indicated otherwise.

.2 Prior to placing mortar and grout, obtain Consultant's acceptance of placement of reinforcement and connectors.

3.4 BONDING AND TYING

.1 Bond walls of two or more wythes using metal connectors in accordance with CSA S304.1, CAN/CSA-A371 and as indicated.

.2 Tie masonry veneer to backing in accordance with National Building Code of Canada (NBC), CSA S304.1, CAN/CSA-A371 and as indicated.

.3 Install unit, adjustable, single wythe and multiple wythe joint reinforcement where indicated and in accordance with CAN/CSA-A370 and CAN/CSA-A371.

.1 Bond walls of two or more wythes using metal connectors in accordance with CAN/CSA-A371 and as indicated.

.2 Install horizontal joint reinforcement 400 mm on centre.

.3 Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 400 mm each side of opening.

.4 Place joint reinforcement continuous in first and second joint below top of walls.

.5 Lap joint reinforcement ends minimum 150 mm.

.6 Connect joint corners and intersections with strap anchors 400 mm on centre.

3.5 REINFORCED LINTELS AND BOND BEAMS

.1 Reinforce masonry beams, masonry lintels and bond beams as indicated.

.2 Place and grout reinforcement in accordance with CSA S304.1, CAN/CSA-A371, and CAN/CSA-A179.

.3 Support and position reinforcing bars in accordance with CAN/CSA-A371.

3.6 GROUTING

.1 Grout masonry in accordance with CSA S304.1, CAN/CSA-A371 and CAN/CSA-A179 and as indicated.

3.7 ANCHORS

.1 Supply and install metal anchors in accordance with CAN/CSA-A370 and CAN/CSA-A371.

3.8 LATERAL SUPPORT AND ANCHORAGE

.1 Supply and install lateral support and anchorage in accordance with CSA S304.1 and as indicated.

3.9 MOVEMENT JOINTS

.1 Reinforcement will not be continuous across movement joints unless otherwise indicated.

3.10 FIELD BENDING

.1 Do not field bend reinforcement and connectors except where indicated or authorized by Consultant.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.3 Replace bars and connectors which develop cracks or splits.

3.11 FIELD QUALITY CONTROL

.1 Site inspections in accordance with Section 04 05 00- Common Work Results for Masonry.

.2 Obtain Consultant acceptance of placement of reinforcement and connectors, prior to placing mortar and grout.

3.12 FIELD TOUCH-UP

.1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

3.13 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 05 00 Common Work Results for Masonry

.2 Section 04 05 12 Masonry Mortar and Grout

.3 Section 04 05 19 – Masonry Anchorage and Reinforcing

.4 Section 07 62 00 – Sheet Metal Flashing and Trim

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM C73-17, Standard Specification for Calcium Silicate Brick (Sand-Lime Brick).

.2 ASTM C216-17, Standard Specification for Facing Brick (Solid Masonry Units Made of Clay or Shale).

.2 Brick Industry Association (BIA)

.1 Technical Note No. 20-2006, Cleaning Brick Work.

.3 CSA Group

.1 CAN/CSA-A82-14, Fired Masonry Brick Made From Clay or Shale.

.2 CAN/CSA-A165 Series-04 (R2014), CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).

.3 CAN/CSA-A371-04 (R2014), Masonry Construction for Buildings.

.4 International Masonry Industry All-Weather Council (IMIAC)

.1 Recommended Practices and Guide Specification for Hot and Cold Weather Masonry Construction.

.5 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)

.1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for brick masonry and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit unit samples in accordance with Section 04 05 00 - Common Work Results for Masonry.

.4 Manufacturer's Written Instructions:

.1 Submit in accordance with Section 04 05 00 - Common Work Results for Masonry.

.5 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including percentages or recycled content materials and products, showing their costs and percentages of post-consumer, post-industrial content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates regional materials.

1.4 QUALITY ASSURANCE

.1 Certificates: provide in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Test and Evaluation Reports: provide certified test reports in accordance with Section 04 05 00 - Common Work Results for Masonry.

.3 Pre-Installation Meetings: conduct pre-installation meeting in accordance with Section 04 05 00 - Common Work Results for Masonry to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

.4 Mock-ups:

.1 Construct mock-ups in accordance with Section 01 45 00- Quality Control and requirements of Section 04 05 00- Common Work Results for Masonry.

.1 Construct mock-up panel of exterior brick construction 1200 x 1800 mm.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle concrete unit masonry in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Packaging Waste Management:

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 SITE CONDITIONS

.1 Provide in accordance with Section 04 05 00 - Common Work Results for Masonry.

1.7 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: provide in accordance with Section 04 05 00 – Common Work Results for Masonry.

.2 Warranty Documentation: submit warranty documents specified.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Face brick:

.1 Fired clay brick: to CAN/CSA-A82.

.1 Type: Special Order, FBX.

.2 Grade: SW.

.3 Size: 90 mm x 90 mm x 290 mm.

.4 Colour and texture: Mutual Materials, Aspen, Mission texture.

.5 Solid/hollow.

.2 Face Block:

.1 Spilt faced block:

.1 Type: Lightweight, split face.

.2 Shapes: Standard and L shaped.

.3 Colour: Expocrete Masonry Block, Charcoal #250.

.4 Size: 390 mm x 190 mm x 90 mm.

.2 Smooth faced block:

.1 Type: Lightweight, smooth face.

.2 Shapes: Half high.

.3 Colour: Expocrete Masonry Block, Natural Grey.

.4 Size: 390 mm x 90 mm x 90 mm.

.3 Reinforcement:

.1 Reinforcement in accordance with Section 04 05 19- Masonry Anchorage and Reinforcing.

.4 Connectors:

.1 Connectors in accordance with Section 04 05 19- Masonry Anchorage and Reinforcing.

.5 Flashings:

.1 Flashing: in accordance with Section 07 62 00 – Sheet Metal Flashing and Trim.

.6 Mortar Mixes:

.1 Mortar and mortar mixes in accordance with Section 04 05 12- Masonry Mortar and Grout.

.7 Grout Mixes:

.1 Grout and grout mixes in accordance with Section 04 05 12- Masonry Mortar and Grout.

.8 Cleaning Compounds:

.1 Use low VOC products in compliance with SCAQMD Rule 1168.

.2 Compatible with substrate and acceptable to masonry manufacturer for use on products.

.3 Cleaning compounds compatible with brick masonry units and in accordance with manufacturer's written recommendations and instructions.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for brick masonry installation in accordance with manufacturer's written instructions.

.1 Visually review substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Protect adjacent finished materials from damage due to masonry work.

3.3 INSTALLATION

.1 Construction to conform to CAN/CSA-A371.

.2 Bond: running.

.3 Coursing height: 200 mm for two bricks and two joints.

.4 Jointing: concave where exposed.

.1 Mixing and blending: mix units within each pallet and with other pallets to ensure uniform blend of colour and texture.

.2 Clean unglazed clay masonry as work progresses.

.3 Reinforcement:

.1 Install reinforcing in accordance with Section 04 05 19- Masonry Anchorage and Reinforcing.

.4 Connectors:

.1 Install connectors in accordance with Section 04 05 19- Masonry Anchorage and Reinforcing.

.5 Flashings:

.1 Install flashings in accordance with Section 07 62 00 Sheet Metal Flashing and Trim.

.6 Mortar Placement:

.1 Place mortar in accordance with Section 04 05 12 - Masonry Mortar and Grout.

.7 Grout Placement:

.1 Place grout in accordance with Section 04 05 12- Masonry Mortar and Grout.

.8 Repair/Restoration:

.1 Upon completion of masonry, fill holes and cracks, remove loose mortar and repair defective work.

.9 Field Quality Control:

.1 Site Tests, Inspection: in accordance with Section 04 05 00- Common Work Results for Masonry.

.10 Tolerances:

.1 To CAN/CSA-A371.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

.2 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.3 Clean unglazed clay masonry: 10 m2 area of wall designated by Consultant for mock up panel as directed below and leave for one week. If no harmful effects appear and after mortar has set and cured, protect windows, sills, doors, trim and other work, and clean brick masonry as follows.

.1 Remove large particles with wood paddles without damaging surface. Saturate masonry with clean water and flush off loose mortar and dirt.

.2 Scrub with solution of 25 ml trisodium phosphate and 25 ml household detergent dissolved in 1 L of clean water using stiff fibre brushes, then clean off immediately with clean water using hose. Alternatively, use proprietary compound recommended by brick masonry manufacturer in accordance with manufacturer's directions.

.3 Repeat cleaning process as often as necessary to remove mortar and other stains.

.4 Use acid solution treatment for difficult to clean masonry as described in Technical Note No.20 by the Brick Industry Association.

.4 Clean concrete brick masonry as work progresses.

.1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of brick and finally by brushing.

.5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.6 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

.1 Brace and protect brick masonry in accordance with Section 04 05 00- Common Work Results for Masonry.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 05 00 – Common Work Results for Masonry

.2 Section 04 05 12 – Masonry Mortar and Grout

.3 Section 07 62 00 – Sheet Metal Flashing and Trim

1.2 REFERENCES STANDARDS

.1 ASTM International Inc.

.1 ASTM E336-16A, Standard Test Method for Measurement of Airborne Sound Attenuation Between Rooms in Buildings.

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA-A165 Series-14 (R2014), CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2, A165.3).

.2 CAN/CSA A371-04 (R2014), Masonry Construction for Buildings.

.3 CSA S304-14, Design of Masonry Structures.

.3 International Masonry Industry All-Weather Council (IMIAC)

.1 Recommended Practices and Guide Specification for Hot and Cold Weather Masonry Construction.

.4 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)

.1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

.5 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S101-14, Standard Methods of Fire Endurance Tests of Building Construction and Materials.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for brick masonry and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit unit samples in accordance with Section 04 05 00 - Common Work Results for Masonry.

.4 Manufacturer's Written Instructions:

.1 Submit in accordance with Section 04 05 00 - Common Work Results for Masonry.

.5 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer, post-industrial content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates regional materials.

1.4 QUALITY ASSURANCE

.1 Certificates: provide in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Test and Evaluation Reports: provide certified test reports in accordance with Section 04 05 00 - Common Work Results for Masonry.

.3 Pre-Installation Meetings: conduct pre-installation meeting in accordance with Section 04 05 00 - Common Work Results for Masonry to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

.4 Mock-ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control and requirements of Section 04 05 00 - Common Work Results for Masonry supplemented as follows:

.1 Construct mock-up panel of exterior and interior concrete unit masonry construction 1200 x 1800 mm.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle concrete unit masonry in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Packaging Waste Management:

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 SITE CONDITIONS

.1 Provide in accordance with Section 04 05 00 - Common Work Results for Masonry.

1.7 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: provide in accordance with Section 04 05 00 – Common Work Results for Masonry.

.2 Warranty Documentation: submit warranty documents specified.

Part 2 Products

2.1 MATERIALS

.1 Standard concrete block units: to CAN/CSA-A165 Series (CAN/CSA-A165.1) and as follows:

.1 Classification: H/15/C/M in all locations unless noted otherwise.

.1 Base course walls between gridlines 6 to 10 and B to H size: two courses 200 x 400 x 100 high nominal size.

.2 Classification: H/15/A/M in rooms 132, 133, and 134.

.3 Special shapes: provide square bull-nosed and double bull-nosed units for exposed corners, door heads and jambs. Provide purpose-made shapes for lintels, beams and bond beams. Provide additional special shapes as detailed on drawings.

.4 Profile/Texture for Architectural Concrete Unit Masonry:

.1 Surface texture: smooth, unless noted otherwise.

.5 Colour: Natural

.6 Unit faces filled with cementitious grout.

.7 Provide concrete blockof composition and type appropriate for fire ratings detailed on drawings.

2.2 REINFORCEMENT

.1 Reinforcement in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

2.3 CONNECTORS

.1 Connectors in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

2.4 FLASHING

.1 Flashing: in accordance with Section 07 62 00 – Sheet Metal Flashing and Trim.

2.5 MORTAR MIXES

.1 Mortar and mortar mixes in accordance with Section 04 05 12 - Masonry Mortar and Grout.

2.6 GROUT MIXES

.1 Grout and grout mixes in accordance with Section 04 05 12 - Masonry Mortar and Grout.

2.7 CLEANING COMPOUNDS

.1 Use low VOC products in compliance with SCAQMD Rule 1168.

.2 Compatible with substrate and acceptable to masonry manufacturer for use on products.

.3 Cleaning compounds compatible with concrete unit masonry and in accordance with manufacturer's written recommendations and instructions.

2.8 TOLERANCES

.1 Tolerances for standard concrete unit masonry tolerances in accordance with CAN/CSA A165.1, supplemented as follows:

.1 Maximum variation between units within specific job lot not to exceed 2 mm.

.2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm.

.3 Out of square tolerance not to exceed 2 mm.

.2 Tolerances for architectural concrete masonry units in accordance with CAN/CSA A165.1, supplemented as follows:

.1 Maximum variation in length or height between units within specific job lot for specified dimension not to exceed 2 mm.

.2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm.

.3 Out of square tolerance not to exceed 2 mm.

.4 Maximum variation in width between units within specific job lot for specified dimension not to exceed 2mm.

Part 3 Execution

3.1 EXAMINATION

.1 Verify surfaces and conditions are ready to accept work of this Section.

.2 Commencing installation means acceptance of existing substrates.

3.2 PREPARATION

.1 Protect adjacent finished materials from damage due to masonry work.

3.3 INSTALLATION

.1 Concrete block units:

.1 Bond: running

.2 Coursing height: 200 mm for one block and one joint typically and 200 mm for two blocks and two joints where noted otherwise.

.3 Jointing: concave where exposed or where paint or other finish coating is specified.

.2 Architectural concrete unit masonry:

.1 Bond: running

.2 Coursing height: 200mm for one block and one joint typically and 100 mm high for one block and one joint where noted otherwise.

.3 Jointing: concave where exposed or where paint or finish coating is specified.

.3 Special Shapes:

.1 Install special units to form corners, returns, offsets, reveals and indents without cut ends being exposed and without losing bond or module.

.2 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.

.3 End bearing: not less than 200mm as indicated on drawings.

.4 Install special site cut shaped units.

3.4 REINFORCEMENT

.1 Install reinforcing in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

3.5 CONNECTORS

.1 Install connectors in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

3.6 FLASHING

.1 Install flashings: in accordance with Section 07 62 00 – Sheet Metal Flashing and Trim.

3.7 MORTAR PLACEMENT

.1 Place mortar in accordance with Section 04 05 12 - Masonry Mortar and Grout.

3.8 GROUT PLACEMENT

.1 Place grout in accordance with Section 04 05 12 - Masonry Mortar and Grout.

3.9 CONSTRUCTION

.1 Build in miscellaneous items such as bearing plates, steel angles, bolts, anchors, inserts, sleeves and conduits.

.2 Construct masonry walls using running bond unless otherwise noted.

.3 Build around frames previously set and braced. Fill behind hollow frames within masonry walls with mortar or grout and embed anchors.

.4 Fit masonry closely against electrical and plumbing outlets so collars, plates and covers overlap and conceal cuts.

.5 Install movement joints and keep free of mortar where indicated.

.6 Hollow Units: spread mortar setting bed from outside edge of face shells. Gauge amount of mortar on top and end of unit to create full joints, equivalent to shell thickness. Avoid excess mortar.

.7 Solid Units: apply mortar over entire vertical and horizontal surfaces. Avoid bridging of airspace between brick veneer and backup wall with mortar.

.8 Ensure compacted head joints. Use full or face-shell joint as indicated.

.9 Tamp units firmly into place.

.10 Do not adjust masonry units after mortar has set. Where resetting of masonry is required, remove, clean and reset units in new mortar.

.11 Tool exposed joints concave. Strike concealed joints flush.

.12 After mortar has achieved initial set up, tool joints.

.13 Do not interrupt bond below or above openings.

3.10 REPAIR/RESTORATION

.1 Upon completion of masonry, fill holes and cracks, remove loose mortar and repair defective work.

3.11 FIELD QUALITY CONTROL

.1 Site Tests, Inspection: in accordance with Section 04 05 00 - Common Work Results for Masonry supplemented as follows:

.1 Noise reduction between two rooms will be tested by independent testing agency appointed and paid by Consultant in accordance with ASTM E336.

.2 Notify inspection agency minimum of 24 hours in advance of requirement for tests.

3.12 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning, supplemented as follows.

.1 Progress Cleaning:

.1 Standard Concrete Unit Masonry:

.1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block. Clean wall surface with suitable brush or burlap.

.2 Architectural Concrete Unit Masonry:

.1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block. Clean wall surface with suitable brush or burlap.

.2 Waste Management: separate waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

3.13 PROTECTION

.1 Brace and protect concrete unit masonry in accordance with Section 04 05 00 - Common Work Results for Masonry.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 05 00 – Common Work Results for Masonry

.2 Section 04 05 12 – Masonry Mortar and Grout

1.2 REFERENCES STANDARDS

.1 ASTM International Inc.

.1 ASTM A153/A153M-16a, Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.

.2 ASTM D1187-97(2011)e1, Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA A179-04 (R2014), Mortar and Grout for Unit Masonry.

.2 CAN/CSA A371-04 (R2014), Masonry Construction for Buildings.

.3 CAN/CSA-A3000-13, Cementitious Materials Compendium; CAN/CSA-A3002-13, Masonry and Mortar Cement.

.4 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)

.1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

.4 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S106-15, Standard Method For Fire Test of Window and Glass Block Assemblies.

1.3 SYSTEM DESCRIPTION

.1 Glass block installations not to be designed to support structural loads.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for brick masonry and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit unit samples in accordance with Section 04 05 00 - Common Work Results for Masonry.

.4 Manufacturer's Written Instructions:

.1 Submit in accordance with Section 04 05 00 - Common Work Results for Masonry.

.5 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer, post-industrial content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates regional materials.

1.5 QUALITY ASSURANCE

.1 Certificates: provide in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Test and Evaluation Reports: provide certified test reports in accordance with Section 04 05 00 - Common Work Results for Masonry.

.3 Pre-Installation Meetings: conduct pre-installation meeting in accordance with Section 04 05 00 - Common Work Results for Masonry to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

.4 Mock-ups:

.1 Construct mock-ups in accordance with Section 01 45 00- Quality Control and requirements of Section 04 05 00- Common Work Results for Masonry.

.1 Construct mock-up panel of exterior block construction 1200 x 200 mm.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle concrete unit masonry in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Packaging Waste Management:

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.7 SITE CONDITIONS

.1 Provide in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Field Measurements:

.1 Make field measurements necessary to ensure proper fit of all members.

1.8 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: provide in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Warranty Documentation: submit warranty documents specified.

1.9 EXTRA MATERIALS

.1 Provide manufacturer's instructions in accordance with Section 01 33 00 - Submittals Procedures covering maintenance requirements.

.2 Extra Stock Maintenance Materials in accordance with Section 01 78 00 - Closeout Submittals: deliver to Owner extra materials. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.

.1 Provide 6 glass blocks each type and size of glass units, under provisions of Section 01 78 00 - Closeout Submittals.

.2 Supply in original cartons using cushioning materials between units. Attach label identifying:

.1 Project Name.

.2 Description of Contents: name of manufacturer, trade name of product, generic description of contents.

Part 2 Products

2.1 MANUFACTURERS

.1 Ensure manufacturer has minimum 5 years experience in manufacturing components similar to or exceeding requirements of project.

2.2 MANUFACTURED UNITS

.1 Pre-approved: Seves Vistabrik – Glass block, Clearview with Sahara finish on 1 side. Distributor: Brock White Canada ULC, 21359 – 115th Avenue NW, Edmonton AB. P: 780-447-1774.

.2 Solid glass block: standard with joint key for mortar bond.

.1 Pattern and design:

.1 Surfaces: Sandblast inner face of outside wythe and outer face of inner wythe.

.2 Colour: clear glass.

.3 Edge coating colour: manufacturer's standard translucent polyvinyl-butyral based white-coloured, latex based coloured edge coating, factory applied, to match mortar colour edge coating.

.2 Nominal sizes:

.1 Square units: 194 mm square x 76 mm thick.

.3 Visible light transmittance: minimum 90 percent.

.4 Compressive strength: 550 KPa.

2.3 ACCESSORIES

.1 Mortar: as specified in Section 04 05 12 - Masonry Mortar and Grout.

.2 Sealant: VOC content to comply with SCAQMD Rule 1168, rigid epoxy resin compound, styrene-free, two component, ASTM D695 Compressive strength 11,000 psi minimum,

suitable for use on substrate indicated, colour selected by Consultant from manufacturer's standard range.

.3 Sealant backing: VOC content to comply with SCAQMD Rule 1168, Non-staining type recommended by sealant manufacturer.

.4 Spacers: plastic, concealed type, allowing pointing mortar and placing reinforcing and panel anchors without obstruction, of size to provide horizontal and vertical joint width indicated, capable of supporting glass units until mortar set, incorporated into structural design of glass unit masonry.

2.4 SOURCE QUALITY CONTROL

.1 Glass block, components and materials to be from single manufacturer.

Part 3 Execution

3.1 INSTALLERS

.1 Provide experienced and qualified technicians to carry out erection, assembly and installation of glass block.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.3 EXAMINATION

.1 Examination: examine conditions in accordance with Section 04 05 00 Common Work Results for Masonry.

3.4 PREPARATION

.1 Surface Preparation: prepare surface in accordance with Section 04 05 00 Common Work Results for Masonry.

.2 Ensure structure or substrate is adequate to support glass block.

.3 Clean glass units of foreign substances.

3.5 INSTALLATION

.1 Erect glass units and accessories in accordance with manufacturer's instructions.

.2 Install glass unit spacers to manufacturer's recommendations.

.3 Set glass units with full bond mortar joints. Furrowing not permitted. Remove excess mortar.

.4 Do not install glass unit when ambient temperature is below 4 degrees C. Maintain ambient temperature above 4 degrees C for 48 hours after installation.

.5 Place units to maintain uniform joint width of 6 mm.

.6 Install unit masonry to avoid contact of glass units with metal accessories or frames.

3.6 CONSTRUCTION

.1 Mortar Placement:

.1 Place pointing mortar in accordance with Section 04 05 12 - Masonry Mortar and Grout.

.2 Set glass with full bond mortar joints. Furrowing not permitted. Remove excess mortar.

.3 Place units to maintain uniform joint width of 6 mm.

.2 Application of Sealant:

.1 Install sealant in accordance with Section 07 92 00 - Joint Sealants.

.2 Apply sealant 24 hours after glass unit masonry installation.

.3 Form surfaces of sealant smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities. Tool surface to a slight concave profile. Edges of joints to expose shoulders of glass units.

.4 Remove excess sealant.

3.7 TOLERANCES

.1 Tolerance for glass block unit construction in accordance with Section 04 05 00 - Common Work Results for Masonry, supplemented as follows.

.1 Variation from specified joint width: plus 2 mm and minimum 0 mm.

.2 Maximum variation from plane of unit to adjacent unit: 1 mm.

.3 Maximum variation from flat plane: 1 mm in 1.2 m, non-cumulative.

3.8 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning, supplemented as follows.

.1 Remove mortar particles using a clean, wet sponge or cloth. Rinse sponge or cloth frequently in clean water to remove abrasive particles that could scratch glass surfaces. Allow any remaining film on the block to dry to a powder.

.2 Remove excess caulking materials with commercial solvents such as xylene mineral spirits naptha and follow with normal wash and rinse. Do not damage caulking by overgenerous application of strong solvents. Comply with solvent manufacturers' printed data for toxicity and flammability warnings.

.3 When glass block panels are completely installed and are not exposed to direct sunlight, final cleaning may be carried out. Start at the top of the panel and wash with generous amounts of clean water. Dry all water from the glass block surface. Change cloth frequently to eliminate dried mortar particles that could scratch the glass surface. Use a clean, dry, soft cloth to remove the dry powder from the glass surfaces.

.2 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

3.9 PROTECTION

.1 Brace and protect glass block unit construction in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Make good damage to adjacent materials caused by glass block installation.

END OF SECTION

1. General

1.1 RELATED REQUIREMENTS

.1 Section 04 21 13 – Brick Masonry
.2 Section 04 22 00 – Concrete Unit Masonry

1.2 REFERENCES STANDARDS

.1 Miscellaneous References:

.1 Canadian Environmental Assessment Act (CEAA).

1.3 ACTION AND INFORMATION SUBMITTALS

.1 Product Data:

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit manufacturer's instructions, printed product literature, specifications and data sheets.

.2 Submit electronic copies of Workplace Hazardous Materials Information System (WHMIS) – Material Safety Data Sheets (MSDS) in accordance with Section 01 35 43 – Environmental Procedures.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's cleaning instructions.

.2 Submit written methodology describing the graffiti removal process.

1.4 QUALITY ASSURANCE

.1 Use only materials from one (1) manufacturer and a single source of supply.

.2 Use only proprietary material from the specified manufacturer's: non-proprietary or secret formulae, or materials having an unknown composition will not be permitted as these may contain harmful substances and may cause deleterious effects to surrounding material or masonry surfaces.

.3 Application to be provided by manufacturer trained and approved applicators only.

1.5 EXTRA MATERIALS

.1 Provide maintenance information in accordance with Section 01 33 00 – Submittal Procedures indicating proper care of anti-graffiti coatings, cleaning instructions, locally available materials used to clean and maintain surfaces, and approximate recoating requirements.

.2 Provide two (2) - 4L (1 gal) container of maintenance cleaner listed in item 2.2 below stored in location directed by the Owner, in accordance with Section 01 78 00 – Closeout Submittals.

2. Products

2.1 MATERIALS: GENERAL

.1 Water: Clean potable water free from contaminants; treat water that has high metal content before use in cleaning.

.2 Masking Materials: Polyethylene or strippable masking (butyl rubber spray) at choice of Trade Contractor.

2.2 ANTI-GRAFFITI COATING

.1 Non-sacrificial, fully breathable sealer that does not alter the look of the substrate to which it is being applied, specifically formulated to prevent graffiti from curing into masonry and precast concrete substrate pores.

. 1 Acceptable materials:

.1 Fabrikem Fabrishield PR Series.

.2 Graffiti Master, Acryli-Master.

.3 ProSoCo, Defacer Eraser Graffiti Barrier NS, with Protective Film Hardener.

.2 Maintenance Cleaners: Manufacturer's recommended maintenance cleaners formulated to clean all masonry types specified prior to application of anti-graffiti coating.

2.3 TOOLS AND EQUIPMENT

.1 Use only brushes with natural or soft plastic bristles.

.2 Use only scrapers of wood or plastic.

.3 Use air compressors equipped with on-line oil filters to avoid spraying oil onto masonry.

.4 Use only plastic or non-ferrous metal piping and fittings.

.5 Use nozzles that give nebulized droplet spray.

3. Execution

3.1 PREPARATION

.1 Place safety devices and signs near work areas as indicated and directed.

.2 Clean all masonry surfaces to receive coating with product specified in accordance with manufacturer's standard range.

.3 Seal or repair openings and joints where there is potential risk of water or chemical infiltration through the wall assembly in accordance with coating manufacturer's recommendations.

.4 Cover surfaces not scheduled for coatings.

.5 Cover and protect surfaces and non-masonry finishes within areas scheduled for coatings.

3.2 APPLICATION

.1 Apply product in environmental conditions that conform with manufacturer's recommendations. Do not apply in wind conditions that will cause overspray to fall beyond the immediate vicinity of the building.

.2 Inspect all masonry surfaces to ensure preparation meets manufacturer's recommendations. Where surfaces are not suitable, do not apply coating until surfaces are made suitable.

.3 Commencing application constitutes acceptance of substrate conditions.

.4 Apply coating at rate and quantity recommended by manufacturer.

.5 Apply coating to all exposed masonry surfaces.

3.3 CLEAN-UP

.1 Rinse off masonry until no indications of chemicals are present.

.2 Rinse from bottom to top and from top to bottom.

.3 Clean up work area as work progresses.

.4 Remove debris and waste from site at end of each work day.

3.4 PROTECTION

.1 Mask or seal vents, windows, and other openings.

.2 Mask glass, and metal adjacent to masonry.

.3 Hang sheeting material from scaffolding to enclose spray.

.4 Workers shall wear eye, head, and face protection, and protective gloves, overalls, boots and filter mask in accordance with MSHA/NIOSH standard.

3.5 SCHEDULE

.1 Provide anti-graffiti coating to all exterior exposed concrete unit masonry.

.2 Provide anti-graffiti coating to all exterior exposed brick masonry.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Quality Control: Tests, inspections, procedures, and related actions during and after execution of the Work by a third party testing agency to evaluate that completed construction complies with requirements whose services do not include contract enforcement activities performed by Consultant.

.2 Quality Assurance: Activities, actions, and procedures performed before and during execution of the Work by the Construction Manager and Trade Contractor to guard against defects and deficiencies and ensure proposed construction complies with requirements.

1.1.1 Delegated Design Professional Engineer: The professional engineer hired or contracted to the fabricator or manufacturer to design specialty elements, produce delegated design submittals and shop drawings to meet the requirements of the Project; who is registered in the province of the Work; and who is not the Consultant.

.3 Letters of Assurance and Due Diligence: Documents prepared by the delegated design professional engineer as recommended by APEGGA's Bulletin K: Letters of Assurance and Due Diligence.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA S16 -14, Design of Steel Structures

.2 CSA W47.1-09 (R2014), Fusion Welding of Steel

.3 CSA W178.1-14, Certification of Welding Inspection Organizations

.4 CSA W55.3-08 (R2013), Certification of Companies for Resistance Welding of Steel and Aluminum

.5 CSA W59-13, Welded Steel Construction (metal arc welding)

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate shop priming and finishing requirements structural drawings.

.2 Testing and Inspections: Contractor will appoint and pay for services of testing agency to perform testing and inspection of work of this Section:

.1 Notify Consultant prior to commencement of fabrication work so testing and inspection may be properly scheduled and reviewed.

.2 Owner may request additional testing and inspection at Contractor's expense when defects revealed.

.3 Correct, or remove and replace structural steel with defects revealed by testing and inspection to the recommendations of the testing authority and to the approval of authorities having jurisdiction.

.3 Sequencing: Sequence steel work to account for the following:

.1 Supply anchorage items embedded in or attached to other construction without delaying the Work

.2 Deliver steel bearing plates and other devices built into concrete and masonry construction so as not to cause delay to the project

.3 Schedule delivery of structural steel to Project site in quantities and at times to maintain continuity of installation

.4 Schedule delivery of steel joists to Project site in quantities and at times to maintain continuity of installation

.4 Delegated Design Requirements: Design structural steel connections required by the Contract Documents to withstand design loadings indicated and in accordance with requirements of the Building Code and CAN/CSA S16-14 to resist forces, moments, shears and allow for movements indicated:

.1 Engage fabricator who utilizes registered professional engineer to prepare calculations, shop drawings, and other structural data for steel joists and connections not shown on drawings that comply with requirements of this Section.

.2 Retain registered professional engineer to ascertain and report fabrication and erection of work meets specific design criteria for materials referenced.

1.4 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 23.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit following product test reports for steel deck materials, from qualified testing agency indicating each of following complies with requirements, based on comprehensive testing of current products:

.1 Provide product certificates signed by steel deck manufacturers certifying products provided comply with requirements of specifications and Building Code.

.2 Provide product data for mechanical and adhesive fasteners indicating load ratings and methods of installation.

.3 Informational Submittals: Provide the following submittals during the course of the work:

.1 Quality Management Plan: Written documents provided by the Trade Contractor indicating quality assurance and activities undertaken by the Trade Contractor including; but not limited to, the following:

.1 Schedule of Tests and Inspections: Submit schedule of tests and inspections performed by the Trade Contractor; prepared in tabular form and including the following:

.1 Specification section number and title

.2 Description of test and inspection

.3 Identification of applicable standards

.4 Identification of test and inspection methods

.5 Number of tests and inspections required

.6 Time schedule or time span for tests and inspections

.7 Entity responsible for performing tests and inspections

.8 Requirements for obtaining samples

.9 Unique characteristics of each quality assurance service

.2 Reports: Submit written reports prepared Trade Contractor's inspection agency that includes the following:

.1 Date of issue

.2 Project title and number

.3 Name, address, and telephone number of testing agency

.4 Dates and locations of samples and tests or inspections

.5 Names of individuals making tests and inspections

.6 Description of the Work and test and inspection method

.7 Identification of product and specification section

.8 Complete test or inspection data

.9 Test and inspection results and an interpretation of test results

.10 Ambient conditions at time of sample taking and testing and inspecting

.11 Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements

.12 Name and signature of laboratory inspector

.13 Recommendations on re-testing and re-inspecting

.2 Delegated Design Submittals: Submit Letters of Assurance and Due Diligence as follows:

.1 At the onset of work of this section and prior to shop drawing submission, prepare and submit a Letters of Assurance, including a summary of the work covered by this section.

.2 On completion of work of this section, prepare and submit a Letter of Due Diligence, including a summary of the work covered by this section.

.3 Letters referred to in .1 and .2 above must cover all aspects of structural steel, steel joist, steel deck work and structural steel stairs including; but not limited to, design of connections and erection.

.3 Source Quality Control Submittals: Submit following mill test reports signed by manufacturers certifying their products comply with following requirements when requested by the Consultant:

.1 Structural steel, including chemical and physical properties

.2 Bolts, nuts, and washers, including mechanical properties and chemical analysis

.3 Direct tension indicators

.4 Headed stud shear connectors

.5 Twist-off tension control bolts or other alternative design bolts

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: Provide design, materials and fabrication in accordance with CAN/CSA S16-14 and CWB certification requirements including, but not limited to, the following:

.1 Fabricator certified by CWB to CSA W47.1 (R2014), Division 1 or 2.1.

.2 Fabricator only subcontract or sublet work of fabrication or installation to another CWB certified company.

.3 Installer CWB certified where they are directly subcontracted by the Contractor to same requirements as fabricator.

.2 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Fabricator: Use fabricator experienced in fabricating structural steel similar to that indicated for this Project and with record of successful in service performance, and sufficient production capacity to fabricate structural steel without delaying the Work.

.2 Installers: Use installers; if different than fabricator, experienced with structural steel work similar in material, design, and extent to that indicated for this Project; with record of successful in service performance; using welders certified by CWB for classification of work being performed; and having same certifications as required by CSA and CWB for fabricator.

.3 Delegated Design: Delegated design performed by professional engineer, registered in the province of the Work and experienced in providing engineering services for the work specified, and as required by Authority Having Jurisdiction.

.4 Certifications: Provide proof of the following during the course of the Work:

.5 Welding Certificates: Comply with applicable CWB standards for classification of work being performed including, but not limited to, following:

.1 Welding inspection: to CSA W178.1-14.

.2 Resistance welding: to CSA W55.3-08 (R2013).

.3 Fusion welding: to CSA W59-13.

.6 Failure of fabricator and installer to maintain CSA and CWB requirements for certification will result in having their certification withdrawn in accordance with the contract that they sign with CSA and CWB, and considered as being in breach of Contract for the Work of the Project leading to decertification.

.3 Quality Management Plan: Provide inspections, testing and reports during the course of the work confirming that the work of steel fabrication and erection is conducted in accordance with the Contract Documents; the frequency of testing and inspection by the Owner's inspection and testing agency may be adjusted in consultation with the Owner, Contractor and Consultant where the steel Subcontractor's own Quality Management Plan demonstrates its effectiveness during the course of the project

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Handling Requirements: Store materials to permit easy access for inspection and identification; keep steel members off ground by using pallets, platforms, or other supports; protect steel members and packaged materials from erosion and deterioration, and as follows:

.1 Store fasteners in a protected place

.2 Clean and re-lubricate bolts and nuts that become dry or rusty before using

.3 Do not store materials on structure in manner that might cause distortion or damage to members or supporting structures

.4 Repair or replace damaged materials or structures as directed

Part 2 Products

2.1 SUBSTITUTIONS

.1 Use of structural steel sections other than those shown on the Drawings or listed in the Specifications will require a formal contract change unless written acceptance was obtained from the Consultant by the fabricator before bid submission.

Part 3 Execution

3.1 EXAMINATION

.1 Report any discrepancy and potential problem areas to Consultant for direction before commencing fabrication or erection.

.2 Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads.

.2 Confirm site safety measures in place and personal protection equipment worn in accordance with General Conditions of Contract.

3.3 ERECTION

.1 Erect structural steel in accordance with CAN/CSA S16-14 and CSA S136.

.2 Obtain Consultant’s review before site cutting or altering any members.

.3 Set structural steel accurately in locations and to elevations indicated on Drawings and reviewed shop drawings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 05 00 – Common Work Results for Metals.

.2 Section 09 91 13 – Exterior Painting

.3 Section 09 91 23 – Interior Painting

1.2 SUBMITTALS

.1 Provide requested information in accordance with Section 01 33 23.

.2 Submit product data for each type of coating products and primers that will receive subsequent architectural coatings indicating:

.1 Submit components and application procedures of the paint system as a single coordinated submittal and indicate compatibility and maximum recoat times for each product.

.2 Identify required surface preparation, primer, intermediate coat (if applicable) and finish coat.

.3 Submit samples indicating welds and finishing techniques prior to starting any architecturally exposed welding and finishing work, as follows:

.1 Submit sample of Hollow Steel Section (HSS) indicating Level 1 and Level 2 welds, using same sized section as detailed on structural drawings.

.2 Submit sample of Channel indicating Level 1 and Level 2 welds, using same sized section as detailed on structural drawings.

.3 Finish samples with primer listed in for use in this Section.

.4 Samples shall be prepared free of tool marks, foundry identification marks, pits and scale and other defects detrimental to finished appearance.

.5 Sample will be used by the Consultant to determine acceptability of welds and surface preparation for architecturally exposed steel fabrications on site.

.6 Consultant may request modifications to the submitted sample, fabricator shall make the changes as indicated until acceptance is obtained from the Consultant.

.4 Submit shop drawings detailing fabrication of AES components, as follows:

.1 Provide erection drawings clearly indicating which members are considered as AES members.

.2 Include details that clearly identify requirements listed in for Fabrication and Erection; provide connections for exposed AES consistent with concepts shown on the architectural or structural drawings.

.3 Indicate welds by standard CWB symbols, distinguishing between shop and field welds, and show size, length and type of each weld; identify grinding, finish and profile of welds as defined in this Section.

.4 Indicate type, size, finish and length of bolts, distinguishing between shop and field bolts; identify high strength bolted slip critical, direct tensioned

shear/bearing connections; indicate which direction bolt heads should be oriented in final assembly.

.5 Clearly indicate which surfaces or edges are exposed and class of surface preparation.

.6 Indicate special tolerances and erection requirements as noted on the drawings or defined herein.

.5 Submit qualification data for firms and persons fabricating and erecting AES demonstrating their capabilities and experience when requested by the Consultant; include lists of completed project names and address, names and addresses of Consultants and Owners, and other information specified; and photographs showing detail of installed AES in referenced projects.

1.3 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) coatings on Iron and Steel Products.

.2 ASTM A780/A780M-09(2015), Standard practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

.2 CSA International

.1 CAN/CGSB 1.181-99, Ready Mixed Organic Zinc-Rich Coating

.2 CAN/CSA G164-99(2013), Standard Test Method for Determination of Surface Lubrication on Flexible Webs.

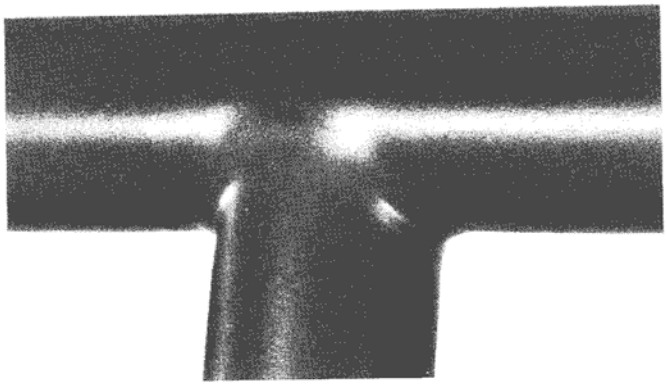
1.4 QUALITY ASSURANCE

.1 Fabricator Qualifications: In addition to qualifications specified in Section 05 05 00, engage a firm experienced in fabricating AES similar to that indicated for this Project with a record of successful in-service performance, as well as sufficient production capacity to fabricate AES without delaying the Work.

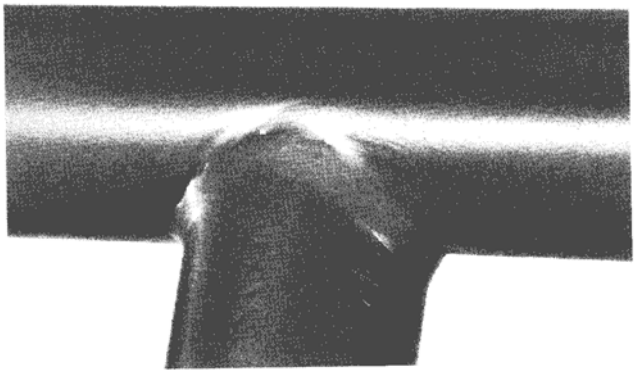
.2 Erector Qualifications: In addition to qualifications listed in Section 05 05 00, engage an experienced erector who has completed AES work similar in material, design, and extent to that indicted for this Project and with a record of successful in-service performance.

.3 The following levels finish for architecturally exposed steel are required by this specification:

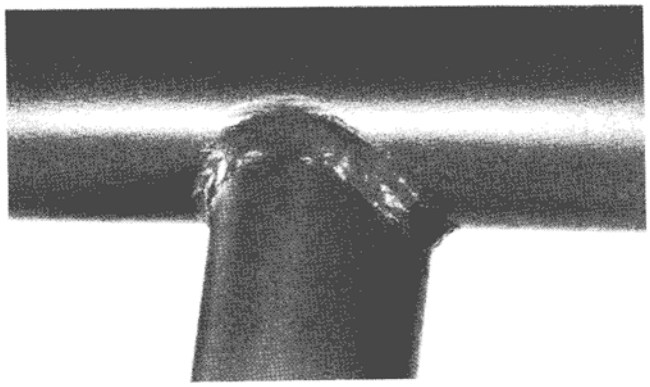
.1 Level 1 – Steel structure including exposed exterior brick support angles and connections outside the vapour retarder, all structure within 2440 mm (8'-0") of the areas designed to serve the public and located in open areas where appearance and finish are of the highest importance and requiring smooth, ornamental quality welds and joints free from pits, tool and assembly marks, as follows:



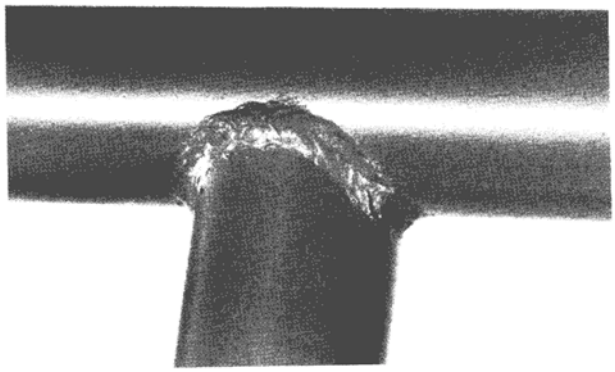
.2 Level 2 – Steel structure between 3600 mm (12'-0") and 4500 mm (14'-9") away from the public, located in exposed areas where appearance and finish are not the prime criteria but still requiring cleanly finished welds with minimal tool and assembly marks, as follows:



.3 Level 3 – Steel structure exposed to view in non-public areas, and floor and roof framing located more than 6100 mm (20'-0") above the public, located in semi-concealed areas where appearance and finish are not the prime criteria, and only minor touch-up is required, as follows:



.4 Level 4 – Steel structure not exposed to view, located in concealed areas where appearance and finish are not the prime criteria, as follows:



.4 Conduct a pre-installation conference at Project site, agenda shall include:

.1 Review of requirements of finishing requirements for architecturally exposed steel.

.2 Coordination with affected Division 5 Sections and Sections 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Store materials to permit easy access for inspection and identification.

.2 Keep steel members off ground by using pallets, platforms, or other supports.

.3 Protect steel members and packaged materials from erosion and deterioration.

.4 Use special care in handling to prevent twisting or warping of AES members.

.5 Erect pre-painted finish pieces using padded slings or other methods to protect them from damage arising from handling including, but not limited to, the following:

.1 Provide padding as required to protect while rigging and aligning member's frames.

.2 Weld tabs for temporary bracing and safety cabling only at points concealed from view in the completed structure or where accepted by the Consultant during the pre-installation meeting.

.3 Submit methods of removing temporary erection devices and finishing, and refinishing pre-painted pieces for review and acceptance by the Consultant prior to erection.

1.6 COORDINATION

.1 The use of bulk shop primers and temporary coatings for all exterior and interior architecturally exposed steel work will not be permitted unless it forms a part of a painting system specified in Sections 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting.

.2 Where non-complying primers are used, this section of work shall completely remove deficient primer from surfaces, and prepare and prime surfaces in accordance with the requirements of Sections 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting for painted steel work at no additional cost to the Consultant or Owner.

.3 Coordinate compatible shop primer for architecturally exposed steel with Sections 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting as follows:

.1 This section will be responsible for surface preparation and application of compatible primer systems.

.2 Structural steel and metal fabrications fabricator may use painting contractor for application of primer provided that Bid Price is coordinated through Contractor.

.3 Metal fabricators will be responsible for applying primer to match shop applied materials at field welds, immediately after completion of welds.

.4 Sections 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting will perform minor site touch-up and repair to priming system, and apply finish coats of paint.

.5 This method of finishing has been specified to minimize primer and finish coating incompatibility, and to satisfy primer “open-time” limits for proper application of finish coats.

.6 The primers specified are intended to form a part of a total system and shall be compatible with and be produced by the same manufacturer as the finish coats.

.4 Coordinate installation of anchors for AES members that connect to the work of other trades as follows:

.1 Furnish setting drawings, templates, and directions for installing anchors, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.

.2 Deliver such items to the project site in time for installation.

Part 2 Products

2.1 SHOP FINISHING; NON ARCHITECTURALLY EXPOSED STEEL

.1 Clean steel surfaces by removing loose rust, mill scale, spatter, slag and flux deposits, and prepare in accordance with SSPC SP3.

.2 No additional primer or finishing is required for interior.

.3 Exterior primer as indicated in Section 09 91 13 - Exterior Painting.

2.2 SHOP PRIMING; ARCHITECTURALLY EXPOSED STEEL

.1 Primer for Bare Steel: As required by MPI Coating System specified in Sections 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting and as follows:

.1 Surface preparation: Minimum SSPC SP3 (interior) or SP6 (exterior) as required by Paint Finish System.

.2 Primer for Galvanized Steel: As required by MPI Coating System specified in Sections 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting and as follows:

.1 Surface preparation: Minimum SSPC SP3 (interior) or SP6 (exterior) as required by Paint Finish System.

2.3 GALVANIZING

.1 Hot Dip Galvanized Finish: In accordance with ASTM A123/A123M-15 or CAN/CSA G164 to locations indicated; 300 g/m2 minimum zinc coating; galvanize components after assembly where size permits.

.2 Galvanizing Repair Paint: High zinc dust content paint for galvanizing welds and repair painting galvanized steel, with dry film coating not less than 94% zinc dust by weight.

.3 Repair of Hot Dip Galvanized Finish: In accordance with ASTM A780; clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint.

2.4 SHOP COATINGS

.1 Zinc Rich Paint: Single component organic zinc anticorrosive primer in accordance with CAN/CGSB 1.181 and as follows:

.1 Clean metal to SSPC SP3 (interior) or SP6 (exterior) in accordance with surface preparation requirements and environmental exposure limitations listed in CAN/CGSB 1.181.

.2 Apply one (1) coat zinc rich paint to all surfaces exposed after assembly to manufacturer’s minimum dry film thickness.

.2 Apply coating immediately after cleaning.

.3 Use primer as prepared by manufacturer without thinning or adding admixtures. Paint on dry surfaces, free from rust, scale, grease, do not paint when temperature is below 7°C.

.4 Do not paint surfaces to be field welded. Prime and apply first finish coat after field welding has been completed, immediately prior to applying final finish coat to completed assembly.

2.5 SHOP CONNECTIONS

.1 Bolted Connections: Make in accordance with Section 05 05 00 – Common Work Results of Metalwork Finishing and Structural Drawings.

.2 Provide bolt type and finish as noted herein and align bolt heads as indicated on the accepted shop erection drawings.

.3 Welded Connections:

.1 Comply with CWB requirements, Section 05 05 00 - Common Work Results of Metalwork Finishing and Structural Drawings.

.2 Appearance and quality of welds shall be consistent with the mock up.

.3 Assemble and weld built up sections by methods that will maintain alignment of members without warp exceeding the tolerance of this section.

Part 3 Execution

3.1 EXAMINATION

.1 Verify exposure of steel components, architectural or non exposed, and finish assemblies as specified.

.2 Report any discrepancy and potential problem areas to Consultant for direction before commencing finishing operations.

3.2 APPLICATION OF PRIMERS AND COATINGS

.1 Primer: Spray applied at fabrication shop by this Section, touch up and recoating by Section in Sections 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting, and as follows:

.1 Work primer into all corners

.2 Touch up bare or worn areas on site after installation.

.3 Leave surfaces unpainted as follows:

.1 Surfaces that are embedded in concrete or mortar; prime partially embedded members to a depth of 50 mm (2”) only.

.2 Surfaces that will be field welded.

.3 Surfaces that will be high strength bolted with slip critical connections.

.4 Surfaces that will receive sprayed applied fire resistant material.

.2 Field touch up and repair shop primer and galvanized finishes at bolts, welds and burned or scratched surfaces using same primer as applied in shop and coat with zinc paint in accordance with ASTM 780.

3.3 ERECTION, ARCHITECTURALLY EXPOSED STEEL (AES)

.1 Set AES accurately in locations and to elevations indicated.

.2 Field welding: Weld profile, quality, and finish shall be consistent with mock-ups accepted prior to fabrication.

.3 Splice members only where indicated, or where found acceptable by the Consultant.

.4 Obtain permission for any torch cutting or field fabrication from the Consultant; finish sections thermally cut during erection to a surface appearance consistent with the mock up.

.5 Do not enlarge unfair holes in members by burning or by using drift pins; ream holes that must be enlarged to admit bolts; replace connection plates that are misaligned where holes cannot be aligned with acceptable final appearance.

3.4 FIELD CONNECTIONS (AES)

.1 Bolted Connections: Install bolts of the specified type and finish in accordance with Structural Drawings

.2 Welded Connections: Comply with CWB procedures for appearance; refer to Section 05 05 00 – Common Work Results for Metalwork and Finishing and Structural Drawings for other requirements, and as follows:

.1 Assemble and weld built up sections by methods that will maintain true alignment of axes without warp.

.2 Verify that weld sizes, fabrication sequence, and equipment used for AES will limit distortions to allowable tolerances.

.3 Obtain Consultant's acceptance for appearance of welds in repaired or field modified work.

3.5 FIELD QUALITY CONTROL (AES)

.1 Structural requirements: Testing and inspecting in accordance with Section 05 05 00 – Common Work Results for Metalwork and Finishing for detailed bolt and weld testing requirements.

.2 AES Acceptance: The Consultant will observe the AES in place and determine acceptability based on the mock up; materials not meeting the standard of workmanship established by the mock up shall be repaired, or removed and replaced at no additional cost to the Owner or Consultant.

3.6 ADJUSTING AND CLEANING

.1 Touch up Painting: Cleaning and Touch up painting of field welds, bolted connections, and abraded areas of shop paint shall completed to blend with the adjacent surfaces in accordance with manufacturer's instructions as specified in Sections 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting.

.2 Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing in accordance with ASTM A780/A780M-09(2015).

END OF SECTION

1. GENERAL

1.1 RELATED REQUIREMENTS

.1 Not Used.

.2 The Contract Documents apply to and govern the Work of this section.

1.2 COORDINATION REQUIREMENTS

.1 Coordination:

.1 Coordinate with other work and sub-trades having a direct bearing on work of this section.

.2 Coordinate with specification requirements for structural steel included in General Notes on Structural Drawings.

1.3 REFERENCES

.1 ASTM A108-07 - Steel Bar, Carbon and Alloy, Cold-Finished.

.2 ASTM A123/A123M-08 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A307-07b - Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.4 ASTM A325M-09 - Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).

.5 ASTM A490-08b - Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.

.6 CISC Handbook of Steel Construction - Code of Standard Practice for Structural Steel, Ninth Edition, 2006.

.7 CISC/CPMA 1-73a - A Quick-drying One-coat Paint for Use on Structural Steel.

.8 CISC/CPMA 2-75 - A Quick-Drying Primer for Use on Structural Steel.

.9 CAN/CGSB 1.132-M90 - Zinc Chromate Primer, Low Moisture Sensitivity.

.10 CAN/CSA G40.20-04/G40.21-04 - General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.11 CAN/CSA S16-01 Consolidation (R2007) - Limit States Design of Steel Structures.

.12 CSA-S136-07 - North American Specification for the Design of Cold-Formed Steel Structural Members.

.13 CSA W47.1-03 - Certification of Companies for Fusion Welding of Steel Structures.

.14 CSA W59-03 (R2008) - Welded Steel Construction (Metal Arc Welding).

.15 CSA W178.1-08 - Certification of Welding Inspection Organizations.

.16 SSPC (The Society for Protective Coatings) (formerly SSPC - Steel Structures Painting Council) - Steel Structures Painting Manual.

1.4 DESIGN REQUIREMENTS

.1 Design components and connections in conformance with CAN/CSA S16.1, to resist all loads and forces shown on Drawings, and otherwise.

.2 Design connections to develop shear capacity of member being connected and show details on Shop Drawings. Design connections to develop moment capacity of member being connected and show detail on Shop Drawings.

.3 Bracing and stability systems shown on Drawings are for stability of completed structure and are not to be assumed as adequate bracing for various stages of construction. Design all temporary bracing systems as required to maintain stability of work at all phases of construction.

.4 Member sizes may be substituted for those shown on Drawings if prior written acceptance of Consultant has been received. Match or exceed strength and stiffness of section being replaced.

.5 Clearly show method of torquing bolts on Shop Drawings.

.6 Design truss components and connections to resist all loads and forces.

.7 Design connections for wide flange beams with a minimum number of bolts for connection equivalent to 1 bolt every 100 mm depth of beam with two (2) bolts minimum.

.8 All columns (including, but not limited to HSS and W sections) to be welded all around to base plates. Minimum 6mm weld thickness.

1.5 SUBMITTALS

.1 Provide submittals accordance with Division 1.

.2 Shop Drawings:

.1 Provide complete fabrication and erection Drawings for all work and items.

.2 Show framing plans and grid lines, bearing and anchorage details, framed openings, accessories, special erection procedures, schedule of materials, camber and loading, fasteners and welds using basic weld symbols to American Welding Society.

.3 Provide separate layout plans and setting details for all bearing and attachment devices supplied under this Section for setting and building in under other Sections.

.4 Include details of all temporary bracing systems required for stability during construction and show the extent of prior work that is required to be in place for the temporary bracing systems as designed.

.5 Fabricator is to certify that all connections, design and erection procedures, have been supervised and carried out by a Professional Engineer. Provide certification in the form of a letter bearing the seal and signature of the

Professional Engineer, and submitted with the Shop Drawings. Failure to submit such a letter will result in the shop drawings being rejected.

.6 Shop Drawings to be checked by Contractor prior to submission to the Consultant.

.7 Review by the Consultant in no way relieves the Contractor of his responsibility for the accuracy of the Shop Drawings.

.8 Specify primer to be used for each member and components highlighting exposed painted steel.

1.6 QUALITY ASSURANCE

.1 Welders' Certificates: Organization certified by the Canadian Welding Bureau in accordance with CSA W47.1.

.2 Inspection Qualifications: Organization fully approved by the Canadian Welding Bureau in accordance with CSA W178.1.

.3 Design connections and erection procedures not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located.

2. PRODUCTS

2.1 MATERIALS

.1 Structural steel to conform to CAN/CSA G40.20/G40.21 with minimum grade as follows:

.1 Rolled steel sections to Grade 350W.

.2 Anchor Bolts: To ASTM A307.

.3 Bolts, Nuts, and Washers: High strength type recommended for structural steel joints, conforming to requirements of ASTM A325M, medium-carbon steel, unless noted otherwise on Drawings.

.4 Welding Materials: CSA W59.

.5 Plates and angles: Grade 300W

.6 HSS Sections: Grade 350W

.2 Primers:

.1 Steel Exposed to View: To CISC/CPMA-2 and SSPC-SP-6.

.2 Steel Not Exposed to View: To CISC/CPMA-1 and SSPC-SP-1.

.3 Exterior Steel Exposed to View: To SSPC-SP-6 commercial blast cleaning.

.4 Shop Standard Primer.

.5 Primers are to be different and distinctive colour for each one used.

.3 Shop Galvanizing: To ASTM A123/A123M, hot dipped galvanizing with a minimum coating of 700 g/m^2.

.4 Shear Stud Connectors: Headed concrete anchors conforming to ASTM A108.

2.2 FABRICATION

.1 Verify dimensions prior to commencing fabrication.

.2 Fabricate to reviewed shop Drawings in accordance with CAN/CSA S16.1.

.3 Weld to CSA W59.

.4 Joint surfaces to be free from fins and tears.

.5 Shop-fabricate openings in structural members when required for other building components. Reinforce openings with steel plates sized and welded in place to restore member to original design strength.

.6 Seats, stiffeners, and connections not permitted to project beyond finished surfaces without permission from the Consultant.

.7 Clean all steel to remove rust, loose mill scale and all foreign matter and apply one coat of shop primer except to surfaces to be welded.

.8 Welding is to conform to the requirements of CSA W59. Do not splice materials without the written consent of the Consultant. Where spliced, 100% x-ray inspection will be mandatory, at the contractor's expense.

.9 Accurately cut and mill column ends and bearing plates to assure full contact of bearing surfaces prior to welding.

.10 Seal all hollow structural sections with suitable cap plates or by welding all around to adjoining members.

.11 Camber horizontal members to accommodate dead load deflection.

2.3 ANCHORAGES

.1 Supply General Contractor with necessary anchorage devices together with a setting diagram.

.2 Erection of steel on the anchorages signifies acceptance of their location according to setting diagram.

.3 Supply and install leveling nuts, shims, and hold down nuts and washers, etc., for anchorages.

3. EXECUTION

3.1 ERECTION

.1 Erect to CAN/CSA S16.1 and CISC Code of Standard Practice for Structural Steel.

.2 Fix and attach all members and bracing by means of field welds.

.3 Field connections to fully develop the member strength or the moment and shears as shown on the Drawings unless otherwise noted.

.4 Where indicated on Drawings, continuously seal all members by continuous welds, grind smooth for field applied primer.

.5 Level, plumb and align all members to CAN/CSA S16.1.

.6 Provide and install all temporary bracing.

.7 Touch up prime painting where required to provide complete coverage including all field connections.

.8 Exposed painted steel to be cleaned by commercial blast in accordance with SSPC-SP-6 to ensure base steel is thoroughly cleaned of all rust, dirt, mill scale, weld splatter, and all other extraneous material followed by solvent cleaning before prime painting structural steel to receive painted finishes. Refer to architectural room finish schedules for extent of exposed painted steel.

.9 Grind all welds smooth and grind all groove welds flush on exposed structural steel.

.10 Galvanize all structural steel components noted or specified, to ASTM A123/A123M.

.11 Do not place any holes or openings in structural steel members without the approval of the Consultant. Where approval is granted, provide reinforcing plates around all openings to maintain design strength.

.12 Weld all anchors required to restrain concrete masonry walls.

.13 Apply two coats of CAN/CGSB 1.132 to all steel exposed to the exterior but not otherwise specified.

.14 Correct to acceptance all errors in member fit and erection.

3.2 STEEL DECK

.1 Frame all openings in steel deck exceeding 450 mm across the flutes.

.2 Supply all steel plates and shelf angles, including anchors, required to support steel deck on masonry walls.

3.3 FIELD QUALITY CONTROL

.1 Field Services by Consultant or his representative consist of:

.1 Periodic visits to the site to familiarize himself generally with the progress and quality of the work and to determine in general if it is progressing according to the contract documents, and

.2 The necessary paperwork related to these services.

.2 Field Services by the Consultant or his representative do not in any way relieve the Contractor of his responsibility to carry out the work as shown in the contract documents.

.3 Inspection:

.1 Materials and workmanship will be subject to inspection and testing by an independent inspection and testing firm certified in accordance with CSA W178.1, retained and paid for by the Contractor and approved by the Consultant.

.2 Conduct testing to CSA W59 and CAN/CSA S16.1 standards, including, but not limited to the following:

.1 Visual examination of all welds and workmanship that are readily accessible (100%).

.2 Random magnetic particle testing of selected shop welds of all components (10% of connections).

.3 Random magnetic particle testing of selected field welds of all components (10% of connections).

.4 Random check of structural steel member sizes (up to 10% of columns and up to 5% of beams, girders, bridging and bracing, etc.).

.5 Visual examination of members for conformance to requirements for architectural finishes (limited).

.6 Bolt specifications, grades and fastening verification (10% of all connections).

.7 Review of Drawings, welding procedures, welders' certifications, data sheets, and welding consumables storage (shop and field).

.8 Review of readily available mill certificates for all material used.

.9 Embed plates will be bend tested on 1% of randomly selected studs, and tested to destruction on (1/3%).

.10 Decking examination of profile and gauge (10%). Inspection of puddle welds and side lap crimping that is accessible (100%).

.11 Confirm correct loading, unloading, and site storage of components.

.12 Confirm acceptability of primer coats.

.13 Tracking of all noted deficiencies, timely faxing of technical reports to all relevant parties, immediate correspondence of important issues to the Engineer of record, and a final summary report including all retained documentation, the final project status.

.3 Provide access for inspection to all places where work is being done, or stockpiled prior to shipment.

.4 Submit copies of mill test reports properly correlated to the materials used to the Consultant upon request.

.5 By an independent inspection and testing firm to test welds in accordance to CSA W178.1. Testing of welds to include visual examination of all welding procedures, at the plant and in the field, plus magnetic partial, x-ray or other means deemed necessary by the testing agency to permit certification of welds.

.6 By an independent inspection and testing firm to test bolts in accordance to CSA W178.1.

.7 The Consultant may request additional testing of welds and bolts to ascertain the full amount of defects if the test noted above indicates excessive deficiencies. Additional costs for extra testing to be paid for by the Contractor.

.8 Contractor to Pay for all costs for re-testing and re-inspection, as a result of defective workmanship.

.9 Contractor to Pay for all costs of repairs to correct defective work.

.10 By an independent inspection and testing firm to submit to the Consultant, a final report certifying all welds and connections, including confirmation that required repairs have been completed. This report must be submitted under the seal and signature of a Professional Structural Engineer registered in the Province of Alberta.

.11 Notify Consultant and by an independent inspection and testing firm 24 hours prior to commencement of shop work for all testing and inspection.

.4 Damage: Make good all areas damaged in connection with the contract regardless of the limits of the contract as shown on the Drawings.

3.4 CLEANING

.1 Clean up and remove from site, all rubbish and surplus material remaining from this Work.

END OF SECTION

1. GENERAL

1.1 RELATED REQUIREMENTS

.1 Not Used.

.2 The Contract Documents apply to and govern the Work of this section.

1.2 REFERENCES

.1 ASTM A307-07b - Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 ASTM A325M-09 - Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).

.3 CAN/CSA G40.20-04/G40.21-04 - General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.4 CAN/CSA S16-01 Consolidation (R2007) - Limit States Design of Steel Structures.

.5 CSA-S136-01 - North American Specification for the Design of Cold-Formed Steel Structural Members.

.6 CISC/CPMA 2-75 - A Quick-Drying Primer for Use on Structural Steel.

.7 CSA W47.1-03 - Certification of Companies for Fusion Welding of Steel Structures.

.8 CSA W59-03 - Welded Steel Construction (Metal Arc Welding).

.9 CSA W178.1-08 - Certification of Welding Inspection Organizations.

1.3 DESIGN REQUIREMENTS

.1 Design in accordance with CAN/CSA S16.1.

.2 Design members and connections in accordance with dimensions and loading shown on Drawings or required by Code.

.3 Design roof joists with a total load deflection of L/240 and live load deflection to L/360.

.4 Design floor joists with a total load deflection to L/360 and live load deflection to L/480.

.5 In joist design include for point loads, either for supported or handing, as noted on Drawings.

.6 Design and space bridging for joists in accordance with CAN/CSA S16.1.

.7 Provide bridging of the type shown or called for, and special systems where shown or where necessary to accommodate duct runs parallel to joist span.

.8 Accommodate duct runs perpendicular to joist spans generally within the panels of the joist. Line joist panel points up joist to joist.

.9 Provide joists with nominal positive camber unless specifically shown otherwise on drawings.

.10 Prior to designing joist in detail submit the general arrangement of panel points, length of panel and configuration of the web for acceptance.

.11 Submit design notes to Consultant.

1.4 SUBMITTALS

.1 Provide submittals accordance with Section 01 33 00.

.2 Shop Drawings:

.1 Provide complete fabrication and erection drawings for all work and items.

.2 Show framing plans, bearing and anchorage details, framed openings, accessories, special erection procedures, schedule of materials, camber and loading, fasteners and welds using basic weld symbols to American Welding Society.

.3 Provide separate layout plans and setting details for all bearing and attachment devices supplied under this Section for setting and building in under other Sections.

.4 Include details of all temporary bracing systems required for stability during construction and show the extent of prior work that is required to be in place for the temporary bracing systems as designed.

.5 Shop Drawings for fabricator designed connections and all erection Drawings are to be signed and sealed by a Professional Engineer. Drawings not sealed will be rejected unchecked.

.6 Shop Drawings to be checked by Contractor prior to submission to the Consultant.

.7 Review by Consultant in no way relieves Contractor of his responsibility for the accuracy of the Shop Drawings.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.1 The organization undertaking to weld under this Section is to be fully approved by the Canadian Welding Bureau under the requirements of CSA W47.1. The Contractor must provide written evidence of qualification under this standard to the Consultant and must qualify under Division 1 or Division 2.1 only. Division 3 qualification will be permitted.

.2 Weld Inspection: The organization undertaking to perform weld inspection under this section shall be fully approved by the Canadian Welding Bureau under the requirements of CSA W178.1.

.3 Design connections and erection procedures not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located.

1.6 WARRANTY

.1 Provide a one (1) year warranty to include coverage for failure to meet specified requirements.

.2 Repair and replace defective work and any other work damaged thereby which becomes defective during the warranty period.

2. PRODUCTS

2.1 MATERIALS

.1 Conform to CAN/CSA G40.20/G40.21.

.2 Welding materials: To CSA W59.

.3 Joist Members: Type W, weldable steel conforming to CAN/CSA G40.20/G40.21 or cold formed steel conforming to CSA S136. Indicate material specifications on Shop Drawings.

.4 Acoustic Insulation: Fibrous glass 17.5 kg/m density profiled to suit deck flutes.

.5 Closures: In accordance with manufacturer's recommendations.

.6 Cover Plates, Cell Closures and Flashings: Steel sheet with minimum base steel thickness of 0.76 mm. Metallic coating same as deck material.

.7 Bridging and Bearing Plates/Angles: To CAN/CSA G40.20/G40.21, Type 300W.

.8 Bolts, Nuts, and Washers: High strength type recommended for structural steel joints, conforming to requirements of ASTM A325M.

.9 Anchor Bolts: To ASTM A307, unless otherwise indicated on Drawings.

.10 Primer:

.1 Steel Exposed to View: To CISC/CPMA 2 and SSPC-SP-6.

.2 Steel Not Exposed to View: TO CISC/CPMA-1 and SSPC-SP-1.

.3 Primers are to be different and distinctive colour for each one used.

2.2 FABRICATION

.1 Fabricate steel joists in accordance with Drawings and CAN/CSA S16.1. Verify all drawing dimensions and conditions prior to commencing fabrication.

.2 Welding in accordance with CSA W59.

.3 Fabricate joists of straight members arranged to form a triangulated truss type structure without joint eccentricities.

.4 Provide bottom and top joist chord extensions where indicated.

.5 Do not splice materials without Consultant's written consent. Where granted, 100% x-ray inspection, paid for by fabricator, will be mandatory. Show all splices on Shop Drawings.

.6 Camber joists to compensate for dead load deflection.

.7 Hollow structural sections to be completely sealed either by welding to other members or by suitably sized end cap plates.

.8 Wire brush and remove all rust, dirt, mill scale, weld splatter and all extraneous material before prime painting all structural steel. Do not prime paint anchor bolts or surfaces in contact with concrete.

.9 Do not prime paint structural steel to be spray fire-protected. Refer to architectural room finish schedules for extent of fire protection.

.10 Supply chord extensions as required.

2.3 SOURCE QUALITY CONTROL

.1 Inspection and Testing: Materials and workmanship will be subject to inspection and testing by an independent inspection and testing firm certified in accordance with CSA W178.1, retained and paid for by Contractor and approved by Consultant.

.1 Testing shall be conducted to CSA W59 and CAN/CSA S16.1 standards, and would include, but is not limited to the following:

.1 Visual examination of all welds and workmanship that are readily accessible (100%).

.2 Random magnetic particle testing of selected shop welds of all components (10% of connections).

.3 Random magnetic particle testing of selected field welds of all components (10% of connections).

.4 Random check of structural steel member sizes (up to 10% of columns and up to 5% of beams, girders, bridging and bracing, etc.).

.5 Visual examination of members for conformance to requirements for architectural finishes (limited).

.6 Bolt specifications, grades and fastening verification (10% of all connections).

.7 Review of Drawings, welding procedures, welders' certifications, data sheets, and welding consumables storage (shop and field).

.8 Review of readily available mill certificates for all material used.

.9 Embed plates will be bend tested on 1% of randomly selected studs, and tested to destruction on (1/3%).

.10 Decking examination of profile and gauge (10%). Inspection of puddle welds and side lap crimping that is accessible (100%).

.11 Confirm correct loading, unloading, and site storage of components.

.12 Confirm acceptability of primer coats.

.13 Tracking of all noted deficiencies, timely faxing of technical reports to all relevant parties, immediate correspondence of important issues to the Engineer of record, and a final summary report including all retained documentation, the final project status.

.2 Provide access for inspection to all places where work is being done, or stockpiled prior to shipment.

.3 Submit copies of mill test reports properly correlated to the materials used to the Consultant upon request.

.4 By an independent inspection and testing firm to test welds in accordance to CSA-W178.1. Testing of welds to include visual examination of all welding procedures, at the plant and in the field, plus magnetic partial, x-ray or other means deemed necessary by the testing agency to permit certification of welds.

.5 By an independent inspection and testing firm to test bolts in accordance to CSA W178.1.

.6 Consultant may request additional testing of welds and bolts to ascertain the full amount of defects if the test noted above indicates excessive deficiencies. Additional costs for extra testing to be paid for by the Contractor.

.7 Contractor to Pay for all costs for re-testing and re-inspection, as a result of defective workmanship.

.8 Contractor to Pay for all costs of repairs to correct defective work.

.9 By an independent inspection and testing firm to submit to the Consultant, a final report certifying all welds and connections, including confirmation that required repairs have been completed. This report must be submitted under the seal and signature of a Professional Structural Engineer registered in the Province of Alberta.

.10 Notify Consultant and by an independent inspection and testing firm 24 hours prior to commencement of shop work for all testing and inspection.

3. EXECUTION

3.1 ERECTION

.1 Erect steel joists in accordance with Drawings and CAN/CSA S16.1.

.2 Unless noted otherwise on the drawing, allow minimum 150 mm bearing when supported by masonry, and minimum 65 mm bearing when supported by structural steel.

.3 Unless noted otherwise on the drawing, extend joist top chord minimum 25 mm past the centreline of supporting beams or walls when bearing from one side of supporting member.

.4 During erection, provide all temporary bracing required as a result of induced loads and stresses.

.5 Coordinate the proper placement of anchor bolts in concrete and masonry construction as required for the support of bearing plates/angles.

.6 Field weld joist seat to bearing plates/angles after alignment and position.

.7 Do not permit erection of decking until joists are sufficiently braced.

.8 Obtain written permission of Consultant prior to field cutting or altering of joists or bridging.

.9 After erection, prime all welds and grind as per shop welds, abrasions, and surfaces not shop primed. Thoroughly clean all areas requiring field touch-up of primer to remove oil, dirt, grease, weld flux and blistered or non-adhering shop primer. Use the same primer as used in the shop.

3.2 CLEANING

.1 Clean up and remove from site, all rubbish and surplus material remaining from this Work.

END OF SECTION

1. GENERAL

1.1 RELATED REQUIREMENTS

.1 Not Used.

.2 The Contract Documents apply to and govern the Work of this section.

1.2 COORDINATION REQUIREMENTS

.1 Coordination:

.1 Coordinate with other work and sub-trades having a direct bearing on work of this section.

.2 Coordinate with specification requirements for metal decking included in General Notes on Structural Drawings.

1.3 REFERENCES

.1 ASTM A653/A653M-08 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 CSSBI (Canadian Sheet Steel Building Institute)

.1 CISC Code of Standard Practice for Structural Steel, Sixth Edition-2000.

.2 Design in Cold Formed Steel, 2003.

.3 CSSBI 10M-08 - Standard for Steel Roof Deck

.4 CSSBI 12M – 08 – Standard for Composite Steel Deck

.5 SSF #6-1995 - Metallic Coated Sheet Steel for Structural Building Products

.3 CAN/CSA S16-01 Consolidation (R2007) - Limit States Design of Steel Structures.

.4 CSA S136-07 - Specification for the Design of Cold-Formed Steel Structural Members.

.5 CSA W47.1-03 - Certification of Companies for Fusion Welding of Steel Structures.

.6 CSA W55.3-08 - Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.

.7 CSA W59-03 (R2008) - Welded Steel Construction (Metal Arc Welding).

.8 CAN/CGSB 1.181-99 - Ready-Mixed Coating Organic Zinc-Rich Coating.

1.4 DESIGN REQUIREMENTS

.1 Design deck units to CSA S136.

.2 Design for joist spacing and support conditions as shown on the drawings and for the design live and dead load as shown on the drawings.

.3 Steel decking is to be rigid enough and connected sufficiently to provide lateral support for the top chord or flange of the supporting elements.

.4 Steel deck is used as a lateral load resisting diaphragm. Steel deck thickness and connections specified on the drawings are the minimum required to resist the lateral loads. The supplier may increase thicknesses and connections if necessary to resist vertical loading.

.5 Design roof decking with a total load deflection of L/240 and live load deflection to L/360.

.6 Design floor decking with a total load deflection to L/360 and live load deflection to L/480.

.7 Where possible, span deck units over three or more supports.

1.5 SUBMITTALS

.1 Provide submittals accordance with Division 1.

.2 Shop Drawings:

.1 Show decking plan, joints, anchorages, supports, projects, openings and reinforcement, details and accessories, section properties of deck profiles, and sample calculations for stress and deflection.

.2 Preliminary Shop Drawings:

.1 Submit preliminary Shop Drawings included layout, assembly and setting drawings.

.2 Provide copies as required to the General Contractor for distribution to the mechanical and electrical contractors for their use in locating, exactly, all required deck openings.

.3 Final Shop Drawings:

.1 Incorporate all required deck openings into final Shop Drawings from returned copies of preliminary Shop Drawings.

.2 Provide copies of final Shop Drawings as required and in particular to the structural steel supplier in order that structural support members may be located and provided for all roof deck openings exceeding 450 mm across the flutes.

.3 Structural support at all deck openings exceeding the above sizes is required and will be provided by auxiliary framing in the steel support structures unless alternative reinforcing and support systems are specifically shown on the drawings.

.4 Shop Drawings are to be signed and sealed by a Professional Engineer. Drawings not sealed will be rejected unchecked.

.5 Shop drawings to be checked by Contractor prior to submission to the Consultant.

.6 Review by the Consultant in no way relieves the Contractor of his responsibility for the accuracy of the Shop Drawings.

1.6 QUALITY ASSURANCE

.1 Conform to CSSBI - Design in Cold Formed Steel.

.2 Welders' Certificates: Organization certified by the Canadian Welding Bureau in accordance with CSA W47.1.

.3 Welders approved for deck welding under procedure W610, by the Canadian Welding Bureau.

.4 Design metal decking, connections and erection procedures not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located.

.5 Contractor to ensure selected metal deck profile is fully compatible with roofing materials.

1.7 DELIVERY, STORAGE, AND PROTECTION

.1 Stack metal deck sheets on wood blocking clear of the ground and tilted sufficiently to ensure no water lies on the material.

.2 Cover components to protect from direct moisture penetration. Vent to permit air movement.

2. PRODUCTS

2.1 MATERIALS

.1 Sheet Steel: ASTM A653/A653M, Structural Quality as required, coating designation ZF75.

.2 Cell Closures over walls: 1.2 mm steel, galvanized, profiled to match deck corrugations.

.3 Mechanical Pipe and Rib Closures parallel to wall: 1.2 mm steel, galvanized.

.4 Zinc Rich Paint: To CAN/CGSB 1.181.

.5 Fireproofing: Mineral wool U/L Guide No.40 U18.7, to provide required rating of walls.

2.2 COMPONENTS

.1 Roof Deck: Nominal depths and minimum thicknesses are noted on drawings.

.2 Floor Deck: Composite decking. Nominal depths and minimum thicknesses as noted on drawings.

.3 Acoustic Deck: Nominal depth and thickness as per drawings.

.4 Acoustic insulation: Fibrous glass 17.5 kg/m density profiled to suit deck flutes. Acoustic insulation to be provided at all acoustic deck locations.

.5 Core thickness for metal decks to be established by the Contractor to meet the design live and dead loads, spans and continuity of the deck.

.6 Gauges for the steel deck may be changed from those shown on the drawings depending upon the steel deck supplier.

2.3 FABRICATION

.1 Fabricate deck sections to CSA S136, and as recommended by the Canadian Sheet Steel Building Institute Standard (CSSBI).

.2 Form adjacent deck sections with interlocking male and female side laps.

.3 Supply deck units in cut lengths to suit support construction and in accordance with reviewed Shop Drawings.

3. EXECUTION

3.1 ERECTION

.1 Perform erection in accordance with drawings and as recommended by the CSSBI.

.2 Layout and join parallel and adjacent sections true and flat prior to permanent fastening.

.3 Locate end joints over bearing support and lap minimum 50 mm where applicable.

.4 Button punch side laps mechanically, 600 mm o.c. maximum unless shown otherwise on the drawings.

.5 For deck openings up to 150 mm across the flutes, no reinforcement is required.

.6 For openings between 150 mm to 450 mm across the flutes, reinforce with 75 x 75 x 6 mm minimum steel angle perpendicular to flutes extended two flutes and welded each side of openings.

.7 For openings over 450 mm across the flutes, the openings shall be framed by the Structural Steel Trade.

.8 Minimum bearing on steel 75 mm.

.9 Weld deck to supporting steel with 20 mm diameter spots, 300 mm o.c. at interior supports and 150 mm o.c. maximum at exterior supports unless shown otherwise on the drawings. Use weld washers where necessary. Welds to be as follows:

.1 Fill weld centres so that the centre height is not below the original metal surface.

.2 Fuse the sheet at the periphery of each Plug Weld for a minimum of 75% of the circumference of the Plug Weld.

.3 There is to be no "burn-through" on the underside of the structural support member.

.10 Provide and install sheet metal cover strips 200 mm wide x 0.91 mm thick material at all deck span reversals and/or where shown on the drawings. Fix by means of sheet metal screws at maximum of 150 mm o.c. to both units.

.11 Immediately after welding, touch up welds with zinc rich paint to prevent corrosion.

.12 Permission of the Consultant is required prior to field cutting or altering of deck or hanging ducts, pipes, mechanical equipment, etc., from deck.

.13 Ensure that construction loads do not damage the deck.

.14 Install wall closures in exposed flutes of exposed deck over walls.

.15 Where deck ribs are parallel to wall, install rib closures at underside of exposed deck between wall and first rib out from wall. Fasten to first rib with sheet metal screws at 300 mm on centre.

.16 Where steel deck passes over fire rated partitions, install mineral wool fireproofing to equivalent fire rating of partitions.

3.2 WELDING DAMAGE

.1 Excessive burning and damage to support structures resulting from careless or improper deck welding procedures to be repaired and made good at the expense of the Metal Deck Contractor.

.2 In the event that repairs to support structure are deemed necessary, upon completion of the repair work, a letter certifying to the adequacy of the repair for the stipulated loading conditions shall be provided by the Contractor. This letter, shall be signed and sealed by a Registered Professional Engineer.

.3 Ensure that welds will match to the support structure below by means of chalk lines or other acceptable methods. Location of the support structure by means of successive "trial and error" burns through the deck is not permissible. Deck units damaged by such practices will be required to be replaced.

3.3 FIELD QUALITY CONTROL

.1 Field Services by the Consultant or his representative consist of:

.1 Periodic visits to the site to familiarize himself generally with the progress and quality of the work and to determine in general if it is progressing according to the contract documents.

.2 Necessary paperwork related to these services.

.2 Field Services by the Consultant or his representative do not in any way relieve the Contractor of his responsibility to carry out the work as shown in the contract documents.

.3 Inspection and Testing:

.1 Materials and workmanship will be subject to inspection and testing by an independent inspection and testing firm retained and paid for by the Contractor and approved by the Consultant.

.2 Testing shall be conducted to CSA W59 and CAN/CSA S16.1 standards, and would include, but is not limited to the following:

.1 Visual examination of all welds and workmanship that are readily accessible (100%).

.2 Random magnetic particle testing of selected shop welds of all components (10% of connections).

.3 Random magnetic particle testing of selected field welds of all components (10% of connections).

.4 Random check of structural steel member sizes (up to 10% of columns and up to 5% of beams, girders, bridging and bracing, etc.).

.5 Visual examination of members for conformance to requirements for architectural finishes (limited).

.6 Bolt specifications, grades and fastening verification (10% of all connections).

.7 Review of drawings, welding procedures, welders' certifications, data sheets, and welding consumables storage (shop and field).

.8 Review of readily available mill certificates for all material used.

.9 Embed plates will be bend tested on 1% of randomly selected studs, and tested to destruction on (1/3%).

.10 Decking examination of profile and gauge (10%). Inspection of puddle welds and side lap crimping that is accessible (100%).

.11 Confirm correct loading, unloading, and site storage of components.

.12 Confirm acceptability of primer coats.

.13 Tracking of all noted deficiencies, timely faxing of technical reports to all relevant parties, immediate correspondence of important issues to the Engineer of record, and a final summary report including all retained documentation, the final project status.

.3 Provide access for inspection to all places where work is being done, or stockpiled prior to shipment.

.4 Damage: Make good all areas damaged in connection with the contract regardless of the limits of the contract as shown on the drawings.

3.4 CLEANING

.1 Clean up and remove from site, all rubbish and surplus material remaining from this Work.

END OF SECTION

1. GENERAL

1.1 RELATED REQUIREMENTS

.1 Not Used.

.2 The Contract Documents apply to and govern the Work of this section.

1.2 REFERENCES

.1 AWS D1.3/D1.3M-2008 - Structural Welding Code – Sheet Steel.

.2 ASTM A653/A653M-08 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM A792/A792M-08 - Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.4 CAN/CGSB 1.181-99 - Ready-Mixed Coating Organic Zinc-Rich Coating.

.5 CSA-S136-07 - North American Specification for the Design of Cold-Formed Steel Structural Members.

.6 CSA W47.1-03 - Certification of Companies for Fusion Welding of Steel Structures.

.7 CSA W59-03 - Welded Steel Construction (Metal Arc Welding).

.8 Alberta Building Code 2006.

1.3 DESIGN REQUIREMENTS

.1 Base design on Limit States Design principals using factored loads and resistance.

.2 Loads and load factors in accordance with the Alberta Building Code.

.3 Determine resistances and resistance factors in accordance with the Alberta Building Code and CSA S136.

.4 Conform to the requirements of specified fire rated assemblies.

.5 Design bridging to prevent member rotation and member translation perpendicular to the minor axis. Provide for secondary stress effects due to torsion between lines of bridging. Collateral sheathing may be used to help restrain member rotation and translation perpendicular to the minor axis for:

.1 Wind Bearing Studs.

.6 Maximum deflections under specific loads shall conform to the following:

.1 Wall studs supporting materials susceptible to cracking (e.g. masonry veneer, Portland cement plaster, and ceramic tile) to L/360. Wall studs supporting materials not susceptible to cracking (e.g. metal cladding, synthetic veneers) L/360.

.2 Building sway due to all effects 1/400 of building heights or 1/500 of storey height.

.7 Design components or assemblies to accommodate specified erection tolerances of the structure.

.8 The spacing of members shall not exceed the following:

.1 Wind bearing wall studs: 400 mm o.c.

.9 Allow for movement of the structure. Design wind bearing stud end connections to accommodate floor/roof deflections such that the studs are not loaded axially.

.10 Connections between stud steel framing members shall be bolts, welding or sheet metal screws.

.11 Resistance for sheet metal screws shall be based on the manufacture's lower bound test values multiplied by the appropriate resistance factor ϕ given in CSA-S136.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Division 1.

.2 Shop Drawings:

.1 Submit four (4) copies of shop drawings and engineering calculations or data verifying the capacity of the members and wall system and the ability of the assemblies to meet the design requirements.

.2 Shop drawings shall be signed and sealed by a Professional Engineer registered in the Province of Alberta.

.3 Samples: Submit three (3) representative pieces of all framing component parts, including mechanical fasteners if used. The length of pieces submitted need not exceed 300 mm. Tag pieces with the name of the part, the metal thickness exclusive of coating and the manufacturer.

.4 Reports: Submit three (3) certified copies of mill reports covering chemical and mechanical properties, and coating designation of steel used in this work.

1.5 QUALITY ASSURANCE

.1 Welders' Certificates: Organization certified by the Canadian Welding Bureau in accordance with CSA W47.1. Companies shall have welding procedures approved and welders qualified for the base material types and thickness that are to be welded.

.2 Design wind bearing steel stud system under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the place where the Project is located.

1.6 DELIVERY, STORAGE, AND PROTECTION

.1 Store and protect steel framing to prevent physical damage or corrosion.

.2 Do not use damaged material.

2. PRODUCTS

2.1 MATERIALS

.1 Framing Materials: Cold-rolled steel conforming to CSA S136, 228 MPa, with metallic coating to ASTM A653/A653M or A792/A792M, minimum coating thickness Z180 or equivalent.

.2 Sheet metal screws shall have a minimum coating thickness of 0.008 mm of zinc or cadmium. Other coatings providing equal or better corrosion protection may be used.

.3 Welding electrodes shall be of the 480 MPa minimum tensile strength series (e.g. E480XXX, E480S-X).

.4 Zinc rich paint for touching up welds and damaged metallic coating that conform to CAN/CGSB 1.181.

.5 The minimum steel thickness exclusive of coating shall be as follows:

.1 Wall studs: 1.22 mm.

.2 Thicker material may be required to satisfy structural requirements.

2.2 FABRICATION

.1 When specified, provide cut-outs centred in the webs of members to accommodate services. Unreinforced cut-outs shall be limited to the dimensions in Table 1. The effect of the cut-outs on the strength and stiffness of the member shall be considered.

.2 Fabrication tolerances for members shall conform to Table 2.

.3 The steel thickness exclusive of the coating shall be marked on each member by embossing, stamping with indelible ink or by colour coding.

2.3 SCREWS

.1 Steal screws shall equal or exceed the minimum diameter indicated on the shop drawings.

.2 Penetration beyond joined materials shall have low profile heads.

.3 Thread types and drilling capability shall conform to the manufacture’s recommendation.

.4 Screws covered by sheathing materials shall have low profile heads.

3. EXECUTION

3.1 GENERAL

.1 Fabrication and erection shall conform to the approved shop drawings. Modifications required to accommodate as-built conditions (other than minor dimensional changes) shall be submitted for approval.

3.2 WELDING

.1 Welds: To CSA W59 or AWS D1.3/D1.3M, whichever is applicable.

.2 For material less than 3 mm thick, shop drawings may show nominal weld leg sizes. For such materials, the effective throats of welding shall not be less than the thickness of the thinnest connected part.

.3 Touch-up welds with zinc rich paint.

3.3 ERECTION

.1 Methods of construction may be either piece (stick-building) or by fabrication into panels (panelized) either on or off site.

.2 Stud steel framing shall be erected true and plumb within the specified tolerances. Temporary bracing shall be employed wherever necessary to withstand all loads to which the structure may be subject during erection and subsequent construction.

.3 Temporary bracing shall be left in place as long as required for the safety and integrity of the structure.

.4 The Erector shall ensure that during erection a margin of safety consistent with the requirements of the Alberta Building Code and CSA S136 exists in the uncompleted structure.

.5 Wall framing and anchoring shall be erected in accordance with approved shop drawings.

.6 Erection Tolerances.

.1 For the purpose of this section, camber is defined as the deviation from straightness of a member or any portion of a member with respect to its major axis, and sweep is defined as the deviation from the straightness of a member or any portion of a member with respect to its minor axis.

.2 For wind bearing studs out of plumbness shall not exceed 1/500th of the member length. Out of straightness (camber and sweep) shall not exceed 1/1000th of the member length.

.3 For track, camber shall not exceed 1/1000th of the member length.

.4 Studs shall seat into top and bottom tracks. The gap between the end of the stud and the web of the track shall not exceed 4 mm for wind bearing studs.

.5 Align adjacent prefabricated panels to provide surface continuity at the interface.

.6 Spacing of studs shall not be more than 3 mm from the design spacing. The cumulative error in spacing shall not exceed the requirements of the finishing materials.

.7 Make all field measurements necessary to ensure the proper fit of all members.

.8 Cutting of members may be by saw or shear. Torch cutting is not permitted.

.9 Holes that are field cut into stud steel framing members shall conform to the requirements of Section 2.2.1 and 3.3.5.

.10 Splicing of steel studs id not permitted.

.11 Insulation equal to the specified shall be placed in all jamb and header assemblies that will be in inaccessible after their installation into the wall. Ensure that insulation is kept dry and not compressed.

.12 Handling and lifting of prefabricated panels shall not cause permanent distortion to any member or collateral material.

3.4 ALLOWABLE DIMENSIONS FOR UNREINFORCED CUT-OUTS (TABLE 1)

MEMBER DEPTH (mm)	ACROSS THE MEMBER WEB (mm)	ALONG THE MEMBER LENGTH (mm)	*CENTRE TO CENTRE SPACING (mm)
92, 102	40 max.	105 max.	600 min.
> 152	65 max.	115 max.	600 min

* The distance from the centerline of the last unreinforced cut-out to the end of the member shall be not less than 300 mm.

3.5 FABRICATION TOLERANCE FOR THE LIGHTWEIGHT STEEL FRAMING MEMBERS (TABLE 2)

MEMBER TYPE	MEMBER DEPTH A (mm)	FLANGE WIDTH B (mm)	LIP LENGTH C (mm)	THICKNESS t (mm)	INSIDE RADIUS R (mm)	CORNER ANGLES	MEMBER LENGTH
Track	-1, +2	-1, +2**	-0, +4	-0	*	±3°	N/A
Wind stud	-1, +2	-1, +2**	-0, +4	-0	*	±3°	±3 mm

* Only applicable to members subject to web crippling.

For $r \leq 2t + 28\%$.

For $2t < r \leq 4t + 9\%$.

Where "r" is the manufacture's specified inside bend radius and "t" is the thickness exclusive of coating.

** Where drywall is attracted directly to the flange, the minimum flange width shall be 31 mm.

3.6 FIELD QUALITY CONTROL

.1 Field Services:

.1 The lightweight steel framing shall be subject to a periodic field review during construction and must be approved prior to application of drywall or sheathing.

.1 Cost of field review shall be paid for by Contractor.

.2 Additional inspection and testing of materials and workmanship, if required, to be carried out by a qualified Independent Inspection Agency, appointed by the Consultant.

.3 Provide necessary cooperation to ensure that inspection can proceed.

.4 Inspection provided in this section does not relieve Contractor of his responsibilities for the performance of the Work. The Contractor is solely responsible for the quality control and he shall implement his own supervisory and quality control procedures.

.5 Materials or workmanship not conforming to the requirements of the contract documents may be rejected at any time during the progress work.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 09 91 13 – Exterior Painting

.2 Section 09 91 23 – Interior Painting

.3 Section 09 97 19 – Painting Exterior Metal Surfaces

1.2 REFERENCES STANDARDS

.1 ASTM International

.1 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A269/A269M-15a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.3 ASTM A307-14e1Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod 60 000 PSI Tensile Strength.

.2 CSA International

.1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA S16-14, Design of Steel Structures.

.4 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

.5 CSA W59-13, Welded Steel Construction (Metal Arc Welding) [Metric].

.3 Green Seal Environmental Standards (GS)

.1 GC-03- Green Seal Environmental Criteria for Anti-Corrosive Paints, Second Edition, January 7, 1997

.4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 The Master Painters Institute (MPI)

.1 Master Painters Institute Green Performance Standard GPS-1-08.

.6 Specialty Steel Industry of North America (SSINA)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.

.1 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Canada.

.2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

.3 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage and waste diversion requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that construction wastes were recycled or salvaged.

.4 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer, pre-consumer content, and total cost of materials for project.

.5 Regional Materials: submit evidence that project incorporates regional materials and products.

.6 Low-Emitting Materials:

.1 Submit listing of paints and coatings used in building, comply with VOC and chemical component limits or restrictions requirements.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21, Grade 350W.

.2 Steel pipe: to ASTM A53/A53M

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Stainless steel tubing: to ASTM A269, seamless welded with AISI No. 4 finish.

.7 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Where possible, fit and shop assemble work, ready for erection.

.3 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m^2 to CAN/CSA-G164.

.2 Shop coat primer: in accordance with chemical component limits and restrictions requirements and VOC limits of GC-03.

.3 Zinc primer: zinc rich, ready mix in accordance with chemical component limits and restrictions requirements and VOC limits of GC-03.

2.4 ISOLATION COATING

.1 Isolate aluminum from following components, by means of bituminous paint:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

.2 Concrete, mortar and masonry.

.3 Wood.

2.5 SHOP PAINTING

.1 Primer: VOC limit 250 g/L maximum to GC-03.

.2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.4 Clean surfaces to be field welded; do not paint.

2.6 ANGLE LINTELS AND BRICK ANGLES

.1 Steel angles: prime painted, sizes provided for openings full length and full length of masonry veneers.

.2 Finish: shop painted.

.1 Primer: VOC limit 250 g/L maximum to GC-03 when applied onsite.

2.7 BOLLARDS

.1 Steel HSS: prime painted, sizes indicated on drawings.

.2 Finish: shop primed. Plastic pipe sleeves.

2.8 SITE SIGN SUPPORTS

.1 Steel HSS: prime painted, sizes indicated on drawings.

.2 Finish: shop painted.

.1 Primer: VOC limit 250 g/L maximum to GC-03 when applied onsite.

2.9 GARBAGE ENCLOSURE MEMBERS

.1 Steel HSS: prime painted, sizes indicated on drawings.

.2 Finish: shop painted.

.1 Primer: VOC limit 250 g/L maximum to GC-03 when applied onsite.

2.10 TRANSFORMER ENCLOSURE MEMBERS

.1 Steel HSS: prime painted, sizes indicated on drawings.

.2 Finish: shop painted.

.1 Primer: VOC limit 250 g/L maximum to GC-03 when applied onsite.

2.11 OVERHEAD DOOR CONTROL POST

.1 Steel plate and pipe: prime painted, sizes indicated on drawings

.2 Finish: shop painted.

.1 Primer: VOC limit 250 g/L maximum to GC-03 when applied onsite.

2.12 OVERHEAD DOOR JAMB AND HEADER

.1 Steel plate: prime painted, sizes indicated on drawings

.2 Finish: shop painted.

.1 Primer: VOC limit 250 g/L maximum to GC-03 when applied onsite.

2.13 OVERHEAD DOOR CHAIN ENCLOSURES

.1 Bent steel plate and lock hasp: prime painted, sizes indicated on drawings

.2 Finish: shop painted.

.1 Primer: VOC limit 250 g/L maximum to GC-03 when applied onsite.

2.14 OVERHEAD DOOR TRACK ENCLOSURES

.1 Steel plate: prime painted, sizes indicated on drawings

.2 Finish: shop painted.

.1 Primer: VOC limit 250 g/L maximum to GC-03 when applied onsite.

2.15 CUSTOM EAVESTROUGH AND REBAR BRACING

.1 Steel plates: prime painted, sizes indicated on drawings

.2 Finish: shop painted.

.1 Primer: VOC limit 250 g/L maximum to GC-03 when applied onsite.

2.16 DOWNSPOUTS AND BRACKETS

.1 Steel fabricated from 24 ga. 100 mm square, prefinished metal.

.2 Finish: shop primed and painted.

.1 Primer: VOC limit 250 g/L maximum to GC-03 when applied onsite.

2.17 SLAB EDGE STEEL ANGLE

.1 Fabricated from 16 ga. prefinished metal.

.2 Finish: shop primed. Painted on site.

.1 Primer: VOC limit 250 g/L maximum to GC-03 when applied onsite.

2.18 GUN RACK LOCK BAR

.1 Steel bar with slots as detailed.

.2 Finish: shop painted.

.1 Primer: VOC limit 250 g/L maximum to GC-03 when applied onsite.

2.19 MISCELLANEOUS SUPPORT STEEL

.1 Steel angles, plates, HSS tubes fabricated to support millwork writing desks, benches and open work stations.

.2 Finish: shop painted.

.1 Primer: VOC limit 250 g/L maximum to GC-03 when applied onsite.

2.20 DUAL COMPARTMENT SUMP PUMP LIDS

.1 Fabricate steel from 6 mm thick raised pattern plate set in L 55 x 55 x 6 frame. Include anchors at 1200 mm on centre for embedding in concrete. Supply trench covers in 1200 mm removable lengths.

.2 Finish: galvanized.

2.21 STAINLESS STEEL BASE

.1 Fabricate stainless steel, 3 mm thick, 100 mm high at millwork as noted.

.2 Weld lengths together as necessary for single piece appearance.

.3 Finish: stainless steel, brushed.

2.22 FEATURE LIGHT FIXTURE CLAMP

.1 Fabricate plate, 100 mm x 80 mm x 6 mm thick, fastened to knife plate with nuts and bolts.

.2 Finish: stainless steel, No. 4 finish by the SSINA.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 ERECTION

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Consultant such as plywood backing, anchor clips, bar anchors, and expansion bolts and shields.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Supply components for work by other trades in accordance with shop drawings and schedule.

.6 Weld field connection.

.7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of:

.1 Primer: maximum VOC limit 250 g/L to GC-03.

.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

.1 Primer: maximum VOC limit 250 g/L to GC-03.

3.3 SHIPSLADDER

.1 Install shipsladders with railings in locations as indicated.

.2 Erect ladders clear of wall on bracket supports.

3.4 TRENCH COVERS

.1 Install trench covers in locations as indicated.

3.5 CHANNEL FRAMES

.1 Install steel channel frames to openings as indicated.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 40 00 – Shop Fabricated Architectural Woodwork

.2 Section 09 21 16 – Gypsum Board Assemblies

.3 Section 09 22 16 – Non-Structural Metal Framing

1.2 REFERENCES STANDARDS

.1 American Wood-Preservers' Association (AWPA)

.1 AWPA M2-16, Standard for the Inspection of Preservative Treated Products for Industrial Use.

.2 AWPA M4-15, Standard for the Care of Preservative-Treated Wood Products.

.2 ASTM International

.1 ASTM E119-16a, Standard Test Method for Fire Tests of Building Construction and Materials.

.3 CSA International

.1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

.2 CSA O80 Series-15, Wood Preservation.

.3 CSA O121-17, Douglas Fir Plywood.

.4 CSA O141-05 (R2014), Softwood Lumber.

.5 CSA O151-17, Canadian Softwood Plywood.

.6 CAN/CSA-O325-16, Construction Sheathing.

.7 CAN/CSA-Z809-08 (R2013), Sustainable Forest Management.

.4 Forest Stewardship Council (FSC)

.1 FSC-STD-01-001 (Version 4-0), FSC Principle and Criteria for Forest Stewardship.

.5 Green Seal Environmental Standards (GS)

.1 GS-11 3rd Edition (2011), Paints and Coatings.

.6 National Institute of Justice

.1 NIJ 018.01, Ratings of Bullet Resistant Materials.

.7 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

.8 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113-A2016, Architectural Coatings.

.9 Sustainable Forestry Initiative (SFI)

.1 SFI-2015-2019, Standard and Rules.

.10 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 UL 752, Standard for Bullet-Resisting Equipment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for rough carpentry work and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Certifications: submit certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan and Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Regional Materials: submit evidence that project incorporates regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

.3 Wood Certification: submit manufacturer's Chain-of-Custody Certificate number for CAN/CSA-Z809 or FSC or SFI certified wood.

.4 Low-Emitting Materials:

.1 Submit listing of paints and coatings used in building, comply with VOC and chemical component limits or restriction requirements.

.2 Submit listing of composite wood products used in building, stating that they contain no added urea-formaldehyde resins, laminate adhesives used in building, stating that they contain no urea-formaldehyde.

1.4 MAINTENANCE MATERIALS SUBMITTALS

.1 Extra Stock Materials:

.1 Provide electrical equipment backboards for mounting electrical equipment as indicated. Use 19 mm thick plywood on 19 x 38 mm furring around spacing, perimeter and at maximum 300 mm intermediate

1.5 QUALITY ASSURANCE

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: by grade mark in accordance with applicable CSA standards.

.3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

.4 Sustainable Standards Certification:

.1 Certified Wood: submit listing of wood products and materials used in accordance with CAN/CSA-Z809 or FSC or SFI.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wood from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for of pallets, banding, as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction Waste Management.

Part 2 Products

2.1 MATERIALS

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:

.1 CAN/CSA-O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.3 CAN/CSA-Z809 or FSC or SFI certified.

.2 Furring, blocking, nailing strips, grounds, rough bucks, backing, fascia backing and sleepers:

.1 Board sizes: "Standard" or better grade.

.2 Dimension sizes: "Standard" light framing or better grade.

.3 Post and timbers sizes: “Standard” or better grade.

.3 Panel Materials:

.1 Douglas fir plywood (DFP): to CSA O121, standard construction.

.1 Urea-formaldehyde free.

.2 Canadian softwood plywood (CSP): to CSA O151, standard construction.

.1 Urea-formaldehyde free.

.3 Plywood, wood based composite panels: to CAN/CSA-O325.

.1 Urea-formaldehyde free.

.4 Wood Preservative:

.1 Surface-applied wood preservative: copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

.2 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where used, pentachlorophenol-treated wood must be covered with two coats of an appropriate sealer.

.5 Fire-retardant coated wood: to CAN/ULC-S102:

.1 Flame Spread Classification: not more than 20.

.2 Smoke developed: not more than 15.

.3 Interior use on surface mounted electrical panel plywood in rooms 139 and 146.

.4 Finish: white.

.6 Ballistic Resistant Laminate:

.1 Panels tested in accordance with ASTM-E119.

.2 Resistant ratings in accordance with UL 752, Level 5 and NIJ 018.01, Level III.

.3 Manufactured by ArmorCore.

.4 Located in rooms 121 and 123.

.7 Primers, Paints: in accordance with manufacturer's recommendations for surface conditions:

.1 Comply with GS-11 SCAQMD Rule 1113.

2.2 ACCESSORIES

.1 Fasteners: to CAN/CSA-G164, for exterior work pressure- preservative, treated lumber.

.2 Wood screws: plain type and size to suit application.

.3 Nails, spikes and staples: to CSA B111.

.4 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for rough carpentry installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 PREPARATION

.1 Application of Preservatives:

.1 Treat surfaces of material with wood preservative, before installation.

.2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one (1) minute soak on plywood.

.3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

.4 Treat material as indicated and as follows:

.5 Wood parapet caps, and eaves trough slopes

.2 Application for Fire-retardant:

.1 Treat plywood by pressure impregnation with fire-retardant chemicals in accordance with CAN/ULC-S102.

.2 Apply fire-retardant by brush, roller or sprayer to 0.8 mm minimum thickness on exposed surface and edges before installation.

.3 Application of Ballistic Resistant Laminate:

.1 Laminate is to be installed in two (2) walls adjacent to discharges stations; behind and beside to 1200 mm above finished floor and 1200 mm away from wall corner.

.2 Walls containing laminate are to be flush with walls with no laminate.

3.3 INSTALLATION

.1 Comply with requirements of NBC, supplemented by the following paragraphs.

.2 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes.

.3 Align and plumb faces of furring and blocking to tolerance of 1:600.

.4 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.5 Countersink bolts where necessary to provide clearance for other work.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 40 00 – Shop Fabricated Architectural Woodwork

.2 Section 09 91 23 – Interior Painting

1.2 REFERENCES STANDARDS

.1 American National Standards Institute (ANSI)

.1 ANSI A208.2-16, Medium Density Fibreboard (MDF) for Interior Applications.

.2 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)

.1 Architectural Woodwork Standards (Edition 2) and Errata.

.3 ASTM International

.1 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.4 CSA International

.1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

.2 CSA O121- 17, Douglas Fir Plywood.

.3 CSA O141- 05 (R2014), Softwood Lumber.

.4 CSA O151- 17, Canadian Softwood Plywood.

.5 CAN/CSA-Z809-08(R2013), Sustainable Forest Management.

.5 Forest Stewardship Council (FSC)

.1 FSC-STD-01-001 (version 4-0) EN, FSC Principle and Criteria for Forest Stewardship.

.6 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2014.

.7 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1168- A2005, Adhesives and Sealants Applications.

.8 Sustainable Forestry Initiative (SFI)

.1 SFI- 2015-2019, Standards and Rules.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for MDF, plywood and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS in accordance with 01 35 43 - Environmental Procedures.

.3 Shop Drawings:

.1 Indicate details of construction, profiles, jointing, fastening and other related details.

.2 Indicate materials, thicknesses, finishes and hardware.

.4 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Submit duplicate 100 x 300 mm sample of Maple Planks.

.5 Certifications: submit certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.

.6 Test and Evaluation Reports: submit certified test reports for composite wood from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.7 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Regional Materials: submit evidence that project incorporates regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

.3 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants used in building, showing compliance with VOC and chemical component limits or restrictions requirements.

.2 Submit listing of composite wood products used in building, stating that they contain no added urea-formaldehyde resins, laminate adhesives used in building, stating that they contain no urea-formaldehyde.

1.4 QUALITY ASSURANCE

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood, particleboard and wood based composite panels to CSA and ANSI standards.

.3 Sustainable Standards Certification:

.1 Certified Wood: submit listing of wood products and materials used in accordance with CAN/CSA-Z809 or FSC or SFI.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wood products from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for of pallets, banding, as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction Waste Management.

Part 2 Products

2.1 MATERIALS

.1 Softwood lumber: S4S, moisture content 19% or less in accordance with following standards:

.1 CSA O141.

.2 CAN/CSA-Z809 or FSC or SFI certified.

.3 NLGA Standard Grading Rules for Canadian Lumber.

.4 AWMAC premium grade, moisture content as specified.

.5 Machine stress-rated lumber is acceptable.

.6 Hardwood lumber: moisture content 12% or less in accordance:

.1 National Hardwood Lumber Association (NHLA).

.2 AWMAC premium grade, moisture content as specified.

.3 CAN/CSA-Z809 or FSC or SFI certified.

.2 Panel Material: urea-formaldehyde free

.1 CAN/CSA-Z809 or FSC or SFI certified.

.2 Douglas fir plywood (DFP): to CSA O121, standard construction.

.3 Canadian softwood plywood (CSP): to CSA O151, standard construction.

.4 Medium density fibreboard (MDF): to ANS/A208.2, density 640-800 Kg m3.

2.2 ACCESSORIES

.1 Wood screws:

.1 Plain, type and size to suit application.

.2 Tamperproof screws for millwork in rooms 140 to 144, 146, 172 and 174.

.2 Splines: metal.

.3 Adhesive and Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.1 Comply with VOC limit SCAQMD Rule 1168 GS-36.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for wood products installation in accordance with manufacturer's written instructions.

- .1 Visually review substrate in presence of Consultant.
- .2 Inform Consultant of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Do finish carpentry to Quality Standards of (AWMAC).

.2 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.

.3 Form joints to conceal shrinkage.

3.3 CONSTRUCTION

.1 Fastening:

- .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
- .2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

- .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by finish carpentry installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 08 99 – Rough Carpentry for Minor Works

1.2 ACTION AND INFORMATION SUBMITTALS

.1 Provide required information in accordance with Section 01 33 0 – Submittal Procedures prior to fabrication; do not fabricate any work until required submittals are reviewed and accepted by the Consultant.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit product data for each type of product indicated including, but not limited to, the following:

.1 Cabinet hardware and accessories

.2 Finishing materials and processes

.3 Manufactured hardboard, medium density fibreboard

.4 High pressure decorative laminate and adhesive for bonding decorative laminate

.5 Low pressure decorative laminate

.6 Solid surfacing material

.2 Shop Drawings: Submit shop drawings indicating location of each item referenced to actual site dimensions, dimensioned plans and elevations, large scale details and thickness of materials, attachment devices, scribe strip locations, locations of exposed fastenings and other components as applicable to the work of this Section.

.1 Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

.2 Submit shop drawings to the local AWMAC Chapter office for review and commentary before work commences.

.3 Samples for Verification: Submit two (2) samples prior to fabrication of casework as follows; accepted samples will form the standard of acceptance for the remainder of the work:

.1 High Pressure Decorative Laminate Clad Panel Products: Laid-up on specified core material, 300 mm x 300 mm for each type, colour, pattern, and surface finish.

.2 Low Pressure Decorative Overlay (Melamine) Surfaced Panel Products: Laid-up on specified core material, 300 mm x 300 mm for each type, colour, pattern, and surface finish.

.3 Solid Surfacing Materials: 150 mm square for each type, colour, pattern, and surface finish.

.4 Exposed Cabinet Fasteners, Hardware and Accessories: One unit for each type and finish.

1.3 REFERENCE STANDARDS

.1 National Electrical Manufacturers Association

.1 ANSI/NEMA LD3-2005, High Pressure Decorative Laminates (HPDL).

.2 CSA International

.1 CAN3 A172M79(R1996), High Pressure Paper Base, Decorative Laminates.

1.4 PROJECT CLOSEOUT SUBMISSIONS

.1 Submit three (3) copies of Project Record Sheet identifying the following:

.1 Project title and address

.2 Owner, Consultant, Construction Manager, and casework Trade Contractor

.3 Materials and finishes used for casework and whether shop finished or site finished and by whom

.4 Type and source of cabinet hardware and any specialty items used under casework

1.5 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Project Quality Standard: Architectural Woodwork Standard (AWS) published by the Architectural Woodwork Manufacturers Association of Canada, together with authorized additions and amendments will be used as a reference standard and forms part of this project specification, and as follows:

.1 Modifications made in this Section that change the requirements of the AWS will govern in case of conflict.

.2 References to Economy, Custom or Premium Grade in this specification are as defined in the AWS; any item not given a specific quality grade will be Premium Grade as defined in the AWS.

.3 Provide a copy of the AWS for reference purposes on the job site.

.4 References in this specification to part and item numbers mean those parts and items contained within the AWS.

1.6 MOCK-UPS

.1 Provide a full size mock-up of standing trim to the job site for review by the Consultant, and as follows:

.1 Mock-up shall include all materials, finishes as specified and form part of work once approved.

.2 The accepted mock-up shall remain on site under a protective covering and will be used as the standard for the work.

1.7 DELIVERY STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver woodwork materials only when building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period, as follows:

.1 Deliver, store, and handle casework in accordance with AWS Section 2 Care and Storage.

.2 Delivered materials that are damaged in any way or do not comply with these specifications will be rejected by the Consultant; remove rejected materials from job site and replace with acceptable materials.

1.8 SITE CONDITIONS

.1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on Shop Drawings where casework is indicated to fit walls and other construction; coordinate fabrication schedule with construction progress to avoid delaying the Work; locate concealed framing, blocking, and reinforcements that support woodwork by site measurements before being enclosed and indicate measurements on Shop Drawings.

.2 Established Dimensions: Establish dimensions and proceed with fabricating casework without confirmed site measurements where site measurements cannot be made without delaying the Work; coordinate with the construction to ensure that actual dimensions correspond to established dimensions; allow for trimming and fitting.

.3 Ambient Conditions: Maintain area or room in which casework is being installed at a uniform temperature and humidity for 24 hours prior to, during and after installation in accordance with AWS for relative humidity and moisture content; provide additional lighting to maintain a minimum of 430 lx on surfaces and areas where casework is being installed.

1.9 WARRANTY

.1 Special Warranty: Provide AWMAC Guaranty and Inspection Service (GIS) in as follows:

.1 Work of this Project will be subject to the AWMAC Guaranty and Inspection Service (GIS) and will be inspected by an AWMAC approved and appointed inspector.

.2 Architectural woodwork will be inspected at the plant and at the site; inspector will make recommendations based on the referenced AWS.

.3 Replace, rework or refinish casework as directed by the AWMAC inspector at no additional cost to the Owner.

.4 Include costs for GIS as a part of the price for this Project.

.2 Term of Special Warranty: Provide a two (2) year Maintenance Bond *or* an AWMAC Guaranty Certificate as follows:

.1 Maintenance Bond: Provide a maintenance bond to the full value of the casework for this Project, certifying that the casework has been manufactured and installed in accordance with the standards incorporated in the AWS.

.2 Guaranty Certificate: Owner will accept the AWMAC guaranty certificate from AWMAC members in good standing at the time of bidding through to Project completion instead of the maintenance bond.

.3 The maintenance bond or guaranty certificate shall cover replacing, reworking or refinishing to make good defects in casework arising from faulty workmanship or defective materials supplied that become apparent during a two (2) year period following the date of Substantial Performance for the Project.

Part 2 Products

2.1 MATERIALS

.1 Use clean stock for each type of woodwork and quality grade specified in accordance with AWS.

.2 Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 8% moisture content.

.3 Anchors: Select material, type, size, and finish required for each substrate for secure anchorage:

.1 Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance.

.2 Provide toothed steel or lead expansion sleeves for drilled-in-place anchors.

.4 Lumber Materials: Provide lumber materials meeting requirements for moisture content and Premium Grade in accordance with AWS Section 3, and as follows:

.1 Non-Exposed Softwood: Fabricator's option, meeting requirements of CAN/CSA O141, kiln dried; dressed 4 sides.

.5 Panel Materials: Provide panel materials meeting requirements for moisture content and Premium Grade in accordance with AWS Section 4, and as follows:

.1 Medium Density Fibreboard (MDF): Meeting ASTM D1037 and ANSI A208.2, Premium Grade for interior use, minimum 700 kg/m³ density; formaldehyde emissions shall be 0.30 ppm or less per $0.424 m^2/m^3$ of room volume .

.2 Fir Plywood: Meeting CSA O121 or CSA O151, cross-banded, sanded G2S, thickness as indicated.

.3 Hardboard: Meeting CAN/CGSB-11.3, Type 2, minimum density 500 kg/m^3, tempered hardboard (Masonite), 6 mm nominal thickness unless noted otherwise, one face smooth finish; colour as selected by Consultant from manufacturer's full range.

.6 Decorative Laminate Finishes: Grades and applications in accordance with AWS Section 4, and as follows:

.1 High Pressure Decorative Laminate (HPDL): Meeting CAN3 A172 or ANSI/NEMA LD3 composed of phenolic resin impregnated Kraft paper filler stock for Class 1 Decorative Laminate of Grade required by woodwork quality standard; colour as selected by Consultant and as follows:

.1 Self Edging Work: General Purpose Grade, HGS standard duty.

.2 Liner Sheet Work: Same as for self edging work.

.3 Backing Sheet Work: BKL backing material, thickness as recommended by manufacturer to prevent warpage of surfaces, sanded on one side; furniture finish, solid white colour.

.7 Adhesives: Decorative laminate: polyvinyl acetate or aliphatic resin in accordance with manufacturer's recommendation for curing under pressure for bonding to wood cores, water resistant type.

2.2 ACCESSORIES

.1 Casework Hardware: Provide cabinet hardware described in this Section in quantity required, with necessary screws, bolts, washers for complete installation.

.1 Fasteners: Non-exposed Fasteners: Fabricators choice consistent with quality level specified.

.2 Hardware: Bolts, nuts, washers, screws, etc., hot dip heavy zinc-coated.

.2 Sealant: 1 part silicone, non-staining, mould and mildew resistant, colour: clear, refer to Section 07 92 00 – Joint Sealants.

2.3 CASEWORK, CLEAR FINISH

.1 Finish: AWMAC custom for clear finish.

.2 Core: combination core plywood to AWMAC Manual.

.3 Veneer: AWMAC minimum A grade all sapwood (white). Species Birch or Maple.

.4 Exposed and Semi-exposed Parts: AWMAC grade.

.5 Edging: minimum 3 mm PVC or 6 mm hardwood: colour to match panel.

2.4 CASEWORK PLASTIC LAMINATE FINISH

.1 AWMAC Quality Grade: Custom.

.2 Construction: to AWMAC Manual for flush overlay, except as otherwise detailed on drawings.

.3 Exposed and Semi-exposed Parts:

.1 Panel Products:

.1 Core for Doors: plywood or plywood composition. MDF or particle board core is unacceptable.

.2 Core for All Other Panel Products: hardwood plywood or plywood composition.

.3 Laminate Grade: general purpose grade, standard duty, 1.06 to 1.27 mm thick.

.4 Plastic laminate to both sides of doors and drawer fronts.

.2 Edge Banding - for Doors and Drawer Fronts: plastic laminate to match faces.

.4 Semi-exposed Parts:

.1 Plastic Laminate Panels:

.1 Core: door panels and door fronts – particle board core.

.2 Colour: White, unless noted otherwise.

.3 Edge Banding: plastic laminate to match faces.

.4 Semi-exposed Surface of perimeter of each Millwork Cabinet: 1.0 mm thick plastic laminate, colour to match door faces.

.2 Semi-exposed Surface of Casework Doors and Frames: same as exposed face.

.3 Post Formed Grade used on the following:

.1 Concealed surface of casework backs.

.2 Concealed surfaces, unless specified otherwise.

.3 Semi-exposed shelves.

.4 Interior portions of case bodies.

.5 All surfaces of drawer boxes.

.4 Laminate Finish/Sheen: suede finish.

.5 Laminate Colours: Refer to drawings.

2.5 PLASTIC LAMINATE WALL PROTECTION

.1 Laminate Grade: general purpose, standard duty, 1.06 to 1.27 mm thick.

.2 Laminate Finish/Sheen: suede finish.

.3 Laminate Colour and Pattern: refer to drawings.

2.6 SOLID SURFACING

.1 Solid surface material (SSM) shall consist or reacted monomers and resins, mineral fillers and pigments manufactured in sheets of 12 mm nominal thickness. SSM shall be solid, non-porous, homogenous, hygienic, renewable, and, when applicable, may feature inconspicuous hygienic seams. SSM shall be free from conspicuous internal strengthening fibres SSM must meet or exceed performance standards set forth in ISSFA-0-2-01.

.2 Solid Surfacing Material by HANEX. Refer to drawings for colour.

2.7 HIGH PRESSURE DECORATIVE LAMINATE COUNTERTOPS AND BACKSPLASH, SELF-EDGE TYPE

.1 Laminate: horizontal general purpose grade, thickness of 1.2 mm, and laminate backer grade, thickness of 0.76 mm.

.1 Laminate finish and surface: matte surface. Refer to drawings for colours.

.2 Core: veneer core plywood, minimum 19 mm thick with Type 1 glue. Liner grade backer sheet to underside of countertops. No added urea formaldehyde.

.3 Backing: laminate backer applied to underside of countertops and back of backsplashes.

.4 Edge Type: High pressure decorative laminate, lumber, no. 1 grade, or 3 mm PVC edge, as detailed on drawings.

.5 Backsplash: profile as detailed on drawings.

2.8 CASEWORK HARDWARE

Item	Description	Finish
Drawer Slides	124 kg. load capacity; steel track; full extension, steel ball bearings. As per Accuride 3600.	ZINC
Shelf Pilasters and Brackets	Steel standards, zinc coated; 1.3 mm adjustable centres; recess mounted; length as indicated on drawings. K&V 255 and 256.	ZINC
Hinges	125 degree opening; concealed hinge; swing free; self closing; nickel plated steel hinge arm and hinge cup. Based on BLUM Modul.	NICKEL
Pulls	Metal square "D" pull; 96 mm c.c.; 39 mm deep. As per Richelieu 2170296 or approved substitution.	METAL
Drawer Locks	Locks: disk pin tumbler type, Richelieu 313130195 or approved substitution. Keying requirements will be finalized during shop drawing stage.	CHROME
Door Locks/Catches	Locks: disk pin tumbler type, Richelieu 310150195 or approved substitution. Keying requirements will be finalized during shop drawing stage. Provide elbow catch for each pair of lockable doors.	CHROME
Grommet	Oval cable entry plug, 18 mm depth, Richelieu 90060106. Provide to counter top areas where electrical outlets, telephone and data outlets are located below and as detailed on drawings.	BLACK
Wire Management	Richelieu 512490.	BLACK
Coat Rod	Chrome-plated steel tubing, 32 mm dia., minimum wall thickness of 1.2 mm, 76 mm dia., chrome-plated cast brass flanges at each end for attachment.	CHROME
Keyboard Tray	Richelieu 50080190: Classic Series vinyl covered keyboard tray with full length foam palm rest, mouse tray built-in, 685 mm wide x 267 mm deep x 20 mm thick.	BLACK
Cash Drawer	M-S Cash Drawer HP-122N: Manual cash drawer, all steel with stainless steel front, black powder coated finish, security drawer key-lock, 5 coin and 5 bill removable money tray insert, 478 mm x 386 mm x 105 mm, with under counter mounting brackets.	BLACK
Sliding Track	Richelieu 8916605170: Strap mount with flat bar running rail, R-Exact.	STAINLESS STEEL
Extension Track	Richelieu 89166011170: Extension rail-connector, joins two	STAINLESS

	rails.	STEEL
Flush Pulls	Richelieu 89058960EKIT185: Magnetic Handles with front pull, round magnetic flush handles with front pull, satin.	NICKEL

Part 3 Execution

3.1 EXAMINATION

.1 Visit site and note state of completion within various areas in which casework is being installed; verify that surfaces are ready to receive work of this Section and that other work is finished and painted before being built-over or covered in any way by installed casework:

.1 Verify that areas in which casework is scheduled are finished and ready to accept work of this Section; with walls painted, ceilings finished, overhead services completed, tested and accepted.

.2 Starting work will be considered as acceptance of conditions.

3.2 PREPARATION

.1 Confirm access is sufficient for large pieces of casework, and that they can be transported easily and safely to final installation location.

.2 Protect adjacent finished surfaces and materials from damage by work of this Section.

.3 Back prime casework immediately after delivery to site.

3.3 INSTALLATION

.1 Install casework plumb, level and true to locations indicated on Drawings and in accordance with AWS.

.2 Anchor to floor, walls or ceiling using fastening devices and hardware consistent with materials being fastened into and quality of finish, and as follows:

.1 Do not use wood plugs

.2 Do not use plastic plugs for ceilings or walls

.3 Provide wall cleats fastened to wall blocking as required

.4 Shim level and square in relation to adjoining surfaces

.5 Scribe accurately to adjacent work

.6 Provide allowance for finish flooring installation to base by related sections of work

.3 Scribe neatly and accurately to smooth snug fit with adjoining surfaces and materials to align work properly; mitre corners accurately.

.4 Perform cutting, fitting, repairing in woodwork as required by other sub-contractors where their Work is connected to or part of this Work.

.5 Cut out openings for mechanical and electrical fittings and fixtures; coordinate and cooperate with mechanical and electrical work and obtain required templates, cutting locations and dimensions.

.6 Apply neat bead of sealant between plumbing fixtures countertops and adjoining walls and casework; seal edges of cut out core material before fixtures installed with moisture resistant compound.

.7 Install countertop to casework units; coordinate schedule and delivery requirements to meet the construction schedule.

3.4 CLOSEOUT ACTIVITIES

.1 Deficient Work: Replace, rework or refinish work that does not meet AWS requirements as directed by Consultant and as required to obtain AWMAC GIS at no additional cost to Owner.

.2 Adjusting: Adjust hardware and operating parts during and after installation to provide smooth and proper operation of casework components.

.3 Cleaning: Clean casework, cabinets, countertops, shelves and fixtures, and remove marks, scratches or marring on exposed and semi-exposed surfaces after work of this Section is complete and prior to Substantial Performance for the project.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 84 00 – Fire Stopping

1.2 DESIGN REQUIREMENTS

.1 Conform to listed requirements to maintain the continuity of fire separations whether or not shown on the drawings.

.2 Do not support non-combustible construction on or from combustible construction.

.3 Firestop openings and joints in fire rated construction with non-combustible material in accordance with Section 07 84 00 – Firestopping, where a fire separation or assembly is required to be of non-combustible construction and terminates at the exterior wall, the underside of floor, ceiling, or roof structures, and at floors.

.4 Do not use combustible members, fastenings, and similar items to anchor fixtures to fire separations.

.5 Firestop openings for non-combustible pipes and ducts to prevent the passage of smoke and flame; Subcontractors shall be responsible for installing firestopping where their work passes through a fire separation, the opening shall be plugged with ULC labelled and approved firestopping sealant, insulation or other material approved by local Authorities Having Jurisdiction to maintain the integrity of the fire separations.

.6 Do not pierce fire separations with electrical or similar service outlets except in accordance with the Building Code.

.7 Existing fire separations must be maintained as such, and any cutting must be sealed to retain the separation's assembly rating.

.8 Refer to technical sections for specific requirements for sealing penetrations and joints of smoke and fire separations.

1.3 REFERENCE STANDARDS

1.4 FIRE TEST RESPONSE CHARACTERISTICS

.1 Provide materials and construction identical to those tested in assembly indicated according to CAN/ULC S101 for assemblies or materials having fire resistance ratings, as verified by an independent testing and inspecting agency acceptable to Authorities Having Jurisdiction for fire resistance ratings of specific assemblies indicated on drawings:

.2 Fire resistance rated assemblies and materials shall bear a label and proof of acceptance as indicated by design designations from ULC List of Equipment and Materials or Warnock Hersey-Intertek Directory of Listed Products. Where no design designation is provided, use only time assigned to materials listed in the Building Code.

.3 Fire resistance rated assemblies and materials will only be accepted from an organization recognized by the Authority Having Jurisdiction as being capable of conducting testing and providing labelling for materials, assemblies and systems that include, but are not limited to, the following organizations:

.1 Underwriters Laboratories of Canada (ULC).

.2 Underwriters Laboratories Inc. (UL).

.3 Intertek-Warnock Hersey (I/WH) ETL Semko.

.4 Acceptance of UL or WHI labels are subject to the following conditions:

.1 Fire resistance rated assemblies and materials bearing an Underwriter's Laboratories Inc. (UL) or Intertek-Warnock Hersey (I/WH) label will be acceptable for use on this project provided that the label indicates acceptance under Underwriters Laboratories of Canada (ULC) and having either a $_{c}$UL, $_{c}$UL$_{us}$, $_{c}$I/WH or $_{c}$I/WH$_{us}$ marking.

.2 Materials that only have a UL, UL$_{us}$, I/WH or I/WH$_{us}$ marking will not be acceptable.

.5 Examples of acceptable marks from Recognized Testing Authorities:

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 – Cast in place concrete

1.2 REFERENCE DOCUMENTS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM D751-06(2011), Standard Test Methods for Coated Fabrics.

.2 ASTM D5147/D5147M-14, Standard Test Method for Sampling and Testing Modified Bituminous Sheet Material.

.3 ATSM D5385/D5385M-93(2014)e1, Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.

.4 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.

1.3 PRODUCT OPTIONS AND SUBSTITUTIONS

.1 Refer to Division 01 for requirements pertaining to product options and substitutions..

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 – Submittal Procedures.

.2 Provide 1 copy of most recent technical waterproofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Provide 1 copy of MSDS for all products and indicate VOC content for primer.

1.5 QUALITY ASSURANCE

.1 Mock-Ups:

.1 Submit mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Construct mock-up of sheet vapour barrier/waterproofing connection installation including one lap joint, one inside corner and at one electrical box. Mock-up may be part of finished work.

.3 Mock-up will be used to judge quality of work, substrate preparation, and material application.

.4 Locate where directed.

.5 Allow 24 hours for review of mock-up by Consultant before proceeding with vapour barrier work.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Mock-ups requiring corrections are to be removed and disposed of. Approved mock-up may remain as part of finished work.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver and store materials, undamaged in original wrappings, in a suitable environment.

.2 Storage and Handling Requirements: Provide adequate protection of materials and work of this section from damage by weather and other cause.

1.7 SITE CONDITIONS

.1 Maintain surfaces and ambient air temperature 5ºC minimum, for a minimum period of 72 hours prior to, during, and after waterproofing application.

Part 2 Products

2.1 PERFORMANCE CRITERIA

.1 Waterproofing membrane must be by same manufacturer as vapour barrier membranes.

2.2 MATERIALS

.1 Primer: proprietary to membrane product.

.2 Waterproofing Membrane: SBS modified bitumen and non-woven polyester reinforcement; conforming to the following properties: Based on product Soprema Colphene Flam 180.

.1 Heat-welded seams, torch application.

.2 Thickness (total): 3.0 mm (120 mil).

.3 Resistance to hydrostatic pressure: to ASTM D5385, 114m (374 ft).

.4 Tensile Strength MD/XD: to ASTM D5147, 17/12.5 kN/m.

.5 Puncture Resistance: to ASTM 5147, 400 N.

.6 Water Vapour Permeance: to ASTM E96/E96M Method B, 021 ng/Pa*s*m2.

.7 Cold Bending at -30ºC (-22ºF): to ASTM D5147, no cracking.

Part 3 Execution

3.1 EXAMINATION

.1 Ensure concrete surfaces are clean, dry, smooth and free of fines, voids, honeycomb, etc.

.2 Surfaces shall be free from loose particles, grease, oil and other foreign matter.

.3 Fill holes and cracks and ensure continuity of flat surface.

.4 All concrete surfaces shall be surface dry and have negative alkalinity when surface tested.

.5 Ambient surfaces and material temperature shall be minimum 5ºC.

3.2 PREPARATION

.1 Protect the work of other trades from damage resulting from work of this Section. Make good such damage to the satisfaction of the Owner.

3.3 APPLICATION/WORMANSHIP

.1 Apply sheet membrane waterproofing to exterior foundation grade beams.

.2 Apply primer at a rate of 6 to 16m^2/L depending on porosity of surface.

.3 Allow primer to dry one hour or until tack free, but not more than 36 hours prior to application of membrane.

.4 Reapply primer if time lapsed between first application and installation of membrane exceeds 36 hours.

.5 Apply membrane in continuous strips, to as long length as possible to minimize joints. Stagger 914 mm and 305 mm widths in accomplishing 1219 mm width; seal butted edges with 150 mm width of membrane.

.6 Lap all ends 100 mm minimum. Seal all seams with mastic, applied in accordance with manufacturer's written instructions.

.7 All outside corners shall be double covered with initial strip of membrane 457 mm wide, centred.

.8 Cut-off at end of day operations shall be sealed with 150 mm wide strip set in mastic.

.9 Refer to manufacturer's written instructions and details for required procedures of installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 21 13.13 – Cement Faced Insulation Board

.2 Section 07 26 00 – Vapour Retarders

.3 Section 07 52 00 – Modified Bituminous Membrane Roofing

1.2 REFERENCES STANDARDS

.1 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S702-14, Standard for Mineral Fibre Thermal Insulation, for Buildings.

1.3 DEFINITIONS

.1 LTTR (Long Term Thermal Resistance): Defined as using techniques from ASTM C1303 or CAN/ULC S770 predicting a foam's R-Value that has been shown to be equivalent to the average performance of a permeably faced foam insulation product over 15 years.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's insulation products and adhesives.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Regulatory Requirements: Provide insulation products that meet or contain less than the regulated limits for Ozone Depletion Potential compounds listed in the Montreal Protocol adopted by the United Nations Environmental Program.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Handling Requirements:

.1 Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply

with manufacturer's written instructions for handling, storing, and protecting during installation.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.

Part 2 Products

2.1 MATERIALS

.1 Above grade insulation (except to roofs): basalt mineral fibre, semi-rigid board insulation, minimum 4.4 lb/ft density, 610 mm x 1219 mm board size, asbestos free, minimum R value of 4.3 per inch, surface burning characteristics when tested in accordance with CAN/ULC-S102, ASTM E84 and UL 723 not to exceed flame spread of 5 and smoke developed of 0. Thickness as indicated. Use one of the following manfucturers:

.1 Fibrex CWB 45

.2 Roxul CavityRock.

.2 Perimeter foundation and under slab insulation in accordance with Section 07 21 13.13 - Cement Face Insulation Board.

.3 Roof Insulation

.1 Extruded polystyrene (XPS) to CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.

.1 Type: 4.

.2 Thickness: as indicated.

.3 Size: 405 x 1220.

.4 Edges: square.

.5 Tapered insulation to provide slope to roof drains. Tapered insulation will not constitute as part of the insulation thickness.

.4 Sprandrel Panel Back Pan Insulation: Fill back pans with the same semi-rigid board insulation as used for above grade insulation.

2.2 ACCESSORIES

.1 Insulation Fasteners:

.1 Mechanical Fasteners: High quality, impact resistant plastic fastener system specifically designed for installation of board insulation materials; 38 mm

diameter, shaft length to suit insulation thickness and hot dipped galvanized fastener to suit substrate, and as follows:

.1 Basis-of-Design Materials: Ucan Fastening Systems, Insulation Fasteners; alternates will be considered for this material.

.2 Insulation Adhesive:

.1 Trowelable Polystyrene Insulation Adhesive: Trowel consistency, synthetic rubber based insulation adhesive compatible with polystyrene insulation in accordance with CGSB 71-GP-24M; suitable for application to temperature of -10°C or lower:

.1 Basis-of-Design Materials: Bakor, 230-21 Rigid Insulation Adhesive; substitutions will be considered for this material and must be compatible with adjacent materials.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 WORKMANSHIP

.1 Install insulation after building substrate materials are dry.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions. Do not compress insulation.

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN4-S604 type A chimneys CAN/CGA-B149.1 and CAN/CGA-B149.2 type B L vents.

.5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.6 Offset both vertical and horizontal joints in multiple layer applications.

.7 Do not enclose insulation until it has been reviewed and accepted by Consultant.

3.3 EXAMINATION

.1 Review substrates and immediately inform Consultant in writing of defects.

.2 Prior to commencement of work ensure:

.1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.4 ROOF INSTALLATION

.1 Install boards at face of finished curb roof penetrations as detailed.

3.5 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.6 PROTECTION

.1 Protect installed board insulation from damage due to harmful weather exposures, physical abuse, and other causes.

.2 Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 02 81 01 – Hazardous Material

.2 Section 03 30 00 – Cast-In-Place Concrete

.3 Section 07 13 00 – Sheet Membrane Waterproofing

.4 Section 07 92 00 – Joint Sealants

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM C518-17, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.2 ASTM C578-17, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

.3 ASTM D696-16, Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30º and 30ºC with a Vitreous Silica Dilatometer.

.4 ASTM D1621-16, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

.5 ASTM D2842-12, Standard Test Method for Water Absorption of Rigid Cellular Plastics.

.6 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 Underwriters Laboratories' of Canada (ULC)

.1 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for cementitious materials and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit electronic copies of WHMIS MSDS in accordance with Section 02 81 01 – Hazardous Materials. Indicate VOC's for cementitious materials.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of pre-consumer and post-consumer content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates required percentage.

.5 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants, paints and coatings used in building, comply with VOC and chemical component limits or restriction requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect cementitious panels from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 43 – Environmental Procedures.

.5 Packaging Waste Management: remove for reuse by manufacturer of crates, pallets, as specified in Construction Waste Management Plan in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets (MSDS) acceptable to Labour Canada.

Part 2 Products

2.1 MATERIALS

.1 Cement faced rigid insulation board: tongue and groove rigid insulation with 10 mm thick cement faced topping.

.2 Insulation: Rigid Insulation Section 07 21 13.

.3 Fasteners: mechanically fasten insulation to grade beams with manufacturer's purposed made fasteners.

2.2 COMPONENTS

.1 Panels: 2 layers (R10), 610 mm x 1220 mm x 50 mm thick. First layer without cement faced finish. Second layer with cement faced finish to be installed with seams offset from the first layer.

.2 Sealant: Fill exposed joints with grey sealant in accordance with Section 07 92 00 – Joint Sealants.

2.3 FINISH OF PANELS

.1 Exposed aggregate: 10 mm thick grey concrete topping with light broom finish.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Install prefinished panels with mechanical fasteners.

.2 Seal exposed joints for visual continuity.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Wash down exposed acrylic exterior surfaces using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths.

.2 Remove excess sealant with recommended solvent.

.3 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by mineral fibre reinforced panel installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIEMENTS

.1 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCE STANDARDS

.1 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC S102-11, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC S114-05, Standard Method of Test for Determination of Non-Combustibility in Building Materials.

.3 CAN/ULC S129—15, Standard Method of Test for Smoulder Resistance of Insulation (Basket Method).

1.3 QUALITY ASSURANCE

.1 Regulatory Requirements: Provide materials that meet requirements for CAN/ULC S102-10, for flame spread rating of 25 or less; CAN/ULC S114-05, for non-combustibility; and CAN/ULC S129-95 (R2001), for smoulder resistance when using materials in fire resistant rated construction.

.2 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Environmental Performance: Use insulation products listed by manufacturer as using non-urea formaldehyde or non-phenol formaldehyde based binders or having GreenGuard^{TM} Environmental Institute Indoor Air Quality Certification.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Handling Requirements: Protect insulation materials from physical damage and from deterioration by moisture and soiling; store undercover and protect from wetting or moisture.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Material Manufacturers: Subject to compliance with requirements specified in this Section, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 CertainTeed Corporation

.2 Johns-Manville Corporation

.3 Knauf Insulation

.4 Owens-Corning Canada Inc.

.5 Roxul Inc.

2.2 MATERIALS

.1 Mineral Fibre Insulation: Unfaced, preformed mineral slag batt insulation in accordance with CAN/ULC S702, Type 1; having a nominal RSI of 0.67/25 mm; rated non-

combustible in accordance with CAN/ULC S114 and having a flame spread rating of 5 or less in accordance with CAN/ULC S102; density 32 kg/m^3; square edges, thickness as required to meet design insulation values indicated on drawings or as required to fill insulated spaces where not indicated, and as follows:

.1 Acceptable Materials:

.1 Fibrex, SAFB Insulation

.2 Roxul Inc., Roxul Plus

.2 Acoustic Batts: Refer to Section 09 21 16 – Gypsum Board Assemblies.

Part 3 Execution

3.1 INSTALLATION

.1 Batt Insulation: Install batt insulation where indicated with continuous vapour retarder on the warm side of the insulation in accordance with ASTM C1320, and as follows:

.1 Where required to maintain continuity of thermal insulation of the building envelope.

.2 Cut and trim insulation neatly to fit spaces; butt ends and edges tight; fit insulation tightly to framing members and around pipes, conduits, and projecting structural members within insulated spaces.

.3 Fill stud space of exterior framed walls with insulation full depth of stud only where no insulation/vapour retardant indicated on exterior face of stud walls.

.4 Do not compress insulation to fit into spaces.

.5 Fill stud space of temporary partitions with insulation.

.6 Hold insulation in position with clips, wires or as recommended by manufacturer when insulation is installed in horizontal locations.

3.2 PROTECTION

.1 Protect installed insulation from damage arising from harmful weather exposures, physical abuse, and other causes.

.2 Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 22 00 – Concrete Unit Masonry

.2 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.

.2 ASTM E283-04(2012), Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

.3 ASTM E2178-13, Standard Test Method for Air Permeance of Building Materials.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for vapour retarders and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit electronic copies of WHMIS MSDS in accordance with Section 01 35 43- Environmental Procedures.

.3 Certificates:

.1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that construction wastes were recycled or salvaged.

1.4 QUALITY ASSURANCE

.1 Mock-Ups:

.1 Submit mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Construct mock-up of sheet vapour barrier/waterproofing connection installation including one lap joint, one inside corner and at one electrical box. Mock-up may be part of finished work.

.3 Mock-up will be used to judge quality of work, substrate preparation, and material application.

.4 Locate where directed.

.5 Allow 24 hours for review of mock-up by Consultant before proceeding with vapour barrier work.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Mock-ups requiring corrections are to be removed and disposed of. Approved mock-up may remain as part of finished work.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect specified materials from air born dusts and wind that will reduce the adhesion and allow tear to membranes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 43 – Environmental Procedures.

.5 Packaging Waste Management: remove for reuse and return crates, pallets, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 PERFORMANCE CRITERIA

.1 Vapour barriers must be by same manufacturer as roof air barrier and waterproofing membranes.

2.2 SHEET VAPOUR BARRIER

.1 Primer: proprietary to membrane product.

.2 Air/Vapour Barrier General Use: SBS modified bitumen and high-strength glass mat reinforcement: Based on Soprema Sopraseal Stick 130.

.1 Self-adhesive membrane.

.2 Thickness: 2.5 mm.

.3 Reinforcement Type: Glass mat.

.4 Top Mat: Sand.

.5 Tear Resistance: 25 N.

.6 Water Vapour Permeance: to ASTM E96 Procedure B, 0.23 ng/Pa*s*m2.

.7 Air Permeability: to ASTM E283 (75 Pa), no measurable air leakage; to ASTM E2178, <0.001 L/s*m2.

.3 Air/Vapour Barrier mechanically fastened around openings: Based on Soprema Sopraseal Stick 1100T.

.1 Self-adhesive membrane compatible with air/vapour barrier with 150 mm lap from edge of openings.

.2 Thickness: 1.0 mm.

.3 Tear Resistance, MD/XD: 535/245 N.

.4 Water Vapour Transmission: to ASTM E96/E96M, 2.1 ng/Pa*s*m2 (<0.037 perm).

.5 Air Permeability: to ASTM E2178, < 0.0005 L/s*m2.

2.3 ACCESSORIES

.1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 150 mm wide for lap joints and perimeter seals, 100 mm wide elsewhere.

.2 Sealant: compatible with vapour retarder materials, recommended by vapour retarder manufacturer.

.3 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

.4 Primers: compatible with vapour retarder materials, recommended by vapour retarder manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for vapour retarder and waterproofing installation in accordance with manufacturer's written instructions.

.1 Visually review substrate in presence of Consultant.

.2 The following are unacceptable for applied membrane:

.1 Fishmouths and folds,

.2 Blisters and bulges,

.3 Insufficient overlaps,

.4 Inadequate adhesion,

.5 Punctures, tears, cuts.

.6 Other similar defects.

.3 Inform Consultant of unacceptable conditions immediately upon discovery.

.4 Proceed with installation only after unacceptable conditions have been remedied. Work that proceeds with unacceptable conditions will be removed regardless of extent of construction, at no cost to the Owner.

3.2 INSTALLATION

.1 Ensure services are installed and inspected prior to installation of retarder.

.2 Install sheet vapour retarder on warm side of exterior wall to form continuous retarder before installation of interior gypsum board.

.3 Install sheet vapour retarder vertically on walls and continuously down to entire exterior faces to lap 150 mm onto waterproofing of foundation.

.4 Use sheets of largest practical size to minimize joints.

.5 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

.6 Lap horizontal membrane joints to shed water to exterior.

3.3 EXTERIOR SURFACE OPENINGS

.1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame. 150 mm lap is required from opening vapour retarder to wall vapour retarder.

3.4 PERIMETER SEALS

.1 Seal perimeter of sheet vapour barrier as follows:

.1 Apply continuous bead of sealant to substrate at perimeter of sheets.

.2 Lap sheet over sealant and press into sealant bead.

.3 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.5 LAP JOINT SEALS

.1 Seal lap joints of sheet vapour barrier as follows:

.1 Attach first sheet to substrate.

.2 Apply continuous bead of sealant over solid backing at joint.

.3 Lap adjoining sheet minimum 150 mm and press into sealant bead.

.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

.5 Install joint membrane, minimum 200 mm wide, centred over joints and gaps.

.6 Lap ends of joint membranes minimum 150 mm.

.7 Do not loop joint membranes into joints.

3.6 INSTALLATION AT TRANSITIONS TO BUILT-UP ROOFING

.1 Install transition membrane at transitions to SBS roofing.

.2 Wall membrane must be by the same manufacturer as the roof membranes for warranty continuity.

3.7 ELECTRICAL BOXES

.1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:

.1 Wrap boxes with film sheet providing minimum 300 mm perimeter lap flange.

.2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

3.8 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.1 Remove insulation material spilled during installation and leave work area ready for application of wall board.

.3 Waste Management: separate waste materials in accordance with Section 01 35 43- Environmental Procedures and 01 74 21- Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 02 81 01 – Hazardous Material

.2 Section 06 08 99 – Rough Carpentry for Minor Works

.3 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM D882-12, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

.2 ASTM E84-16, Standard Test Method for Surface Burning Characteristics of Building Materials.

.3 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.

.2 Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01- Hazardous Materials.

.3 Submit drawings: stamped and signed by professional engineer registered or licensed in Canada.

.4 Quality Assurance Submittals: submit following in accordance with Section 01 45 00- Quality Control.

.1 Existing Substrate Condition: report deviations, as described in PART 3 - EXAMINATION in writing to Consultant.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Applicator: company specializing in performing work of this section experience with installation of air/vapour barrier systems.

.1 Completed installation must be approved by the material manufacturer.

.2 Applicator: company:

.1 Currently licensed by certifying organization.

.2 Must maintain their licence throughout the duration of the project.

.2 Mock-Up:

.1 Construct mock-up in accordance with Section 01 45 00- Quality Control.

.2 Construct typical exterior wall panel, window; illustrating materials interface and seals and sill.

.3 Locate where directed.

.4 Mock-up may remain as part of finished work.

.5 Allow 24 hours for inspection of mock-up by Consultant before proceeding with air/vapour barrier Work.

.3 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.

.1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Avoid spillage: immediately notify Consultant if spillage occurs and start clean up procedures.

.4 Clean spills and leave area as it was prior to spill.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

1.7 AMBIENT CONDITIONS

.1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00- Temporary Utilities.

.3 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

1.8 SEQUENCING

.1 Sequence work in accordance with Section 01 32 16.07- Construction Progress Schedules - Bar (GANTT) Charts.

.2 Sequence work to permit installation of materials in conjunction with related materials and seals.

1.9 WARRANTY

.1 For sheet materials the twelve (12) months warranty period prescribed in subsection GC 12.3 of General Conditions "C" is extended to 24 months.

.2 Provide two (2) years warranty under provisions of Section 01 78 00- Closeout Submittals.

.3 Warranty: include coverage of installed sheet materials which:

.1 Fail to achieve air tight and watertight seal.

.2 Exhibit loss of adhesion or cohesion.

.3 Do not cure.

Part 2 Products

2.1 PERFORMANCE CRITERIA

.1 Air barriers must be by same manufacturer as roof and vapour barrier membranes.

2.2 MATERIALS:

.1 Primer: proprietary to membrane product.

.2 Vaprour Permeable Air Barriers: Tri-layer laminated polypropylene facer.

.1 Self-adhesive membrane compatible with vapour retarder membrane.

.2 Thickness: 0.6 mm (24 mil)

.3 Tensile Strength MD/XD: to ASTM D882, 5.95/3.65 kN/m

.4 Water Vapour Permeance: to ASTM E96 methods A and B, 629 ng/Pa*s*m2 911 perm) and 972 ng/Pa*s*m2 (17 perm)

.5 Air permeability at 75 Pa: to ASTM E2178, 0.0025 L/s*m2.

.6 Flame Spread: to ASTM E84, Class A.

2.3 SEALANTS

.1 Sealants in accordance with Section 07 92 00- Joint Sealants.

.2 Buty Sealant Type A: CGSB 19-GP-14M, butyl rubber base, single component, solvent release, non-skinning, Shore "A" Hardness Range of 10 to 30; black colour.

.3 Sealant Type B: CAN/CGSB-19.13M, single component, chemical curing, capable of continuous water immersion, non-sagging type, Shore "A" Hardness Range of 20 to 35 to black colour.

2.4 ACCESSORIES

.1 Thinner and cleaner for Butyl Sheet: as recommended by sheet material manufacturer.

.2 Attachments: galvanized steel bars and anchors.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 GENERAL

.1 Perform Work in accordance with Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification requirements for materials installation.

.2 Perform Work in accordance with National Air Barrier Association - Professional Contractor Quality Assurance Program and requirements for installation materials.

.3 Perform Work in accordance with Canadian Urethane Foam Contractor's Association - Professional Contractor Quality Assurance Program and requirements for installation materials.

3.3 EXAMINATION

.1 Verify that surfaces and conditions are ready to accept work of this section.

.2 Ensure surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer's requirements.

.3 Report unsatisfactory conditions to Consultant in writing.

.4 Do not start work until deficiencies have been corrected.

.1 Beginning of Work implies acceptance of conditions.

.5 The following are unacceptable for applied membrane:

.1 Fishmouths and folds,

.2 Blisters and bulges,

.3 Insufficient overlaps,

.4 Inadequate adhesion,

.5 Punctures, tears, cuts.

.6 Other similar defects.

3.4 PREPARATION

.1 Remove loose or foreign matter, which might impair adhesion of materials.

.2 Ensure substrates are clean of oil or excess dust; masonry joints struck flush, and open joints filled; and concrete surfaces free of large voids, spalled areas or sharp protrusions.

.3 Ensure substrates are free of surface moisture prior to application of self-adhesive membrane and primer.

.4 Ensure metal closures are free of sharp edges and burrs.

.5 Prime substrate surfaces to receive adhesive in accordance with manufacturer's instructions.

3.5 INSTALLATION

.1 Install materials in accordance with manufacturer's instructions.

.2 Secure sheet seal to gypsum board materials with self-adhesive.

.1 Position lap seal over firm bearing.

.3 Apply sealant within recommended application temperature ranges.

.1 Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11- Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.7 PROTECTION OF WORK

.1 Protect finished work in accordance with Section 01 61 00- Common Product Requirements.

.2 Do not permit adjacent work to damage work of this section.

.3 Ensure finished work is protected from climatic conditions.

END OF SECTION

PART 1 General

1.1 INTENT

.1 This specification Section specifies the supply, fabrication and installation of the wall panel system specified, including panel supports and anchorage to the building structure.

.2 It is expected that the same subcontractor will supply and install the vapour and air seal membrane and the wall insulation.

1.2 RELATED SECTIONS

.1 Section 07 21 13 – Board Insulation.

.2 Section 07 26 00 – Vapour Retarders.

.3 Section 07 62 00 – Sheet Metal Flashing and Trim.

1.3 SUSTAINABILITY REQUIREMENTS

.1 Refer to Section 01 35 43 - Environmental Procedures for requirements relevant to this section.

1.4 REFERENCES

.1 International Code Council (ICC) Evaluation Service Evaluation Report ESR-1687.

1.5 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Design panel system so that all finishes, support and attachment systems conform to requirements of authority having jurisdiction.

.2 Panel deflection shall not exceed L/175. Panels shall exhibit no permanent deformation when subjected to positive and negative pressures caused by local 1/50 design wind loads indicated in Table C-2, Division B, Appendix C of the latest edition of the Alberta Building Code.

.3 Deflection of panel support framing shall not exceed L/175.

.4 Make allowance in the panel design for movement within the system caused by deflection of the building structure and to accommodate variations in plane of system substrate.

.5 Provide adequate stiffening to prevent wind induced vibration and materials fatigue.

.6 Design and install system to accommodate panel expansion and contraction without causing visible panel warping or deformation of fastening system, singly or in combination, caused by:

.1 Temperature range from 1% January design temperature to 2.5% July dry design temperature for the project location indicated in Table C-2, Division B, Appendix C of the latest edition of the National Building Code.

.2 Surface temperature variation of 85 centigrade degrees.

.3 Anticipated ambient relative humidity range.

.7 Water Ingress and Egress: Panel system shall be designed in accordance with the rain screen principles published by the National Research Council of Canada. The intent is to:

.1 Provide a barrier to:

.1 Rain.
.2 Snow.
.3 Insects.

.2 Equalize air pressure between the exterior and interior of the panels such that exterior moisture is not drawn into the system.

.3 Facilitate drainage to the exterior of any moisture that does enter the system.

.8 Thermal Transmission:

.1 Wall insulation and panel support framing shall be in two layers having the same profile thickness to minimize thermal bridging.

.2 The first layer of framing shall be anchored to the building structure.

.3 The second support framing layer shall be perpendicular to the first layer and separated from the first layer by 6mm thick neoprene pads.

.9 Design panel system to transmit all loads to the main structure without exceeding the capacity of any fastener.

.10 Panel cladding system shall have a flush appearance from the exterior with no visible irregularities and with no reveal other than the design module joint width.

.11 Minimize penetrations through sheet membrane air and vapour barrier.

.12 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:

.1 Outdoor exposure period: 2500 hours.
.2 Humidity resistance exposure period: 5000 hours.

1.6 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

.1 Comply with requirements of Section 01 33 00 - Submittal Procedures.

.2 Shop drawings shall incorporate design and performance criteria and requirements of related work which may affect work of this Section, including the following:

.1 Panel layout on building elevations and if applicable, reflected soffit plan.
.2 Panel dimensions.
.3 Fastening and anchoring methods.
.4 Layout of exposed fasteners. Identify fixed and "loose" fastener locations.
.5 Detail and location of joints.
.6 Provisions to minimize thermal bridging.
.7 Provision for expansion and contraction of system components.
.8 Rain screen principles for pressure equalization and drainage.
.9 Details at openings and at mechanical and electrical fixtures and penetrations.
.10 Head, jamb and sill details.
.11 Materials and finish.
.12 Transition to adjoining exterior wall finishes.

.3 Shop drawings shall be signed and sealed by a Professional Engineer specializing in structural design and licensed to practice in the Province, attesting to the ability of the metal panel assembly to meet requirements related to movement and distortion under the specified thermal and wind induced loads, including inward and outward loads, and loads induced by deflection of the building structure.

.3 Submit product data sheets for panel system materials. Include product characteristics, performance criteria, limitations and colours.

.4 Submit duplicate 400 x 400 mm samples of panels, including typical joint intersection, secured to an assembly of fastening system to building, representative of materials, finishes and colours.

1.7 QUALIFICATIONS

.1 Fabrication and installation shall be by a firm approved for the project by panel manufacturer.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Store and protect material from weather and from damage due to construction activities.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

1.10 MOCK-UP

.1 Provide a mock up wall approximately 3 m x 3 m illustrating vapour and air seal membrane, insulation, panel anchorage system, panels and joints, coping, corner detail and transitions to adjacent dissimilar exterior finishes.

.2 Mock-up shall include all components of the wall system and if approved by Consultant may be incorporated into finished work.

.3 Notify 72 hours before installation of mock-up for inspection by Consultant. Do not proceed further with panel system work until mock-up has been approved.

1.11 EXTENDED WARRANTY

.1 Provide panel manufacturer's standard written warranty covering failure of factory-applied exterior finish on panels, occurring after expiry of standard contract warranty period.

1.12 PRODUCT OPTIONS AND SUBSTITUTIONS

.1 Refer to Section 01 62 00 – Product Options and Substitutions for requirements related to product options and substitutions.

PART 2 Products

2.1 PANEL SYSTEM COMPONENTS

.1 Panels:

.1 Acceptable Product: Trespa Meteon FR, minimum 8 mm thick, manufactured by Trespa International B.V. represented in North America by:

Trespa North America Ltd.
62 Greene Street
New York, NY 10012
Tel: 1 800 487 3772
Info.NorthAmerica@Trespa.com

Represented in Alberta by:

Contact: Greg Gerhart
Allied Technical Sales Ltd.
Tel: 403 461 3188

.2 Decorative high-pressure laminate to EN 438-6:2005 and having properties published on manufacturer's web site.

.2 Exposed Panel and Joint Face Colours: Refer to drawings.

.3 Exposed Fasteners: stainless steel, head compatible with panel manufacturer's standard caps coloured to match specific panel faces on which caps are located.

.4 Non-Exposed Fasteners: hot dip galvanized steel or stainless steel.

.5 Panel Anchorage System: two layers of continuous metal framing, perpendicular to each other, and as follows:

.1 First Layer: attached to building structure: extruded aluminum or hot dip galvanized steel, Z275 coating, secured to building structure.

.2 Second Layer: extruded aluminum or, if not directly supporting panels, hot dip galvanized steel, Z275 coating.

.3 Panel Support Framing/Cavity Spacer: extruded aluminum.

.6 Thermal Break Pads: minimum 3mm thick neoprene, to thermally isolate layers of panel support framing.

.7 Adjustable Metal Clip Angles: manufactured from extruded aluminum or Z-275 hot dip galvanized steel, designed to accommodate construction tolerances, expansion and contraction of the panel system and panel system design load requirements.

.8 Insulation: mineral fibre, as specified in Section 07 21 13 – Board Insulation, thickness for two layer installation between panel support framing members.

.9 Sheet Membrance Air/Vapour barrier as specified in Section 07 26 00 – Vapour Retarders.

.10 Flashings and Transition Strips: extruded or minimum 1.2 mm thick brake shaped sheet aluminum, colour to match adjacent exposed panel faces.

2.2 FABRICATION

.1 Panel dimensions: base panel dimension by field measurement. Make allowance for field adjustments as recommended by manufacturer.

.2 Panel lines, breaks and angles: sharp, true and surfaces free from warp or buckle.

.3 Provide fastener hole dimensions to allow for concentric panel expansion and contraction and as recommended by manufacturer.

PART 3 Execution

3.1 EXAMINATION

.1 Before installation examine alignment of substrate and notify Consultant in writing if substrate does not comply with requirements.

3.2 INSTALLATION

.1 Subject to project schedule constraints, install panels as close as possible to middle of local ambient air temperature range.

.2 Install vapour and air seal membrane and insulation in accordance with related specification Sections and as indicated on drawings.

.3 Install panel anchorage and panels in accordance with:

.1 Panel manufacturer's written instructions and recommendations.

.2 Accepted shop drawings.

.4 Fasten to allow for movement due to thermal and humidity induced expansion and contraction and wind loads. Take care not to over-tighten panel fasteners that are intended to allow panel expansion and contraction.

.5 Maintain following installation tolerances:

.1 Maximum variation from plane or location shown on shop drawings: 10 mm in 10 m, non-cumulative.

.2 Maximum deviation for vertical member: 3 mm in an 8.5 m.

.3 Maximum deviation for a horizontal member: 3 mm in an 8.5 m.

.4 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75 mm.

.6 Remove strippable coating from panels, if applicable, as they are installed.

3.3 CLEAN-UP

.1 Leave work clean, free from grease, finger marks and stains.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 21 13 – Board Insulation

.2 Section 07 26 00 – Vapour Retarders

.3 Section 07 27 00 – Air Barriers

.4 Section 07 62 00 – Sheet Metal Flashing and Trim.

1.2 REFERENCES STANDARDS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process

.2 ASTM B209-10, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate

.3 ASTM B211-12e1, Standard Specification for Aluminum and Aluminum Alloy Rolled or Cold Finished Bar, Rod, and Wire

.4 ASTM B221-12, Standard for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

.5 ASTM C1166-06(2011), Standard Test Method for Flame Propagation of Dense and Cellular Elastomeric Gaskets and Accessories

.6 ASTM C1185-08(2012), Standard Test Methods for Sampling and Testing Non Asbestos FIBER REINFORCED CEMENT Flat Sheet, Roofing and Siding Shingles, and Clapboards

.7 ASTM C1186-08(2012), Standard Specification for Flat Fibre Reinforced Cement Sheets

.8 ASTM D395-03(2008), Standard Test Methods for Rubber Property Compression Set

.9 ASTM D412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers Tension

.10 ASTM D624-00(2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

.11 ASTM D746-07, Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact

.12 ASTM D1149-07(2012), Standard Test Methods for Rubber Deterioration Cracking in an Ozone Controlled Environment

.13 ASTM D2240-05(2010), Standard Test Method for Rubber Property Durometer Hardness

.14 ASTM E96/E96M-12, Standard Test Methods for Water Vapour Transmission of Materials

.15 ASTM E2178-11, Standard Test Method for Air Permeance of Building Materials

.2 Underwriter Lavatories of Canada (ULC):

.1 CAN/ULC-S102-10, Surface Burning Characteristics of Building Materials and Assemblies

.2 CAN/ULC-S114-05, Standard Method of Test for Determination of Non-combustibility in Building Materials

.3 CAN/ULC-S134-92, Fire Test for Exterior Wall Assemblies

.4 CAN/ULC-S135-04, Standard Test Method for the Determination of Combustibility Parameters of Building Materials Using an Oxygen Consumption Calorimeter (Cone Calorimeter), Includes Amendment 1

.3 Canadian Construction Materials Centre (CCMC):

.1 CCMC 13549-R, Technical Guide 07 193 Sheathing Membrane - Breather Type

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate the Work of this Section with the installation of gypsum sheathing board and air barrier; Sequence work so that installation of fibre reinforced cement panels and support framing coincides with installation of substrate preparation without causing delay to the Work.

1.4 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit manufacturer’s data sheets covering the care and recommended maintenance procedures for incorporation into maintenance manuals.

.2 Shop Drawings: Submit shop drawings of panel systems, components, façade material, panel layout and accessories to the Consultant for review.

.3 Samples:

.1 Submit for approval 100mm x 150mm (4" x 6") sample of proposed colour and texture for Consultant's acceptance.

.2 Submit full size samples of accessories as requested by Consultant.

.4 Manufacturers Warranties: Submit copies of manufacturers warranties.

1.5 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Submit manufacturer’s written instructions for cleaning solutions, materials and procedures, include name of original installer and contact information.

.1 Provide specific warning of any maintenance practice or materials that may damage or disfigure the finished Work.

1.6 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Manufacturer / Supplier: Obtain materials from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties.

.2 Installers: Execute Work of this Section using qualified personnel skilled in installation of work of this Section, having a minimum of five (5) years proven

experience of installations similar in material, design, and extent to that indicated for this Project.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Delivery: At the time of delivery, visually inspect all materials for damage. Note any damaged to materials on the receiving ticket and immediately report to the shipping company and the material manufacturer.

.1 Remove damaged materials from the site immediately.

.2 Storage: Store materials in accordance with manufacturer's written instructions, raised off the ground and cover with a weather proof flame resistant sheeting or tarpaulin.

.3 Handling: Material shall be handled in accordance with sound material handling practices and in accordance with manufacturer's written instructions.

1.8 SITE CONDITIONS

.1 Site Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings where fibre reinforced cement panels are indicated to fit walls and other construction.

.2 Establish dimensions and proceed with fabricating fibre reinforced cement panels where field measurements cannot be made without delaying the work; allow for site trimming and fitting.

.3 Ambient Conditions: Install materials outlined in this Section after completion of work by other Sections is complete, and all penetrations are watertight; to provide adequate dry, clean, level, and plumb surfaces for installation and adhesion.

1.9 WARRANTY

.1 Warrant the work of this section in accordance with manufacturer's warranty for a period of ten (10) years from date of delivery of material and agree to repair or replace faulty materials which becomes evident during the warranty period without cost to the Owner and at the Owner's convenience.

.2 Warranty includes but is not limited to: Maintain the mechanical qualities, water tightness and frost resistance, providing the panels are correctly installed on a ventilated construction in accordance to the installation procedures outlined in this Section.

.3 Special Finish Warranty: Submit a written warranty, signed by manufacturer, covering failure of the exterior finish on fibre reinforced cement panels within the specified warranty period and agreeing to repair finish or replace panels that show evidence of finish deterioration.

.1 Deterioration of finish includes, but is not limited to, colour fade, chalking, and cracking, for a period of ten (10) years from date of Substantial Performance.

1.10 SCOPE

.1 Work furnished and included:

.1 Panel Profile.

.2 Associated flashings.

.3 Supporting brake metal angled and other required supports for panels.

.4 Semi-Rigid insulation, refer to Section 07 21 13.

.5 Membrane vapour retarders, refer to Section 07 26 00.

.6 Membrane air barriers, refer to Section 07 27 00.

.2 Related work not included:

.1 Structural framing required to support the cladding system.

Part 2 Products

2.1 MATERIALS DISTRIBUTORS

.1 Materials and accessories specified herein are distributed by: Engineered Assemblies.

2.2 PERFORMANCE REQUIREMENTS

.1 Delegated Design: Design fibre reinforced cement panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

.2 Structural Performance: Provide fibre reinforced cement panel assembly capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:3

.1 Wind Loads: Uniform pressure of 40 psf inward and outward wind pressures.

.2 Deflection Limits: fibre reinforced cement panel assemblies shall provide L/180 maximum deflection stiffness required by the panel manufacturer.

.3 Condensation: Panels shall accommodate positive drainage for moisture entering or condensation occurring within panel system.

.3 Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and night time-sky heat loss.

.1 Temperature Change (Range): Temperature range from 1% January design temperature to 2.5% July dry design temperature for the project location indicated in Table C-2, Division B, Appendix C of the latest edition of the National Building Code.

.2 Surface temperature variation of 85 centigrade degrees.

.4 Design to accommodate, by means of control joints, movement in wall system and between wall system and building structure, caused by structural movements, without permanent distortion, damage to in fills or racking of joints.

.5 Air space at top and bottom of building, or each wall termination, for buildings less than 18m (60'), shall be 25mm (1") to facilitate airflow from behind the panels. Do not block vertical airflow at windows, doors, eaves, or at the base of the building. Airflow shall be continuous from bottom to top so there is air movement behind each panel. For walls over 18m (60') in height, increase the ventilated cavity between rear of panels and exterior sheathing to 32mm (1-1/4"). Air flow behind the panels is critical to the performance of the Rear Ventilated Rain Screen design.

.6 Fasteners shall accommodate thermal expansion/contraction without excessive stress to the panel. Each panel shall have central lock points to support gravity loads.

.7 Design members and suspension system to withstand gravity load, live loads, including negative loads, as calculated in accordance with the building code.

.8 Structural panel supports shall provide the minimum L/300 deflection stiffness required by the panel manufacturer. Panels themselves shall not deflect more than L/180 maximum at serviceability limit states.

2.3 MATERIALS

.1 Fibre C Panel, Rieder Series, Fibre Reinforced Cement Panels (FRCP):

.1 Fully compressed, autoclaved FRCP, color through-out the panel. The surface of the panel is characterized by fine sanding lines in the long direction.

.2 Application:

.1 Exterior Facades

.3 Thickness: 13 mm (1/2")

.4 Dimensions:

.1 Provide special sizes to match seems shown on drawings.

.5 Finish:

.1 Through-colored, semi-transparent finish

.2 Colored finish with an additional, permanent, clear, waterproof top-coating.

.6 Physical Characteristics: ASTM C1185, ASTM C1186, and EN 12467.

.7 Bulk Density: 2,420 kg/m³

.8 Bending tensile strength: >18.0 N/mm^2

.9 Modulus of elasticity for deformation calculation: 10,000 N/mm^2.

.10 Modulus of elasticity for restraint calculation: 30,000 N/mm^2.

.11 Moisture Expansion 0-100%, mean: 0.05%.

.12 Strength classification (EN 12467): Class 4.

.13 Thermal conductivity: 2.0 W/mK

.14 Fire reaction: (CAN/ULC-S135) Suitable for non-combustible construction in Canada.

.15 Basis of Design:

.1 Fibre C, Rieder Series, Fibre Reinforced Cement Panels as manufactured by Euro Panel and distributed by Engineered Assemblies.

.16 Anchors to be exposed.

.2 Substructure:

.1 Vertical Girts:

.1 Vertical girts supporting panels are 1.2mm (18 gauge) thick, galvanized zinc-coated steel to ASTM A653 with Grade A coating Z275. Painted black.

.1 Shop Primers: Provide primers that are compatible with paint systems specified in Section 09 91 00.

.2 Preformed galvanized metal sheet, 1.2mm (18 gauge) thick, minimum base steel nominal thickness, notched or perforated for drainage.

.3 Girt locations as determined and approved by engineer of record, to align with modular panel fasteners spaced based on manufacturer's panel load data.

.4 Front fastened systems:

.1 Girts behind panels to be vertical to allow vertical ventilation.

.2 Preformed black galvanized steel girts to be used at inside and outside corners to ensure corners are straight and closed visually, and used at intermediary panel locations and where panels come together.

.3 Girts provided by Engineered Assemblies; info@engineeredassemblies.com or (905) 816-2218.

.5 Cavity behind panel: Minimum 25mm (1") of unrestricted space.

.6 Gap between panels: Minimum of 8mm (5/16") to allow for expansion and contraction.

.7 EPDM Rubber Separation Strip: Designed and supplied by Engineered Assemblies to be installed between the panel and the vertical girt to allow movement between panel and support system, meeting the following:

.1 Shore "A" Hardness: ASTM D2240.

.2 Compression Set, 22h at 212°F (100°C): ASTM D395.

.3 Ozone Resistance, 100 mPa 100h @ 104°F (40°C) 20%

.4 Elongation: ASTM D1149.

.5 Tensile Strength: ASTM D412.

.6 Elongation at Rupture: ASTM D412.

.7 Tear Strength: ASTM D624.

.8 Brittleness Temperature at -40°F (-40°C): ASTM D746.

.9 Flame Propagation, Option II; ASTM C1166.

.8 Substructure to account for control joints of building to ensure a girt is not connected across the control joint.

.9 Install panels across one set of vertical girts to ensure that expansion and contraction of the substrate is controlled within framing members.

.2 Horizontal Clip System: 38mm (1-1/2") wide, die cut aluminum extruded clip, adjustable to plumb structure, minimum 1.2mm (18 gauge) thick galvanized zinc-coated steel to ASTM A653. System to provide compliance to ASHRAE 90.1 and thermally broken façade requirements of the building code.

.1 Adaptable horizontal framing members.

.2 Clip Depth: to accommodate insulation depth.

.1 150mm (6")

.3 Vertical Clip Spacing:

.1 864mm (34")

.2 1041mm (41")

.3 1220mm (48")

.3 Basis of Design Product: EA RVRS TClip and Girt, Model T150, by Engineered Assemblies.

.3 Fasteners:

.1 Colour matched stainless steel rivets, as per Engineered Assemblies recommendations. No dissimilar materials allowed, in selection of fasteners.

.2 All holes are pre-drilled in the panel at same diameter

.3 Fixed holes include a stainless steel grommet on the rivet stem.

.4 Floating holes have rivet only.

.4 Bird and Vent Screen:

.1 Continuous bird and vent screen located at top and bottom of panel system, where opening is minimum 25mm (1") wide, with minimum 50% free air flow, manufactured by Engineered Assemblies from perforated aluminum, painted black.

.5 Flashings: Prefinished steel as specified in Section 07 62 00 – Sheet Metal Flashings and Trim.

.1 Flashings at edges, top and bottom of panel system as per architectural drawings.

.6 Vapour Barriers in accordance with Section 07 26 00 – Vapour Retarders.

.7 Insulation: As indicated in Section 07 21 13 – Board Insulation.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions:

.1 Examine substrates to receive work and surrounding adjacent surfaces for conditions affecting installation. Coordinate with related sections to ensure proper dimensions are maintained.

.2 Verify site dimensions by accurate field measurements so that work will be accurately designed, fabricated and fitted to the structure.

.3 All penetrations through the façade for the work of other trades shall be fitted with a watertight sleeve. Verify flashings are in place, sealed with waterproof membrane and covered with building membranes.

.4 Maintain sheathing membrane integrity.

.2 Notify Contractor in writing of any conditions that are not acceptable.

.3 Proceed with installation after verification and correction of surface conditions acceptable to manufacturer.

3.2 INSTALLATION

.1 Erect panel system and sub-framing in accordance with manufacturer’s instructions.

.2 Erect panels in straight lines, true, level and plumb. Maintain dimensions required by manufacturer for minimum distances from edge for holes and penetrations.

.3 Fasten support profiles to horizontal sub-frame, anchored to the exterior wall assembly. Support profiles include joint insert to align the panels and resist movement. Install fixed or adjustable sub-frame to accommodate panelized or irregular wall construction. Joints of the bearing profiles may not be overlapped by cladding panels.

.4 Girt locations as determined and stamped by Professional Engineer, to align with modular panel fasteners spaced based on manufacturer's panel load data.

.5 Space at top and bottom of each wall minimum 25mm (1"), as per manufacturer's details. Install perforated, preformed black aluminum bird screen within the gap, to allow for ventilation and reduce rodent infiltration.

.6 Install panels by "Lift and Lock" assembly, allowing for replacement of damaged panels without use of special tools or removal of adjacent panels.

.7 Installation to allow for thermal expansion of the panel. Provide a minimum of 10mm (3/8") space between top and bottom of each panel.

.8 Size of rivets as per manufacturer's written instructions. No other types of fasteners are acceptable. Exposed rivets shall not be accepted unless by the Consultant in writing.

.9 Install panels with joints centered over framing. Install all joint inserts straight to the panel, as recommended by panel manufacturer.

.10 Do not install using damaged, warped or misaligned material.

.11 Where panels fit into accessories, allow room for expansion.

.12 Finished installation shall be properly secured, free of rattles, distortions, waviness, and protrusions, damaged or chipped components.

.13 Cut and flash wall penetrations with metal flashing.

.14 Install breathable sheathing membrane in accordance to manufacturer's instructions. No penetrations are to be left in installed membrane.

3.3 CLEANING

.1 Progress Cleaning: Leave work area clean at the end of each workday, ensuring safe movement of passing pedestrians.

.2 Final Cleaning: At completion of installation, clean all surfaces so they are free of foreign matter using cleaners recommended by material manufacturer.

.3 Restore panels and accessory components damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by the Consultant, remove and replace damaged systems with new at no additional cost to the Owner.

.4 Waste Management: Co-ordinate recycling of waste materials and packaging at appropriate facility, diverting waste from landfill. Certified installer shall be responsible for ensuring waste management efforts are practiced.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 62 00 – Sheet Metal Flashing and Trim.

.2 Section 07 92 00 – Joint Sealants

1.2 REFERENCES STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B18.6.3- 2013, Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series).

.2 ASTM International

.1 ASTM D2369-10(2015)e1, Test Method for Volatile Content of Coatings.

.2 ASTM D2832- 92(2016), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.

.3 ASTM D5116-10, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.

.3 CSA International

.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.4 Environmental Choice Program (ECP)

.1 CCD-045-95, Sealants and Caulking Compounds.

.5 Green Seal Environmental Standards (GS)

.1 GS-36-11, Standard for Commercial Adhesives.

.6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

.7 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S706-09, Standard for Wood Fibre Insulating Boards for Buildings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal siding and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.

.1 Indicate VOC's for caulking materials during application and curing.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Canada.

.2 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, soffits, fascia, metal furring, and related work.

.4 Samples:

.1 Submit duplicate 300 x 300 mm samples of siding material, of colour and profile specified.

.5 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating construction wastes were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

.4 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants, paints and coatings used in building, comply with VOC and chemical component limits or restriction requirements.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal siding from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse and return of pallets and crates as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 STEEL CLADDING AND COMPONENTS, CORRUGATED SIDING

.1 Sheet Steel: exposed to exterior, to ASTM A653M-96, Grade A, Z180 coating designation factory prefinished.

.2 Finish coating: Class.

.3 Colour: Vic West 56072 Charcoal

.4 Thickness: 0.76mm base metal thickness.

.5 Profile: 68 x 22mm deep, corrugated siding

2.2 FASTENERS

.1 Nails: CSA B111. Screws: ASME B18.6.3. Purpose made, cadmium plated steel.

2.3 CAULKING

.1 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.1 Test for acceptable VOC emissions in accordance with ASTM D2369 and ASTM D2832.

.2 Sealants: Comply VOC limit to SCAQMD Rule 1168 GS-36.

2.4 ACCESSORIES

.1 Exposed trim: inside corners, outside corners, drip cap, undersill trim, starter strip and window/door trim of same material, colour, gloss as cladding, with fastener holes pre-punched.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections are acceptable in accordance with manufacturer's written instructions.

.1 Visually review substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 INSTALLATION

.1 Install cladding in accordance with CGSB 93.5, and manufacturer's written instructions.

.2 Install one layer exterior wall sheathing paper horizontally by stapling lapping edges 150mm.

.3 Install continuous starter strips, inside and outside corners, edgings, drip, cap, sill and window/door opening flashings as indicated.

.4 Install outside corners, fillers and closure strips with carefully formed and profiled work.

.5 Install fascia cladding as indicated.

.6 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.

.7 Attach components in manner not restricting thermal movement.

.8 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07 92 00 - Joint Sealants.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by preformed metal siding installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 61 00 – Sheet Metal Roofing

.2 Section 07 62 00 – Sheet Metal Flashing and Trim

1.2 REFERENCE STANDARDS

.1 ASTM International Inc.

.1 ASTM C1396/C1396M-17, Standard Specification for Gypsum Board.

.2 ASTM D41-05/D41M-11(2016), Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.

.3 ASTM D6162/D6162M-16, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fibre Reinforcements.

.4 ASTM D6163/D6163M-16, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.

.5 ASTM D6164/D6164M-16, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.

.2 Alberta Roofing Contractors Association (ARCA)

.1 ARCA Roofing Specifications Manual-1997.

.3 Canadian Standards Association (CSA International)

.1 CSA A123.21-14, Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane-Roofing Systems

.2 CSA A231.1-14/A231.2-14, Precast Concrete Paving Slabs/Precast Concrete Pavers.

.3 CSA O121-17, Douglas Fir Plywood.

.4 CSA O151-17, Canadian Softwood Plywood.

.4 Factory Mutual (FM Global)

.1 FM Approvals - Roofing Products.

.5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.6 Underwriters Laboratories' of Canada (ULC)

.1 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.2 CAN/ULC-S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Convene pre-installation meeting two weeks prior to beginning roofing Work, with roofing contractor's representative and Consultant in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart to:

- .1 Verify project requirements.
- .2 Review installation and substrate conditions.
- .3 Co-ordination with other building subcontractors.
- .4 Review manufacturer's installation instructions and warranty requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

- .1 Provide electronic copy of most recent technical roofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Provide two copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures, and indicate VOC content for:
  - .1 Primers.
  - .2 Sealers.

.3 Provide shop drawings:

- .1 Indicate tapered insulation, flashing and control joints, details.
- .2 Provide layout for tapered insulation.

.4 Manufacturer's Certificate: certify that products meet or exceed specified requirements.

.5 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.

1.5 QUALITY ASSURANCE

.1 Installer qualifications: company or person specializing in application of modified bituminous roofing systems approved by manufacturer.

1.6 FIRE PROTECTION

.1 Fire Extinguishers:

- .1 Maintain one stored pressure rechargeable type with hose and shut-off nozzle,
- .2 ULC labelled for A, B and C class protection.
- .3 Size as indicated on roof per torch applicator, within 6m of torch applicator.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions, Section 01 61 00- Common Product Requirements.

.2 Storage and Handling Requirements:

.1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.

.2 Provide and maintain dry, off-ground weatherproof storage.

.3 Store rolls of membrane in upright position. Store membrane rolls with salvage edge up.

.4 Remove only in quantities required for same day use.

.5 Place plywood runways over completed Work to enable movement of material and other traffic.

.6 Store sealants at +5 degrees C minimum.

.7 Store insulation protected from weather and deleterious materials.

.3 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.2 Fold up metal banding, flatten and place in designated area for recycling.

1.8 SITE CONDITIONS

.1 Ambient Conditions

.1 Do not install roofing when temperature remains below -18 degrees C for torch application.

.2 Minimum temperature for solvent-based adhesive is -5 degrees C.

.2 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.

1.9 WARRANTY

.1 Provide the Owner, through “A.R.C.A” a written five (5) year A.R.C.A. Warranty stating that the roofing system has been constructed in accordance with the plans and specification and that the workmanship has followed the requirements of the membrane manufacturer.

.2 The certificate must state that the roofing system will remain weather tight and free from imperfections for a minimum of five (5) years from the date of construction completion certificate and that any and all damage resulting from failure to provide above stated performance shall be repaired to the satisfaction of the Owner at no additional cost.

.3 Provide the Owner, through the “Membrane Manufacturer”, an additional five (5) year material guarantee stating this roofing system shall remain watertight and free from material defects for a total of ten (10) years after the final completion date and that all repairs and/or replacement shall be carried out at no additional cost to the Owner.

.4 Non A.R.C.A.-Member bidders must include proof of fire-safety training, including successful completion of the roofer certification program for crew members.

.5 Non A.R.C.A. Member bidders must supply a five (5) year Bond worth 20% or $500,000, whichever is less, of the value of the project for five (5) years upon completion of

deficiency stage of contract. The bond must come complete with a total of two inspections by ARCA Warranty Ltd. Accredited roofing inspector at two (2) year and four (4) year marks. The costs of the bond and inspections are the responsibility of the contractor and shall be added to the value of the bond. The bond must be responsible for any deficiencies or warranty work immediately following the inspections. The bond must be continuous for five (5) years. Two (2) year bonds with options to renew will not be acceptable.

Part 2 Products

2.1 PERFORMANCE CRITERIA

.1 Compatibility between components of roofing system is essential. Provide written declaration to Consultant stating that materials and components, as assembled in system, meet this requirement. Roof membranes must be by same manufacturer as air barrier and vapour retarder membranes.

.2 Roofing System: to CSA A123.21 for wind uplift resistance.

2.2 DECK COVERING

.1 Gypsum board sheathing: to ASTM C1396/C1396M, 12.7 mm thick.

2.3 DECK PRIMER

.1 Asphalt primer: to CGSB 37-GP-9Ma.

2.4 VAPOUR RETARDER

.1 SBS Modified Bitumen Membrane, to CGSB 37-GP-56, 2.2mm thickness, reinforced with 95m^2 glass fleece, lightly sanded top surface and thermofusible film on underside.

.2 Soprema SopraVap R or IKO MVP, fully adhered with primer.

2.5 ADHESIVE

.1 Adhesive for securing overlay board and insulation: asphalt extended vulcanized adhesive, two-component unit, consisting of two liquids mixed on site to produce pourable adhesive. Soprema Duotack or acceptable substitute.

2.6 POLYSTYRENE INSULATION

.1 Extruded polystyrene (XPS) insulation, Expanded polystyrene (EPS) insulation to CAN/ULC-S701, Type 4, thickness as indicated, square edges.

2.7 TAPERED SUMP INSULATION AT DRAINS

.1 Provide the following:

.1 Polisocyanurate: to CAN/ULC S704-03, Type 2, Class 3; HCFC-free construction; minimum LTTR of 0.99 RSI (5.6R) value per 25mm thickness; with inorganic fibre-reinforced facer; minimum 138 kPa compression strength.

2.8 LAMINATED PRIMARY MEMBRANE BASE SHEET

.1 Soprema Soprasmart Board 180, 4.8 mm thick or IKO Protectobase Board 180, 4.8 mm thick.

.2 Install over insulation to provide torch safe surface.

2.9 CAP SHEET:

.1 Soprema Sopralene Stick HR GR or accepted substitution.

2.10 FLEXIBLE FLASHING AND AIR SEAL MEMBRANE

.1 Provide minimum 2.5 mm thick, SBS modified bitumen pre-manufactured sheet, with manufacturer's standard internal reinforcement, compatible with substrates

2.11 SEALERS

.1 Plastic cement: Rubberized asphalt as per ARCA Requirements

2.12 WALKWAYS

.1 Walkways to consist of one additional ply of cap sheet membrane. Colour to be different from field membrane as selected by Consultant.

2.13 CARPENTRY

.1 Refer to Section 06 10 00.01- Rough Carpentry.

2.14 FASTENERS

.1 Covering to steel deck: No. 10 flat head, self tapping, Type A or AB, cadmium plated screws. Recommend FM Approved screw and plate assemblies.

Part 3 Execution

3.1 QUALITY OF WORK

.1 Do examination, preparation and roofing Work in accordance with Roofing Manufacturer's Specification Manual, ARCA Roofing Specification Manual.

.2 Do priming in accordance with manufacturers written recommendations.

.3 The interface of the walls and roof assemblies will be fitted with durable rigid material plywood providing connection point for continuity of air barrier.

.4 Assembly, component and material connections will be made in consideration of appropriate design loads, with reversible mechanical attachments.

3.2 EXAMINATION OF ROOF DECKS

.1 Verification of Conditions:

.1 Review with Consultant deck conditions including parapets, construction joints, roof drains, plumbing vents and ventilation outlets to determine readiness to proceed.

.2 Evaluation and Assessment:

.1 Prior to beginning of work ensure:

.1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.

.2 Curbs have been built with vapour retarder below.

.3 Roof drains and overflow drains have been installed at proper elevations relative to finished roof surface.

.4 Plywood and lumber nailer plates have been installed to deck, walls and parapets as indicated.

.3 Do not install roofing materials during rain or snowfall.

3.3 PROTECTION OF IN-PLACE CONDITIONS

.1 Cover walls, walks and adjacent work where materials hoisted or used.

.2 Use warning signs and barriers. Maintain in good order until completion of Work.

.3 Clean off drips and smears of bituminous material immediately.

.4 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.

.5 Protect roof from traffic and damage. Comply with precautions deemed necessary by Consultant.

.6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.

.7 Metal connectors and decking will be treated with rust proofing or galvanization.

3.4 DECK SHEATHING

.1 Mechanically fasten to steel deck Glass Mat Gypsum Board with screws reversible mechanical attachments to steel deck's upper rib surfaces, spaced 400mm on centre each way, in accordance with FM190.

.2 Place with long axis of each sheet transverse to steel deck ribs, with end joints staggered and fully supported on ribs.

3.5 PRIMING AUXILLARY LEVELING SURFACE

.1 Apply deck primer to gypsum board roofing substrate at the rate recommended by manufacturer.

3.6 INSTALLATION OF VAPOUR RETARDER ON GYPSUM BOARD SHEATHING- TORCH APPLIED

.1 Install fireguard tape to exposed joints in gypsum board sheathing, including joints between it and up-stands.

.2 Prime existing surfaces prior to installing new vapour retardant. Let the primer flash prior to installing the membrane.

.3 Torch apply the new membrane to the existing vapour retardant.

3.7 (EXPOSED) CONVENTIONAL MEMBRANE ROOFING (CMR) APPLICATION

.1 Insulation: fully adhered, adhesive application:

.1 Adhere insulation to laminated vapour barrier using foam adhesive.

.2 Place boards in parallel rows with ends staggered, and in firm contact with one another.

.3 Cut end pieces to suit.

.4 Apply adhesive in accordance to Manufacturer and ARCA

.5 Separate the membrane and insulation with a drainage layer or slipsheet.

.2 Tapered insulation application:

.1 Mop insulation to vapour retarder and top layer of insulation to bottom layer with hot asphalt at rate of 1 kg/m2.

.2 Install tapered insulation as first insulation layer, accept as detailed otherwise, in accordance with shop drawings. Stagger joints between layers 150 mm minimum.

.3 Laminated Primary Membrane Base Sheet Overlay Board: adhesive application:

.1 Adhere overlay board to insulation with vulcanized adhesive at the rate of 1 litre per m2.

.2 Place boards in parallel rows with end joints staggered. Cap joints approximately 25 mm.

.3 Cut ends to suit and apply adhesive in continuous ribbons at 300 mm on centre.

.4 Cap sheet application:

.1 Starting at low point on roof, perpendicular to slope, unroll cap sheet, align and reroll from both ends.

.2 Unroll and torch cap sheet onto base sheet taking care not to burn membrane or its reinforcement.

.3 Lap sheets 75 mm minimum for side laps and 150 mm minimum for end laps. Offset joints in cap sheet 300 mm minimum from those in base sheet.

.4 Application to be free of blisters, fishmouths and wrinkles.

.5 Do membrane application in accordance with manufacturer's recommendations.

.5 Flashings:

.1 Complete installation of flashing base sheet stripping prior to installing membrane cap sheet.

.2 Install base sheet onto substrate in 1 metre wide strips.

.3 Lap flashing base sheet to membrane base sheet minimum 150 mm and seal by or torch welding.

.4 Lap flashing cap sheet to membrane cap sheet 250 mm minimum and torch weld.

.5 Provide 75 mm minimum side lap and seal.

.6 Properly secure flashings to their support, without sags, blisters, fishmouths or wrinkles.

.7 Do work in accordance with manufacturer's recommendations and Section 07 62 00 - Sheet Metal Flashing and Trim.

3.8 WALKWAYS

.1 Install walkway membrane in accordance with manufacturer's instructions as indicated.

.1 Apply primer to cap sheet membrane and torch apply, ensuring selvage edge is removed.

.2 Install pavers on insulation at rainwater leaders, level on insulation pads, and for ice fall protection as indicated on drawings.

3.9 FIRE SAFETY

.1 Inform Owner of unforeseen fire hazards and obtain instructions before proceeding or continuing with torch application.

.2 An onsite safety person shall be employed by the Contractor and be on site at all times during the roofing process and shall remain on site two (2) hours after torching has stopped. During this period, the safety person shall scan perimeter and roof penetration details with a hand held infrared gun. Localized hot spots to be investigated for potential fire hazards by cut tests.

.3 The safety person shall ensure and enforce all safety requirements of the site, as required by Workers' Compensation safety department. Before proceeding with the work, advise the local fire authority of the nature of the work to be undertaken and dates of construction.

.4 There shall be one fire extinguisher per torch system used on the roof. Failure to provide or not having one available will result in immediate job shut-down.

.5 Keep suitable fire extinguishers within 10 meters of each torch in use.

.6 Do not use torches near wall cladding

.7 Take additional precautions against fire as needed to provide adequate fire safety.

.8 Install fire protection tape over cracks, voids and openings in substrate where a torch applied membrane will be installed.

3.10 FIELD QUALITY CONTROL

.1 Inspections:

.1 Inspection and testing of roofing application will be carried out by a third party inspection agency certified to perform ARCA inspections.

.2 Contractor will pay for seven (7) inspections in different phases of construction from start to finish. Inspection costs to include travel, living allowance, site inspections, testing and reports.

.3 Contractor to schedule inspections with inspection agency according to construction schedule and so all areas of the roof are inspected.

.4 If additional inspections and testing are required Contractor to send request in writing to Owner prior to the final two (2) inspections are completed.

3.11 CLEANING

.1 Remove bituminous markings from finished surfaces.

.2 In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their documented instructions.

.3 Repair or replace defaced or disfigured finishes caused by work of this section.

.4 Waste Management: separate waste materials in accordance with Section 01 74 21-Construction/Demolition Waste Management and Disposal.

.1 Place materials defined as hazardous or toxic in designated containers.

.2 Clearly label location of salvaged material's storage areas and provide barriers and security devices.

.3 Ensure emptied containers are sealed and stored safely.

.4 Divert unused aggregate materials from landfill to local facility for reuse as reviewed by Consultant.

.5 Unused coating material must be disposed of at official hazardous material collections site.

.6 Unused adhesive, sealant and asphalt materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.7 Dispose of unused adhesive material at official hazardous material collections site.

.8 Dispose of unused sealant material at official hazardous material collections site.

.9 Dispose of unused asphalt material at official hazardous material collections site.

.10 Divert unused gypsum materials from landfill to recycling facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 52 00 – Modified Bituminous Membrane Roofing

.2 Section 07 62 00 – Sheet Metal Flashing and Trim

.3 Section 07 92 00 – Joint Sealants

1.2 INTENT

.1 Provide insulated and uninsulated sheet metal roofs, to form a pre-designed roof system.

1.3 REFERENCES

.1 ASTM International

.1 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM A792/A792M-10(R2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.

.3 ASTM D523-14 Standard Test Method for Specular Gloss.

.4 ASTM D822-D822M-13, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.2 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act (CEPA), 1999.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC)

.1 CCMC-2011, Registry of Product Evaluations.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for sheet metal roofing and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Canada.

.4 Samples:

.1 Submit two (2) 300 x 300 mm samples of sheet metal material.

.5 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating construction wastes were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages of recycled content materials and products, showing their costs and percentages of post-consumer and pre-consumer content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates regional materials and products, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.5 QUALITY ASSURANCE

.1 Mock-ups:

.1 Submit mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Fabricate sample roofing panel using identical project materials and methods to include typical seam.

.3 Mock-up may be used:

.1 To judge workmanship, substrate preparation, operation of equipment and material application.

.4 Locate where directed.

.5 Allow 24 hours for review of mock-up by Consultant before proceeding with sheet metal flashing work.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work.

.7 Accepted mock-up may remain as part of finished Work.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect sheet metal roofing from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, and/or crates, as specified in Construction Waste Management Plan in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

1.7 DESCRIPTION OF ROOFS

.1 Roof Type R2 - Insulated:

.1 Standing seam metal panels
.2 Purpose made clips for standing seam panels to allow for 25 mm air space.
.3 175 mm of rigid insulation
.4 Roof vapour barrier membrane
.5 Gypsum board sheathing
.6 Metal deck

.2 Roof Type R4 - Un-insulated:

.1 Standing seam metal panels
.2 Purpose made clips for standing seam panels
.3 Roof vapour barrier membrane
.4 Gypsum board sheathing
.5 Metal deck

Part 2 Products

2.1 STANDING SEAM ROOFING PANELS

.1 Prefinished steel with factory applied silicone modified polyester.

.1 Class F2S.
.2 Colour: Vicwest, Zinc-Quartz, #18-1968.
.3 Specular gloss: 30 units +/-5 to ASTM D523.
.4 Coating thickness: 25 micrometres minimum.
.5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:
  .1 Outdoor exposure period 1000 hours minimum.
  .2 Humidity resistance exposure period 1000 hours minimum.
.6 Metal panel: 0.61 thick, grade 40 to ASTM A653. Seam size 38 mm high spacing 400 mm.
.7 Profile: VicWest Tradition 150 with interlocking ribs at 400 mm spacing.

2.2 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB-37.5.

.3 Sealant: Asbestos-free sealant, compatible with systems materials, recommended by system manufacturer Caulking see Section 07 92 00 - Joint Sealants.

.4 Fasteners: concealed.

.5 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.6 Touch-up paint: as recommended by sheet metal roofing manufacturer.

2.3 FABRICATION

.1 Fabricate sheet metal panels in accordance with AA ASM-35.

.2 Factory formed individual pieces in 2400 mm maximum lengths on Out Building and lengths to suit of clerestory roof. Make allowances for expansion at joints.

.3 Hem exposed edges on underside 12 mm, mitre and seal.

.4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.5 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections are acceptable for sheet metal roofing installation in accordance with manufacturer's written instructions.

.1 Visually review substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Use concealed fastenings except where accepted in writing by Consultant before installation.

.2 Install sheet metal roof panels using cleats spaced at 400 on centre.

.3 Secure cleats with 2 fasteners each and cover with cleat tabs.

.4 Transverse seams in adjacent panels.

.5 Flash roof penetrations with material matching roof panels, and make watertight.

.6 Form seams in direction of water-flow and make watertight.

.7 Clean and flux metals before soldering.

.8 Follow sheet metal manufacturer's recommendations for soldering procedures.

3.3 STANDING SEAM ROOFING

.1 Use 400 mm wide by lengths of sheets to suit for the clerestory roof and 2400 mm for Out Building roof to make roofing with standing seams 400 mm on centre without straight run of standing seam exceeding 10 m.

.2 Fold lower end of each pan under 20 mm.

.1 Slit fold 25 mm away from corner to form tab where pan turns up to make standing seam.

.2 Fold upper end of each pan over 50 mm.

.3 Hook 20 mm fold on lower end of upper pan into 50 mm fold on upper end of underlying pan.

.3 Apply sheet metal roofing beginning at eaves. Loose lock pans to valley flashing and edge strips at eaves and gable rakes.

.4 Finish standing seams 25 mm high on flat surfaces. Bend up one side edge 40 mm and other 45 mm.

.1 Make first fold 6 mm wide single fold and second fold 12 mm wide, providing locked portion of standing seam with 5 plies in thickness.

.2 Fold lower ends of seams at eaves over at 45 degrees angle.

.3 Terminate standing seams at ridge and hips by turning down in tapered fold.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by sheet metal roofing installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 42 33 – Plastic Wall Panel Cladding

.2 Section 07 44 56 – Mineral Fiber Reinforced Cementitious Panels

.3 Section 07 46 13 – Preformed Metal Siding

.4 Section 07 52 00 – Modified Bitumous Membrane Roofing

.5 Section 07 61 00 – Sheet Metal Roofing

.6 Section 08 11 00 – Metal Doors and Frames

.7 Section 08 36 13.02 – Sectional Metal Doors

.8 Section 08 44 13 – Glazed Aluminum Curtain Walls and Aluminum Windows

1.2 REFERENCES STANDARDS

.1 The Aluminum Association Inc. (AAI)

.1 AAI-Aluminum Sheet Metal Work in Building Construction-2002.

.2 AAI DAF45-03, Designation System for Aluminum Finishes.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A606/A606M-15, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.

.2 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM B32-08(2014), Standard Specification for Solder Metal.

.4 ASTM D822/D822M-13,Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.3 Canadian Roofing Contractors Association (CRCA)

.1 Roofing Specifications Manual 1997.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.

.2 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.

.5 Canadian Standards Association (CSA International)

.1 CSA A123.3-05, Asphalt Saturated Organic Roofing Felt.

.2 AAMA/WDMA/CSA 101/I.S.2/A440-2008, Standard/Specification for Windows, Doors, and Unit Skylights.

.3 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.6 Green Seal Environmental Standards

.1 Standard GS-03-93, Anti-Corrosive Paints.

.2 Standard GS-11-97, Architectural Paints.

.3 Standard GS-36-00, Commercial Adhesives.

.7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.8 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule #1113-16, Architectural Coatings.

.2 SCAQMD Rule #1168-05, Adhesives and Sealants.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 43 - Environmental Procedures.

.3 Shop Drawings:

.1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Canada.

.4 Samples:

.1 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, finishes and colours.

.5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section on-site installation, with contractor's representative Consultant in accordance with Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM) Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2

2.1 PREFINISHED STEEL SHEET

.1 Aluminum-zinc alloy coated steel sheet: to ASTM A792/A792M, commercial quality, grade 33with AZ150 coating, regular spangle surface, chemically treated for unpainted finish.

.2 Prepainted Galvanized Steel: commercial quality to ASTM A653/A653M with Z275 zinc coating prepainted with baked on enamel with colours of proven durability for exterior exposure, to CSSBI Technical Bulletin No. 7, 5000 series, 0.76 mm thick (22 ga).

2.2 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Sealants:

.1 Maximum VOC limit compliant with SCAQMD Rule 1168.

.2 One component, elastomeric, chemical curing, VOC compliant with SCAQMD Rule #1168.

.3 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

.4 Fasteners: of same material as sheet metal, to CSA B111, flat head roofing nails of length and thickness suitable for metal flashing application.

.5 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.6 Solder: to ASTM B32, alloy composition Sn50-Zn49.

.7 Flux: commercial quality as recommended by sheet metal manufacturer.

.8 Touch-up paint: as recommended by prefinished material manufacturer.

.1 Maximum VOC limit compliant with Standard GS-11 or SCAQMD Rule 1113.

.9 Flashing anchor clips: 0.80 mm thick galvanized steel.

2.3 FABRICATION

.1 Fabricate metal flashings and other sheet metal work as indicated.

.2 Hem exposed edges on underside 12 mm.

.1 Mitre and seal corners with sealant.

.3 Form end dams for sill flashings to be tied into jamb flashings.

.4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

.6 Construction flashing joints to allow for flashing movement, using flat “S” lock seams.

.7 Maintain minimum of 22 mm lap at all joints. Provide 25 mm anchor projection of “S” locks.

.8 Maintain minimum 1:5 slope on horizontal surfaces of flashings, parapets and control joints.

.9 Fabricate cap flashings to have drip leg minimum 110 mm high.

.10 Fabricate cap and counter flashings to lap 100 mm over base flashings.

2.4 METAL FLASHINGS

.1 Form flashings, copings and fascias to profiles indicated of 0.70mm thick prefinished steel.

2.5 EAVES TROUGHS AND DOWNSPOUTS

.1 Form eaves troughs and downspouts from prefinished steel sheet metal.

.2 Sizes and profiles as indicated.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install sheet metal work as detailed.

.2 Use concealed fastenings except where accepted before installation.

.3 Lock end joints and caulk with sealant.

.4 Install surface mounted reglets true and level, and caulk top of reglet with sealant.

3.3 EAVES TROUGHS AND DOWNSPOUTS

.1 Install eaves troughs and secure to building at 750 mm on centre with eaves trough spikes through spacer ferrules.

.1 Slope eaves troughs to downspouts.

.2 Seal joints watertight.

.2 Install downspouts back to wall.

.1 Secure downpipes to wall with straps at 1800 mm on centre; minimum two straps per downpipe.

.3 Manufacturer's Field Services:

.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 02 81 01 – Hazardous Materials

.2 Section 04 22 00 – Concrete Unit Masonry

.3 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S101-14e5, Standard Methods of Fire Endurance Tests of Building Construction and Materials.

.2 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.3 CAN/ULC-S115-11 (R2016), Standard Method of Fire Tests of Firestop Systems.

1.3 DEFINITIONS

.1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.

.2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.

.3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.

.4 Tightly Fitted: (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction.

.1 Words "tightly fitted" indicates the integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

.3 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.

.1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.

.2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures and.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company specializing in fire stopping installations approved by manufacturer.

.2 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative and Consultant in accordance with

.3 Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.

.2 Storage and Protection:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

.3 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.

.1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended and conforming to specified special requirements described in PART 3.

.2 Fire stop system rating: as noted on drawings.

.2 Service penetration assemblies: systems tested to CAN-ULC-S115.

.3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.

.4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

.7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.10 Sealants for vertical joints: non-sagging.

.11 Repenetrable fire stopping at communication and data cabling.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.

.1 Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

.1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.4 SEQUENCES OF OPERATION

.1 Proceed with installation only when submittals have been reviewed by Consultant.

.2 Install floor fire stopping before interior partition erections.

.3 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.

.4 Mechanical pipe insulation: certified fire stop system component.

.1 Ensure pipe insulation installation precedes fire stopping.

3.5 FIELD QUALITY CONTROL

.1 Notify Consultant when ready for review and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.7 SCHEDULE

.1 Fire stop and smoke seal at:

.1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.

.2 Top and bottom of fire-resistance rated masonry and gypsum board partitions.

.3 Intersection of fire-resistance rated masonry and gypsum board partitions.

.4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.

.6 Openings and sleeves installed for future use through fire separations.

.7 Around mechanical and electrical assemblies penetrating fire separations.

.8 Rigid ducts: greater than 129 cm^2 : fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

.9 Data and Communication Cabling: penetrations to use repenetrable fire stop systems.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 22 00 – Concrete Unit Masonry

.2 Section 06 40 00 – Shop Fabricated Architectural Woodwork.

.3 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM C919-12(2017), Standard Practice for Use of Sealants in Acoustical Applications.

.2 ASTM C920-14a, Standard Specification for Elastomeric Joint Sealants.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Manufacturer's product to describe:

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit WHMIS MSDS in accordance with Section 01 35 43- Environmental Procedures.

.3 Manufacturer's Instructions:

.1 Submit instructions to include installation instructions for each product used.

.4 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Testing to be provided by an independent inspection agency to confirm assemblies field test to STC 46.

1.4 MOCK-UPS

.1 Provide a mock-up for the following applications:

.1 Acoustic sealant between gypsum board perimeter panels and under floor track.

.2 Acoustic sealant between concrete block wall and gypsum board ceiling.

.3 Epoxy sealant around steel fixtures with high build coating finish.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit assembly test information and maintenance data for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect joint sealants

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse by manufacturer of packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21- Construction Waste Management and Disposal.

1.7 SITE CONDITIONS

.1 Ambient Conditions:

.1 Proceed with installation of joint sealants only when:

.1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 5 degrees C.

.2 Joint substrates are dry.

.3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Joint-Width Conditions:

.1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Health Canada.

Part 2 Products

2.1 MANUFACTURERS

.1 Subject to compliance with requirements, manufacturer's products that may be incorporated into the Work include, but are not limited to, the following:

.1 GE Silicones Limited

.2 ChemRex Inc., Sonneborn

.3 Chemtron Manufacturing Ltd.

.4 Dow Corning Canada Inc.

.5 Sika Chemical of Canada Ltd.

.6 Tremco Ltd.

2.2 MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas, which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

.3 Where sealants are qualified with primers use only these primers.

.4 Provide joint sealants, backings, and other related materials that are compatible under conditions of application, as demonstrated by sealant manufactured based on testing and site experience.

.5 Colours of exposed joint sealants will be selected by the Consultant from the manufacturer's complete range to match existing finish materials.

.6 Joint sealants to be paintable grade for exposed interior applications.

2.3 SEALANT MATERIAL DESIGNATIONS

.1 Epoxy Sealant:

.1 Rigid, two-part, high solids, high modulus epoxy resin compound, no substitutions. Acceptable products:

.1 Sika AnchorFix 3001.

.2 DynaPoxy EP-1200, Pecora Corporation.

.2 Multi-Component Sealant:

.1 Chemical curing, non-sag, Shore A Hardness 20-35, conforming to ASTM C920, Grade NS, Class 25, use NT, M and A.

.3 Silicone Sealant Exterior 1:

.1 Exterior weatherproofing sealant, one-part, low modulus, neutral cure, conforming to ASTM C920, Type S, Grade NS, Class, 25, use NT, M, G, A and O, colour selected by Consultant.

.4 Silicone Sealant Exterior 2:

.1 Air-seal sealant: One part, silicone, conforming to ASTM C920, Type S Grade NS, Class 25, use NT, M, G, A and O.

.5 Silicone Sealant Structural Glazing:

.1 Shore A hardness 15-25, conforming to CAN/CGSB-19.13-M, Classification C-1-40-B-N and C-1-25-B-N, and ASTM C920, Type S, Grade P, Class 25, use T,M.

.6 Silicone Sealant Interior:

.1 One part, conforming to ASTM C920, Type S, Grade NS, Class 25, mould and mildew resistant, transparent finish.

.7 Interior Acoustic Sealant:

.1 Non-skinning, non-hardening, single component synthetic rubber sealant, conforming to ASTM E90, with antifungal additive.

.8 Polyurethane Sealant:

.1 Two-component, self-levelling, polyurethane elastomeric sealant, conforming to ASTM C920, Type M, Grade P, Class 25.

.9 Butyl Sealant Type A: Butyl rubber base, single component, solvent release, non-skinning, Shore “A” hardness range 10 to 30.

.10 Sealant Type B: single component, chemical curing, capable of continuous water immersion, non-sagging type, Shore “A” hardness range of 20 to 35.

.11 Preformed compressible and non-compressible back-up materials:

.1 Polyethylene, urethane, neoprene or vinyl foam:

.1 Extruded closed cell foam backer rod.

.2 Size: oversize 30 to 50 %.

.2 Neoprene or butyl rubber:

.1 Round solid rod, Shore A hardness 70.

.3 High density foam:

.1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m3density, or neoprene foam backer, size as recommended by manufacturer.

.4 Bond breaker tape:

.1 Polyethylene bond breaker tape which will not bond to sealant.

2.4 SEALANT SELECTION

.1 Control and expansion joints on the exterior of exterior surfaces of unit masonry walls: sealant type: Silicone Sealant Exterior 1.

.2 Control and expansion joints on the interior of exterior surfaces of unit masonry walls: sealant type: Epoxy Sealant between gridlines 7 to 10 and B to G.

.3 Perimeters of exterior penetrations: sealant type: Silicone Sealant Exterior 2.

.4 Perimeters of interior frames, as detailed and itemized: sealant type: Silicone Sealant Interior.

.5 Interior masonry vertical control joints (block-to-block, block to concrete, block to steel, and intersecting masonry walls): sealant type: Epoxy Sealant within gridlines 7 to 10 and B to G and Multi-component Sealant outside gridlines 7 to 10 and B to G.

.6 Joints at tops of non-load bearing masonry walls at the underside of poured concrete: sealant type: Epoxy Sealant.

.7 Perimeter of bath fixtures and millwork (e.g. sinks, tubs, urinals, stools, water closets, basins, vanities): sealant type: Silicone Sealant Interior.

.8 Acoustic separations: sealant type: Acoustic sealant.

.9 Concrete slab control joints: sealant type: Polyurethane Sealant.

2.5 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.

.2 Primer: in accordance with sealant manufacturer's written recommendations.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for joint sealants installation in accordance with manufacturer's written instructions.

.1 Visually review substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

.1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

.1 Sealant:

.1 Apply sealant in accordance with manufacturer's written instructions.

.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.

.3 Apply sealant in continuous beads.

.4 Apply sealant using gun with proper size nozzle.

.5 Use sufficient pressure to fill voids and joints solid.

.6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.7 Tool exposed surfaces before skinning begins to give slightly concave shape.

.8 Remove excess compound promptly as work progresses and upon completion.

.2 Curing:

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place.

3.7 FIELD QUALITY CONTROL

.1 Inspections:

.1 Inspection and testing of acoustic application will be carried out by a third party inspection agency certified to perform inspections to confirm Sound Transmission Class (STC) ratings of designated acoustic rooms.

.2 Contractor will pay for inspections at completion of acoustic rooms, prior to Substantial Completion. Inspection costs to include travel, living allowance, site inspections, testing and reports.

.3 If acoustic rooms perform lower than the noted STC ratings, Contractor to pay for all remediation to construction and retesting by the same inspection agency until STC levels are met.

.4 Rooms 105, 107, 109, 110, 141, 142, and 144 are to be testing to STC 50. Rooms 141 and 142 are considered one room.

3.8 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

.2 Clean adjacent surfaces immediately.

.3 Remove excess and droppings, using recommended cleaners as work progresses.

.4 Remove masking tape after initial set of sealant.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.3 Waste Management: separate waste materials in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

3.9 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by joint sealants installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 08 71 00 – Door Hardware

.2 Section 08 81 00 - Glass and Glazing

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M-15e1, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM B29-14, Standard Specification for Refined Lead.

.3 ASTM B749-14, Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.

.4 ASTM E330/E330M-14, Standard Test Method for structural Performance of Exterior Windows, Doors, Skylights and Cutrain Walls by Uniform Statice Air Pressure.

.2 Canadian Standards Association (CSA International)

.1 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.3 Canadian Steel Door Manufacturers' Association (CSDMA)

.1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.

.2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 1990.

.4 National Fire Protection Association (NFPA)

.1 NFPA 80-2016, Standard for Fire Doors and Other Opening Protective.

.2 NFPA 252-2017, Fire Tests of Door Assemblies.

.5 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1113-16, Architectural Coatings.

.2 SCAQMD Rule 1168-05 Adhesives and Sealants Applications.

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.2 CAN/ULC-S702-14, Standard for Thermal Insulation, Mineral Fibre, for Buildings.

.3 CAN/ULC-S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

.4 CAN4-S104-15, Standard Method for Fire Tests of Door Assemblies.

.5 CAN4-S105:2016, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

1.3 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.

.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

.3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 NFPA 252 for ratings specified or indicated.

.4 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104, NFPA 252 and listed by nationally recognized agency having factory inspection services.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for block masonry and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Canada.

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed arrangement of hardware fire rating and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings reinforcing fire rating finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

.4 Samples:

.1 Submit one 300 x 300 mm corner sample of each type of frame.

.5 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer, post-industrial content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates regional materials.

1.5 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Section 01 35 43 – Environmental Procedures.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

2.2 DOOR CORE MATERIALS

.1 Provide evidence that the project incorporates minimum percentage (20%) of recycled materials/products.

.2 Honeycomb construction:

.1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m^3 minimum sanded to required thickness.

.3 Stiffened: face sheets laminated and insulated core.

.1 Insulation:

.1 Expanded polystyrene: CAN/ULC-S701, Type D, density 16 to 32 kg/m^3.

2.3 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.1 Adhesive: maximum VOC content compliant with SCAQMD Rule 1168.

.2 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 PRIMER

.1 Touch-up prime CAN/CGSB-1.181.

.1 Maximum VOC limit compliant with GC-03.

2.5 PAINT

.1 Field paint steel doors and frames in accordance with Sections 09 91 23 - Interior Painting, 09 91 13 - Exterior Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

.1 Maximum VOC emission level compliant with GS-11, GC-03 and SCAQMD Rule 1113.

2.6 ACCESSORIES FOR DOORS

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior, top and bottom caps: steel.

.3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

.4 Door bottom seal: Refer to Hardware Section 08 71 00.

.5 Metallic paste filler: to manufacturer's standard.

.6 Fire labels: metal riveted.

.7 Sealant:

.1 Seal interior frames at wall connections with translucent silicone sealant.

.2 Seal fire rated frames with paintable, fire sealant.

.8 Glazing:

.1 Make provisions for glazing as indicated and provide necessary glazing stops.

.2 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screws dry glazing of snap-on type.

.3 Design exterior glazing stops to be tamperproof.

.4 Glazing to be in accordance with Section 08 81 00 – Glass and Glazing.

2.7 DOOR AND METAL WINDOW FRAMES - FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Exterior frames: 1.6 mm welded type construction. Design framing members to withstande their own weight, weight of glass, loads imposed by motion of operable elements, and design wind and suction loads to a maximum allowable deflection of 1/175 of span, when tested to ASTM E330.

.4 Interior frames: 1.6 mm welded type construction.

.5 Blank, reinforce, drill and tap frames for mortised, templated hardware, electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.6 Protect mortised cutouts with steel guard boxes.

.7 Prepare frame for door silencers, three (3) for single door, two (2) at head for double door.

.8 Manufacturer's nameplates on frames and screens are not permitted.

.9 Conceal fastenings except where exposed fastenings are indicated.

.10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.11 Insulate exterior frame components with polyurethane insulation.

2.8 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide two (2) anchors for rebate opening heights up to 1,520 mm and one (1) additional anchor for each additional 760 mm of height or fraction thereof.

.4 Locate anchors for frames in openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in two (2) temporary jamb spreaders per frame to maintain proper alignment during shipment.

.7 Fabricate frame products in one piece except where shipping limitations requires frames to be spliced. Notify Consultant of these frames prior to manufacturing.

2.10 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

.2 Exterior doors: insulated, hollow steel construction. Interior doors: honeycomb construction.

.3 Fabricate doors with longitudinal edges locked seamed, adhesive assisted. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.4 Blank, reinforce, drill doors and tap for mortised, templated hardware electronic hardware.

.5 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.6 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.8 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN4-S104, NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.9 Manufacturer's nameplates on doors are not permitted.

2.11 DOORS: HONEYCOMB CORE CONSTRUCTION

.1 Form face sheets for exterior doors from 1.6 mm sheet steel with polystyrene core laminated under pressure to face sheets.

.2 Form face sheets for interior doors from 1.6 mm sheet steel with honeycomb core laminated under pressure to face sheets.

2.12 HOLLOW STEEL CONSTRUCTION

.1 Form face sheets for exterior doors from 1.6 mm sheet steel.

.2 Form face sheets for interior doors from 1.6 mm sheet steel.

.3 Reinforce doors with vertical stiffeners, securely laminated to face sheets at 150 mm on centre maximum.

.4 Fill voids between stiffeners of exterior doors with polystyrene core.

.5 Fill voids between stiffeners of interior doors with honeycomb core.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continuity of air/vapour barriers.

3.4 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.

.1 Hinge side: 1.0 mm.

.2 Latchside and head: 1.5 mm.

.3 Finished floor, top of carpet noncombustible sill and thresholds: 13 mm.

.3 Adjust operable parts for correct function.

.4 Install louvres.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.6 GLAZING

.1 Install glazing for doors and frames in accordance with Section 08 80 50 - Glazing.

3.7 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking; clean doors and frames.

.3 Clean glass and glazing materials with approved non-abrasive cleaner.

.4 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

.5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.6 Waste Management: separate waste materials in accordance with Section 01 74 21-Construction/Demolition Waste Management and Disposal.

3.8 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by door and frame installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 40 00 – Shop Fabricated Architectural Woodwork

.2 Section 08 11 00 – Metal Doors and Frames

.3 Section 08 71 00 – Door Hardware

1.2 REFERENCE STANDARDS

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC).

.1 Quality Standards for Architectural Woodwork (Edition 2) and Errata.

.2 Canadian Standards Association (CSA International).

.1 CSA A440.2-14/A440.3-14, Fenestration Energy Performance.

.2 CSA O115-M1982(R2001), Hardwood and Decorative Plywood.

.3 CAN/CSA O132.2 Series-90(R1998), Wood Flush Doors.

.4 CAN/CSA-O132.5-M1992(R1998), Stile and Rail Wood Doors.

.5 CAN/CSA-Z808-96, A Sustainable Forest Management System: Guidance Document.

.3 National Fire Protection Association (NFPA).

.1 NFPA 80-16, Standard for Fire Doors and Other Opening protectives.

.2 NFPA 252-17, Fire Tests of Door Assemblies.

.4 Underwriters' Laboratories of Canada (ULC).

.1 CAN4-S105:2016, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet.

.2 Submit electronic copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOC's:

.1 For caulking materials during application and curing.

.2 For door materials and adhesives.

.3 Shop Drawings:

.1 Shop drawings to indicate door types and cutouts for lights, sizes, core construction, transom panel construction and cutouts.

.4 Samples:

.1 Submit one 300 x 300 mm corner sample of each type wood door.

.2 Show door construction, core, glazing detail and faces.

.5 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Protection:

.1 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.

.2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.

.3 Protect doors from scratches, handling marks and other damage. Wrap doors.

.4 Store doors away from direct sunlight.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Dispose of corrugated cardboard, and plastic packaging material in accordance with site Waste Management Plan.

.3 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.

.4 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 WOOD FLUSH DOORS

.1 Solid core: to CAN/CSA-O132.2.1.

.1 Construction:

.1 Solid particleboard core: stile and rail frame bonded to particleboard core with wood lock blocks, 7-ply construction.

.2 Solid wood core:

.1 Glued block core with wood edge band.

.2 Framed block glued core.

.3 Stile and rail core.

.4 7-ply construction.

.2 Face Panels:

.1 Hardwood; veneer grades: Grade I (Premium).

.2 Hardboard: composition face.

.3 Laminated plastic: with hardwood plywood subface.

.3 Adhesive: Type II (water resistant) for interior doors.

2.2 LAMINATED PLASTIC

.1 Plastic laminate: As noted on drawings and in Section 06 40 00 – Shop Fabricated Architectural Woodwork.

.2 Backing: hardwood plywood subface to CSA O115.

.3 Laminated plastic adhesive: Low VOC, polyvinyl acetate or aliphatic resin.

.4 Hardware: Sliding track, extension track, and flush pulls as noted in Section 06 40 00 – Shop Fabricated Architectural Woodwork.

2.3 FABRICATION

.1 Vertical edge strips to match face veneer.

.2 Prepare doors for glazing. Provide hardwood glazing stops, to match face veneer with mitred corners.

.3 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.

.4 Finish laminated plastic smooth and flush with stile edges of door and bevel at approximately 20 degrees.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Unwrap and protect doors in accordance with Section 01 61 00 – Common Product Requirements.

.2 Install doors and hardware in accordance with manufacturer's printed instructions.

.3 Adjust hardware for correct function.

.4 Install glazing in accordance with Section 08 80 50- Glazing.

.5 Secure transom and side panels by means of concealed fasteners or countersunk screws concealed by means of wood plugs matching panel in grain and colour.

3.3 ADJUSTMENT

.1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

3.4 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking; clean doors and frames.

.3 Clean glass and glazing materials with approved non-abrasive cleaner.

.4 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

.5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.6 Waste Management: separate waste materials in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by door and frame installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 22 00 – Concrete Masonry

.2 Section 07 05 80 – Common Work Results of Fire Rated Separations and Assemblies

.3 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCES STANDARDS

.1 ASTM International Inc.

.1 ASTM A568/A568M-15, Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.

.2 ASTM A653/A653M-15, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.

.3 ASTM A1008/A1008-16, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

.4 ASTM B221/B221M-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

.5 ASTM C1396/C1396M, Standard Specification for Gypsum Board.

1.3 ADMINISTRATION REQUIREMENTS

.1 Coordination: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified below, and as follows:

.1 Coordinate locations of all access panels in gypsum board ceilings with Consultant for size and location prior to installation, making every effort to locate outside of gypsum board ceilings.

.2 Coordinate acceptable locations and sizes with Architectural Reflected Ceiling Plans; no access panels are allowed in public corridors or feature ceilings.

.3 Coordinate closely with mechanical and electrical sections for size and locations of access panels in walls and ceilings; provide access doors and panels required for project.

1.4 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 23.

.1 Product Data: Submit product data for each type of door and frame indicated, including construction details relative to materials, individual components and profiles, finishes, and fire ratings required for access doors and frames.

.2 Shop Drawings: Submit coordination drawings and reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items with concealed framing, suspension systems, piping, ductwork, and other construction. Show the following:

.1 Method of attaching door frames to surrounding construction.

.2 Ceiling mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim.

.3 Samples: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: Provide fire rated access doors and frames in accordance with NFPA 80 or ULC S104, and labelled and listed by UL, ULC or ITS/Warnock Hersey, or another testing and inspecting agency acceptable to authority having jurisdiction and Section 07 05 80 – Common Work Results for Fire Rated Separations and Assemblies.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, off ground, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect toilet and urinal compartments from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

.5 Packaging Waste Management: remove for reuse and return of packaging materials, padding, and pallets, as specified in[Construction Waste Management Plan in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 NON-RATED ARCHITECTURAL ACCESS PANELS

.1 Flush doors and trimless frames, fabricated as follows:

.1 Aluminum Extrusions: ASTM B221/B221M, alloy 6063-T6.

.2 Door: Extruded aluminum frame with gypsum board inlay and structural nylon corner elements:

.1 Gypsum Board: to ASTM C1396/C1396, 16 mm thickness to match adjacent construction.

.2 Size: Square or rectangular sized to suit access requirements if not indicated on Drawings.

.3 Latch: Flush cam latch operated by tamper-resistant torx drive.

.4 Hinge: Concealed, two point pin hinge, non corroding, allowing door to open 120° and allowing door to be removed.

.5 Edge Bead: Recessed extruded aluminum frame edge bead providing surface that can be finished to adjacent gypsum board.

.6 Accessories: Fibreglass reinforced nylon, zinc plated screws, stainless steel springs and retaining wire to manufacturer's standard.

.7 Finish: Aluminum frames, gypsum board, nylon and aluminum cam latch to receive the same finish and paint as the surrounding surface.

.8 Acceptable materials:

.1 Access Panel Solutions, BaucoPlus Architectural Access Panel.

2.2 FIRE RATED ACCESS PANELS IN GYPSUM BOARD

.1 Flush, fire rated access doors and trimless frames, fabricated from zinc coated steel sheet, and as follows:

.1 Cold-Rolled Steel Sheets: ASTM A1008/A1008M, Commercial Steel (CS), or ASTM A1008/A1008M, Drawing Steel (DS), Type B; stretcher-levelled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A568/A568M.

.2 Galvanizing: Electrolytic zinc-coated steel sheet, complying with ASTM A591/A591M, Class C coating or ASTM A653/A653M Z180 (G60) mill phosphatized zinc coating, at fabricator's option.

.3 Door: Flush panel, minimum thickness of 0.95 mm.

.4 Latch: Self-latching bolt operated by standard screwdriver with interior release.

.5 Hinge: Concealed, two point pin hinge, non-corroding, allowing door to open 120° and allowing door to be removed.

.6 Automatic Closer: Spring type.

.2 Edge Beads: Edge trim formed from 0.80 mm nominal thickness zinc coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

.3 Door Frame: Minimum 1.6 mm thick sheet metal with gypsum board bead.

.1 Acceptable materials: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

.1 Acudor Products, Inc., FB-5050-DW

.2 Nystrom Building Products Co., UW Series

2.3 FABRICATION

.1 Provide access door assemblies manufactured as integral units ready for installation.

.2 Provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness for metal surfaces exposed to view in the completed Work.

.3 Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

.4 Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed based on size of door or panel opening.

.5 Apply manufacturer's standard protective coating on aluminum that will come in contact with concrete after fabrication.

2.4 FINISHES

.1 Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

.2 Finish metal fabrications after assembly.

.3 Steel Finishes:

.1 Surface Preparation: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. For galvanized surfaces, apply, after cleaning, a conversion coating suited to the organic coating to be applied over it. For zinc coated surfaces, clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A780.

.2 Factory Priming for Field-Painted Finish: Apply shop primer immediately after cleaning and pre-treating, as follows:

.1 Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

.2 Shop Primer for Zinc Coated Steel: Organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.

.3 Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

Part 3 Execution

3.1 PREPARATION

.1 Advise installers of other work about specific requirements relating to access door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.2 INSTALLATION

.1 Installation shall be completed by Section 04 22 00 – Concrete Masonry and Section 09 21 16 – Gypsum Board Assemblies.

.2 Comply with manufacturer's written instructions for installing access doors and frames.

.3 Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

.4 Install access doors with trimless frames flush with adjacent finish surfaces, unless noted otherwise.

.5 Install non-rated architectural access panels recessed to receive finish material in areas 101 to 126.

3.3 ADJUSTING

.1 Adjust doors and hardware after installation for proper operation.

.2 Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning, supplemented as follows.

.1 Progress Cleaning: Leave Work area clean at the end of each day.

.2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by sectional metal door installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 05 12 – Masonry Mortar and Grout

.2 Section 04 22 00 – Concrete Unit Masonry

.3 Section 07 92 00 – Joint Sealants

.4 Section 09 96 59 – High-build Glazed Coatings

1.2 REFERENCES STANDARDS

.1 Aluminum Association (AA)

.1 Aluminum Standards and Data 2017.

.2 American National Standard (ANSI), National Association of Architectural Metal Manufactures (NAAMM), Hollow Metal Manufactures Association (HMMA).

.1 ANSI H35.2-2017, Dimensional Tolerance for Aluminum Mill Products.

.2 ANSI/NAAMM HMMA 863-04 Fifth Edition-05, Guide Specifications for Detention Security Hollow Metal Doors and Frames.

.3 ANSI/SDI A250.8-2014, Specifications for Standard Steel Doors and Frames (SDI-100)

.3 ASTM International Inc.

.1 ASTM A307-14a1, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.

.2 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM F1450-12a, Standard Test Methods for Hollow Metal Swinging Door Assemblies for Detention and Correctional Facilities.

.4 ASTM F1643-05(2012), Standard Test Methods for Detention Sliding Door Locking Device Assembly.

.5 ASTM F1758, Standard Test Methods for Detention Hinges Used on Detention-Grade Swinging Doors.

.6 ASTM F1915, Standard Test Methods for Glazing for Detention Facilities.

.4 The Coating Society (SSPC)

.1 SSPC-SP 6/NACE No.3, Commercial Blast Cleaning.

.5 CSA International

.1 CAN/CSA-G40.20-13/G40.21-13, general Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.6 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)

.1 SCAQMD Rule 1115-16, Architectural Coatings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for block masonry and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.4 Manufacturer’s Instruction:

.1 Submit manufacturer’s installation instructions.

.5 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer, post-industrial content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates regional materials.

1.4 QUALITY ASSURANCE

.1 Doors and frames that exhibit rusting or distortion or surface irregularities due to improper fabrication or handling will be rejected.

.2 Door slabs to be tested and certified to meet a minimum Level 3 ANSI/NAAMM 863, ASTM F1450 testing requirement for all static load, rack, door impact and glazing impact tests. Provide copy of test results along with shop drawings.

.3 Door installation to be by qualified installers, approved by Manufacturer, with a minimum ten (10) years experience in installation of detention doors. Provide Consultant with proof of installer qualifications prior to commencing installation.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle concrete unit masonry in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Packaging Waste Management:

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 SITE CONDITIONS

.1 Provide in accordance with Section 04 05 00 - Common Work Results for Masonry.

1.7 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for cleaning, reglazing and maintenance of doors for incorporation into manual in accordance with Section 01 78 00 – Closeout Submittals.

.2 Warranty Documentation: submit warranty documents specified.

Part 2 Products

2.1 MANUFACTURED PRODUCTS

.1 Approved details and specification for sliding detention doors identified as appended to this section.

.2 Manufactured products and installation must meet the details and specifications without deviation. No changes or substitutions will be accepted without prior written approval by the Owner.

.3 Details contained in the bid documents that supersede the following drawings are to be reviewed with Consultant prior to any procurement, fabrication or installation to ensure compliance.

2.2 MATERIALS

.1 Sheet Steel: commercial zinc-coated quality to ASTM A653/A653M, wipe coat designation.

.2 Steel Plates and Shapes: to CAN/CSA-G40.20/21, Type 250W.

.3 Insulation: 50 mm thick rigid fibreglass AF-545.

.4 Hardware: tracks, hangers, guides, pulls, locks and hinges, to Owner standard.

.5 Security Glass and Gaskets: 6 mm thick Lexan Margard to corridor side, 6 mm air space, 6 mm thick Lexan Margard to cell side.

.6 Security Screws: flat head chip-off type and tamper resistant pin Torx for glass stops, sized to suit.

.7 Anchor Bolts: to ASTM A307

.8 Hardware: locks, double escutcheons, lock buckets and paracentric keys by door supplier. All doors to be keyed alike, provide six (6) keys total.

.1 Acceptable locks:

.1 Chubb 1030D-1

.2 Folger Adams 32D

.3 Southern Steel 1030-D1

.4 RR Brink 7030D

.2 Primer: Product compatible with epoxy finish topcoat accepted by high build coating manufacturer and in accordance to Section 09 96 59 – High-build Glazed Coatings.

.9 Epoxy Sealant: to gaps 2 mm or larger.

2.3 FABRICATION

.1 Fabricate sliding steel doors, swinging steel doors and associated frames to sizes and configuration detailed on reviewed shop drawings.

.2 Fabricated units square and true, free or distortion and twists. Accurately form and fit corners and interconnecting sections, to close fitting tolerances.

.3 Full-weld together all corners and interconnecting joints. Grind welds smooth to a flat plane flush with component surfaces.

.4 Fabricate doors allowing for adequate clearance from frames on all sides, with a maximum permissible warp of 3 mm when measured diagonally across doors.

.5 Fabricate doors using one piece sheet for each side.

.6 Weld reinforcement to door face sheets in a manner that will not distort or telegraph through face sheets.

.7 Reinforce, drill and tap doors and frames for hardware, glass stops and fitments.

.8 Rabbet the door viewport glazing to be flush with interior door skin.

.9 Incorporate door pulls into the viewport frame.

.10 Food pass-through must be flush with inside door skin when closed.

.11 Rail assembly to have anti-lift feature.

.12 Hinges to be heavy-duty capacity with non-removable pins.

.13 Door frame to have mitred corners and 50 mm drop at header to prevent access to top of door.

.14 Receiver/Guide Rail to be cut 300 mm from top and bottom. Provide inspection port for hook bolt engagement.

2.4 SURFACE PREPARATION

.1 Remove welding slag and spatter from exposed surfaces. Grind exposed welds smooth and evenly. Fill surface depressions with metallic filler and sand to uniform smooth finish.

.2 Remove rust, scale, oil and other foreign substances to SSPS-SP 6 to provide clean surfaces. Light sand blast or etch the surface in accordance with high-build coating manufacturer's recommendations or minimum of SSPC SP 6, whichever is more stringent.

.3 From factory, prime paint doors and frames after fabrication and cleaning in one uniform coat, free of streaks and sags using an epoxy high-build coating primer compatible with final high build epoxy top coat.

.4 Provide a small quantity of primer used for door priming at factory for site applied touch-up prier to finished top-coat applications.

Part 3 Execution

3.1 EXAMINATION

.1 Verify surfaces and conditions are ready to accept work of this Section.

.2 Commencing installation means acceptance of existing substrates.

3.2 PREPARATION

.1 Protect finished materials from damage due to adjacent masonry work.

3.3 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and date sheets.

3.4 INSTALLATION

.1 Coordinate installation of anchors being cast into masonry work.

.2 Install sliding doors, swinging doors and frames plumb and square, in accordance with detail drawings and with maximum diagonal distortion of 3 mm.

.3 Final installed gap between door and frame must not exceed 3mm.

.4 Final installed gap between door and frame must be a consistent 3mm.

.5 No gap will be permitted to narrow downward so as to provide a potential hanging point for materials wedged into gap.

.6 Final gap, door, frame and all other installed component tolerances and adjustments, are to be completed as requested and subject to acceptance by both the Consultant and Owner.

.7 Rigidly anchor frames in place.

.8 Install sliding doors complete with hardware so as to slide freely with undue effort.

.9 Install swinging doors complete with hardware so that doors open and close freely with undue effort.

.10 Epoxy sealant applied to door glazing, food tray and any gaps 2 mm or larger in accordance with Section 07 92 00 – Joint Sealants.

.11 Site finish and spray with applied epoxy paint in accordance with Section 09 96 59 – High Build Glazed Coatings.

3.5 GROUT PLACEMENT

.1 Place grout in accordance with Section 04 05 12 - Masonry Mortar and Grout.

.2 Grout fill frame in accordance with the following drawings.

3.6 PROTECTION

.1 Protect primed finish of doors and frames during the course of construction in accordance with Section 01 61 00 – Common Product Requirements.

.2 Cover doors and frames with temporary, non-staining, heavy-duty, flexible board until ready to apply finish. Cover material to be fastened or adhered to doors and frames without damaging the primed finish.

3.7 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning, supplemented as follows.

.2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 – Construction Waste Management.

END OF SECTION

Hollow Metal Door & Pressed Steel Frame Shop Drawings - DRAFT

Project: SLIDING AND SWINGING CELL DOORS
LEVEL 3 NAAMM 863-98 ASTM F1450-97 PERFORMANCE CRITERIA

GENERAL NOTES: PLEASE READ

1) FABRICATION OF HOLLOW METAL DOORS & FRAMES WILL NOT COMMENCE UNTIL THE FOLLOWING IS RECEIVED:
   A) APPROVED HARDWARE SCHEDULE
   C) ALL NECESSARY HARDWARE TEMPLATES
   NOTE: LEAD TIMES VARY SO THIS INFORMATION IS CRITICAL

2) THESE DRAWINGS ARE FOR OWNER USE ONLY. OWNER WILL NOT ACCEPT ANY RESPONSIBILITY DUE TO ERRORS CAUSED BY THE USE OF THESE DRAWINGS BY OTHER TRADES.

3) DOORS AND FRAMES TO BE REINFORCED FOR SURFACE MOUNTED HARDWARE AS REQUIRED. DRILLING AND TAPPING FOR ATTACHING OF SURFACE MOUNTED HARDWARE BY OTHERS. DOORS AND FRAMES WILL BE BLANKED, REINFORCED, DRILLED AND TAPPED FOR MORTISED TEMPLATED HARDWARE. TRIM MOUNTING HOLES AND ALL HOLES Ø1/2" [13 mm] & LESS, BY OTHERS.

4) MAXIMUM ALLOWABLE DISTANCE BETWEEN THE SLIDING DOOR AND THE FRAME MUST BE LIMITED TO 1/8" [3 mm]. FIELD SHIMMING MAY BE REQUIRED ON SITE BY THE INSTALLATION CONTRACTOR TO OBTAIN THE DESIRED CLEARANCES.

5) ALL DOORS AND FRAMES TO BE MARKED WITH THE DOOR MANUFACTURER'S NAME AND PRODUCT NUMBER ON THE SECOND HINGE FROM THE TOP UNLESS SPECIFIED OTHERWISE.

6) ALL HOLLOW METAL FRAMES SHALL BE OF WELDED CONSTRUCTION UNLESS NOTED OTHERWISE.

7) ALL SWING TYPE FRAMES TO BE PREPARED FOR PUSH-IN TYPE SILENCERS, 3 PER STRIKE JAMB FOR SINGLE FRAMES OR 2 PER HEAD FOR DOUBLE FRAMES.

8) ALL HARDWARE LOCATIONS ON THE DOORS & FRAMES TO BE AS PER THE FOLLOWING DRAWINGS, UNLESS ADVISED OTHERWISE.

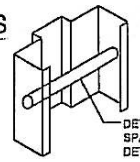
9) GENERAL CONTRACTOR IS RESPONSIBLE TO ENSURE THAT FRAMES AND DOORS ARE SET PLUMB, SQUARE, LEVEL AND THAT WALLS AND FRAME ARE FULLY GROUTED. THE MANUFACTURER OF HOLLOW METAL DOORS AND/OR PRESSED STEEL FRAMES CAN NOT CONTROL THE QUALITY OF EITHER THE HARDWARE, THE FIELD INSTALLATION OF HARDWARE, OR THE PROPER ERECTION OF FRAMES IN THE WALL.

10) ALL BURRS AND SHARP EDGES MUST BE REMOVED AFTER INSTALLATION.

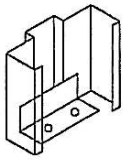
11) THE FOLLOWING SHOP DRAWINGS REFLECT A STANDARD 195 mm BLOCK WALL CONSTRUCTION, SITE CONDITIONS MAY VARY.

REVISIONS:	NOTES:		JOB:		
			CONTRACTOR:		
			DRAWN BY:	DATE:	
			W.O.#:	FILE NUMBER:	PG.#:

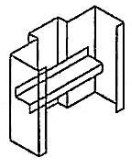
A-3 ANCHOR TYPES



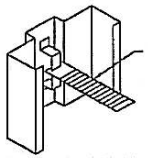
WELDED ROD ANCHOR



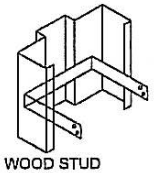
STANDARD FIXED BASE ANCHOR



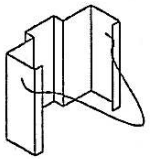
STEEL STUD ANCHOR



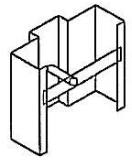
CORRUGATED TAIL ANCHOR



WOOD STUD ANCHOR



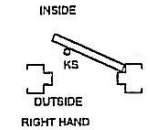
CONCRETE BLOCK WALL WIRE ANCHOR

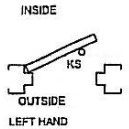


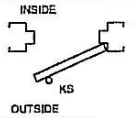
EXISTING WALL ANCHOR

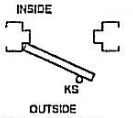
B-3 DOOR AND FRAME HANDING CHART

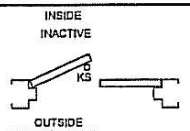
TO DETERMINE HAND(SWING) OF DOOR AND FRAME
STAND OUTSIDE - FACING DOOR

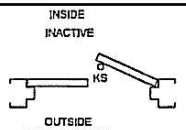


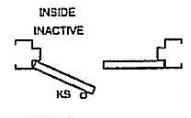


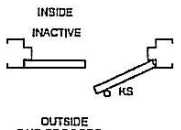












* KS IS THE KEY SIDE OF DOOR (PLEASE CHECK ALL SWINGS TO ENSURE KEY IS ON PROPER SIDE OF DOOR)

FIRE RATING LABELS

A - 3 HOUR
B - 1 1/2 HOUR
C - 45 MINUTE
20M - 20 MINUTE

DOOR MATERIALS

HM - HOLLOW METAL DOOR - HONEYCOMB
IHM - INSULATED HOLLOW METAL DOOR - POLYSTYRENE
SLH - STEEL STIFFENED (LAMINATED-HONEYCOMB)
SLP - STEEL STIFFENED (LAMINATED-POLYSTYRENE)
SWF - STEEL STIFFENED (WELDED-FIBREGLASS)
SCW - SOLID CORE WOOD DOOR
HCW - HOLLOW CORE WOOD DOOR
PLM - PLASTIC LAMINATED

REMOVABLE STOPS

PL - PULL SIDE OF DOOR
PS - PUSH SIDE OF DOOR

ANCHOR TYPES

SS - STEEL STUD ANCHOR
CT - CORRUGATED TAIL ANCHOR
WS - WOOD STUD ANCHOR
EWA - EXISTING WALL ANCHOR
CB - CONCRETE BLOCK WIRE ANCHOR
BA - BASE ANCHOR
WR- WELDED ROD ANCHOR

HARDWARE

PP - PUSH & PULL
RIM - RIM PANIC
VR - VERTICAL ROD
FB - FLUSH BOLT
R/F - REINFORCE
CVR - CONCEALED VERTICAL ROD

DOOR SWINGS

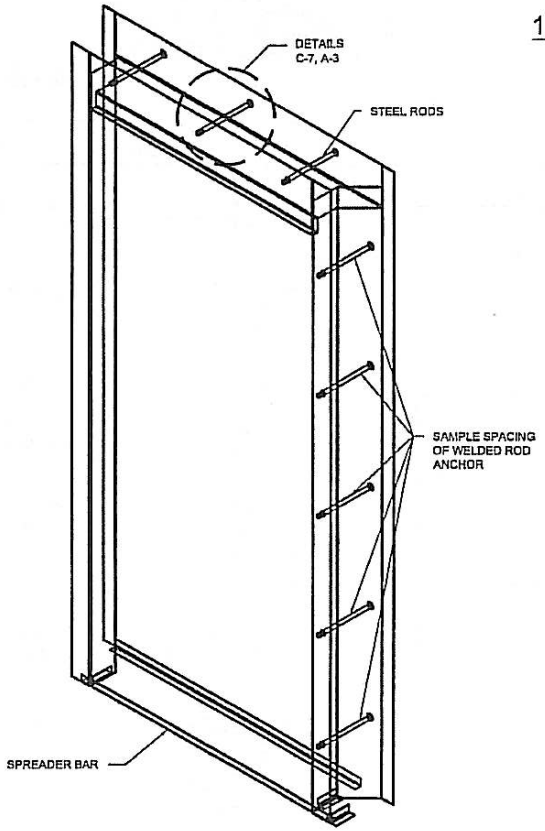
LH - LEFT HAND
LHR - LEFT HAND REVERSE
RH - RIGHT HAND
RHR - RIGHT HAND REVERSE

REVISIONS:

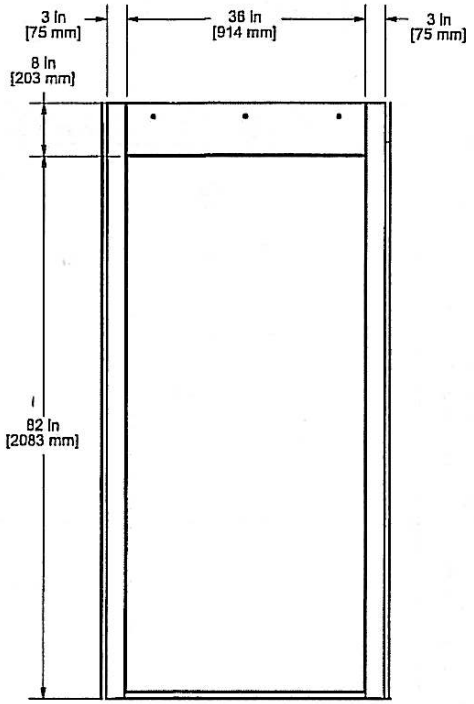
NOTES:

JOB:
CONTRACTOR:
DRAWN BY:
DATE:
W.O.#:
FILE NUMBER:
PG.#:

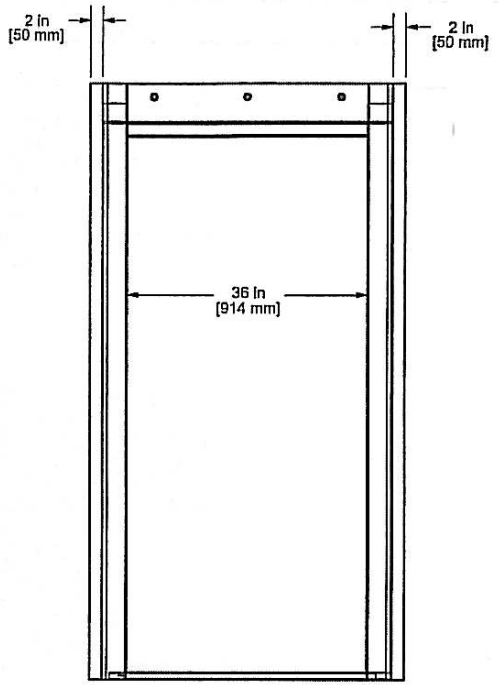
12GA. FRAME FOR SLIDING DOOR



A-4 ISOMETRIC VIEW



B-4 CORRIDOR SIDE

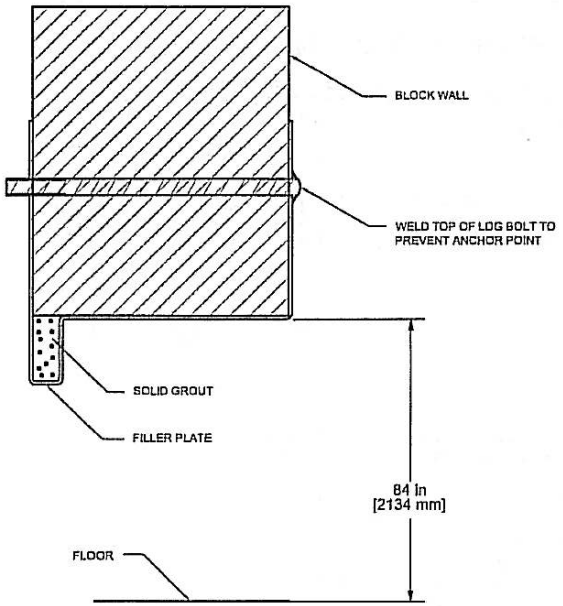


C-4 ROOM SIDE

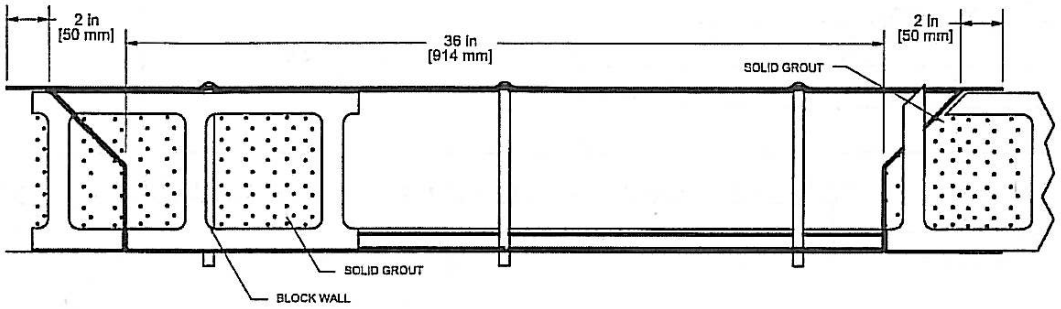
REVISIONS:	NOTES:		JOB:		
			CONTRACTOR:		
			DRAWN BY:	DATE:	
			W.O.#:	FILE NUMBER:	PG.#:

NOTE: FRAME MUST BE FULLY GROUTED FOR PROPER SLIDING ASSEMBLY INSTALLATION

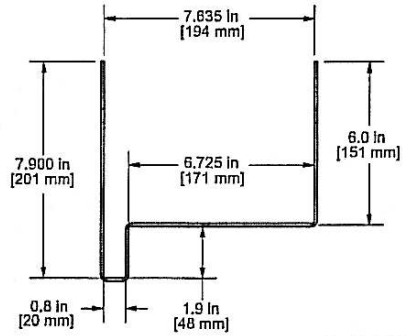
NOTE: OPTIONAL 2" LENGTH X 3/16" [51 x 5 mm] FILLER PLATE CONTINUALLY WELDED TO HEADER AND SIDES OF FRAME.

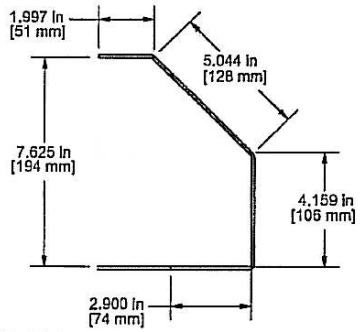


A-5 SECTION THROUGH FRAME



B-5 CROSS SECTION THROUGH JAMBS & HEADER



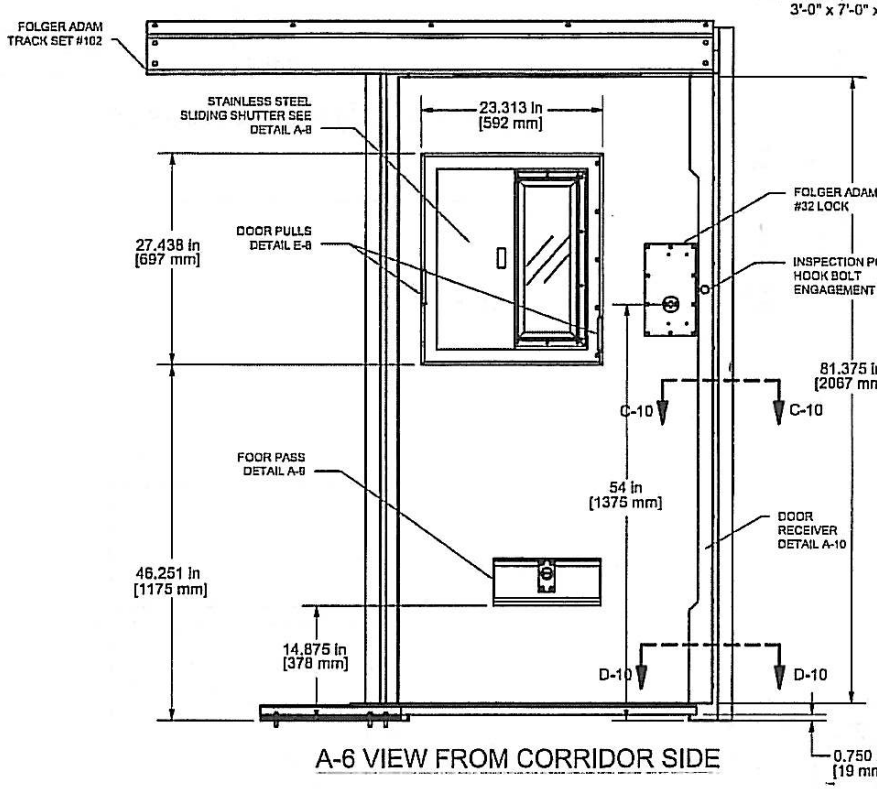


C-5 JAMB PROFILES FOR BENDING

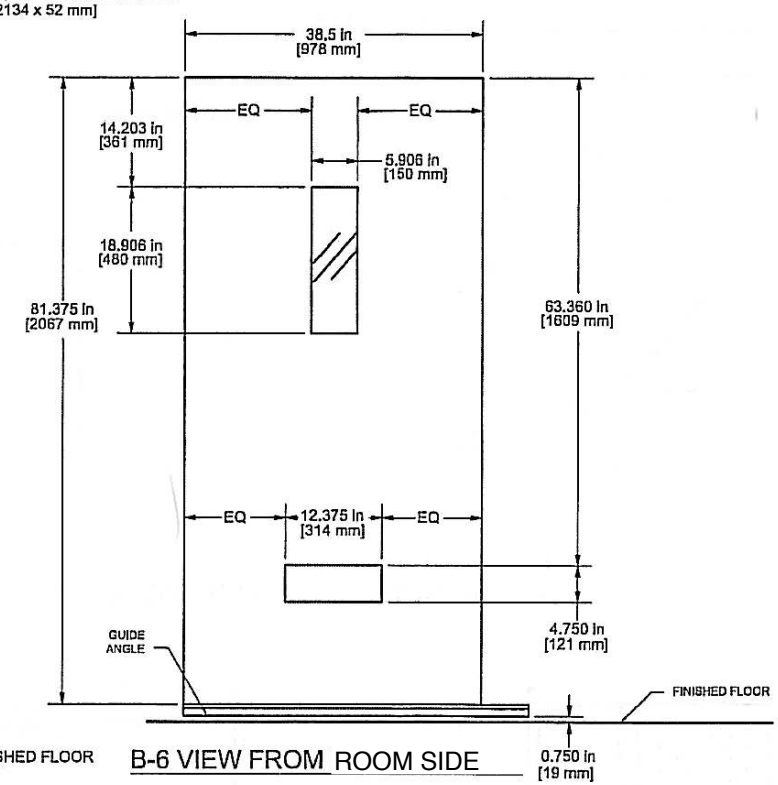
REVISIONS:	NOTES:		JOB:		
			CONTRACTOR:		
			DRAWN BY:	DATE:	
			W.O.#:	FILE NUMBER:	PG.#:

TYPE A DOOR (SLIDING)

12GA. FRAME & 14GA. STEEL STIFFENED DETENTION DOOR
LEVEL 3 NAAMM 863-98 AND ASTM - F1450-97 PERFORMANCE CRITERIA
FOR STATIC LOAD, RACK, IMPACT, & EDGE CRUSH TESTS
3'-0" x 7'-0" x 2" [914 x 2134 x 52 mm]

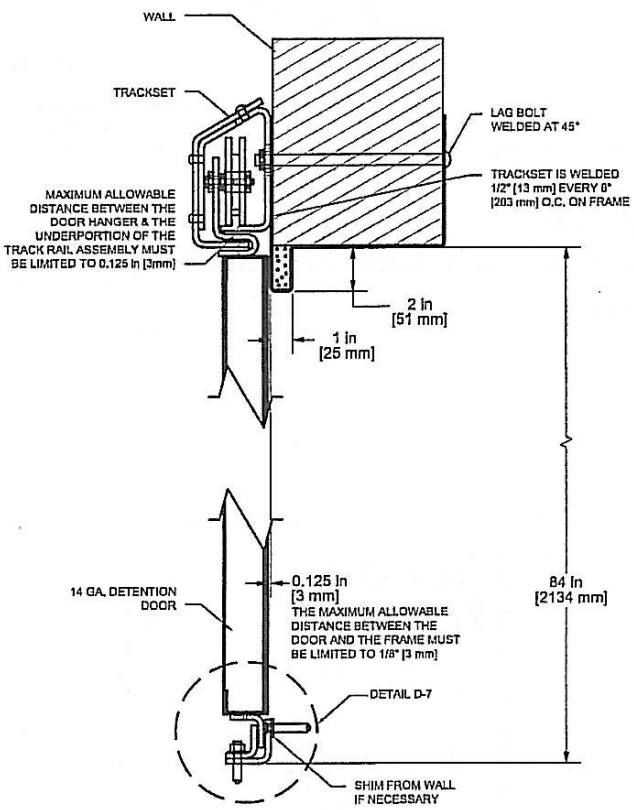


A-6 VIEW FROM CORRIDOR SIDE



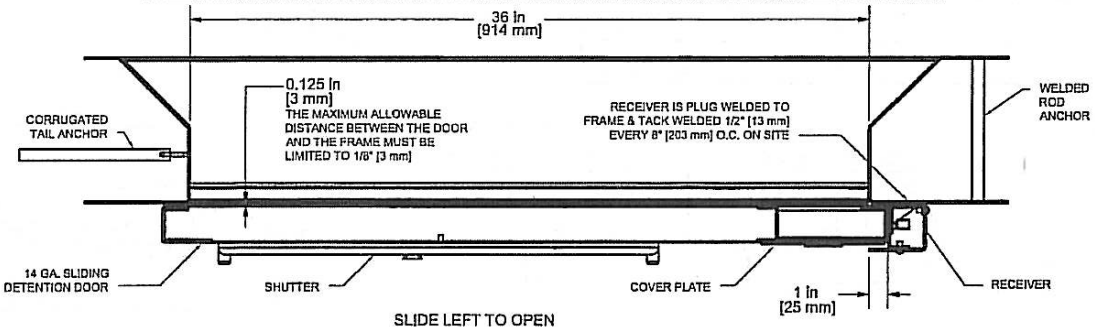
B-6 VIEW FROM ROOM SIDE

REVISIONS:	NOTES:		JOB:		
			CONTRACTOR:		
			DRAWN BY	DATE:	
			W.O.#:	FILE NUMBER:	PG.#:



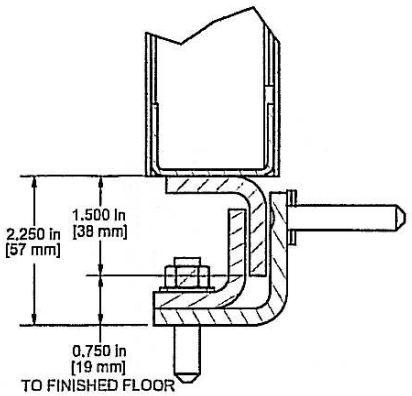
A-7 SECTION THROUGH TRACKSET AND DOOR

CROSS SECTION THROUGH DOOR AND RECEIVING ENCLOSURE

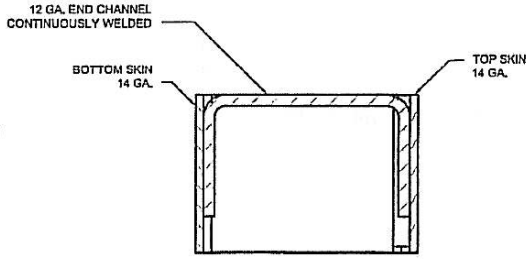


B-7 CT ANCHOR

C-7 WR ANCHOR

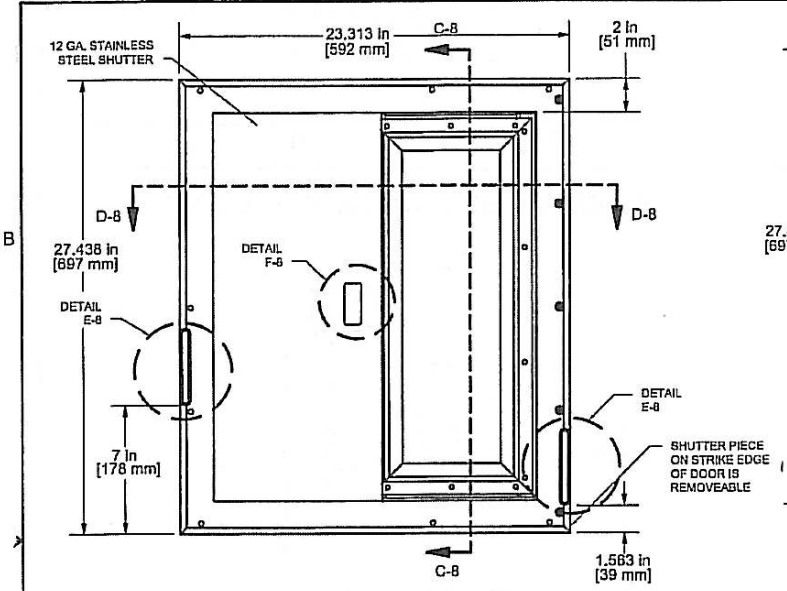


D-7 DETAIL

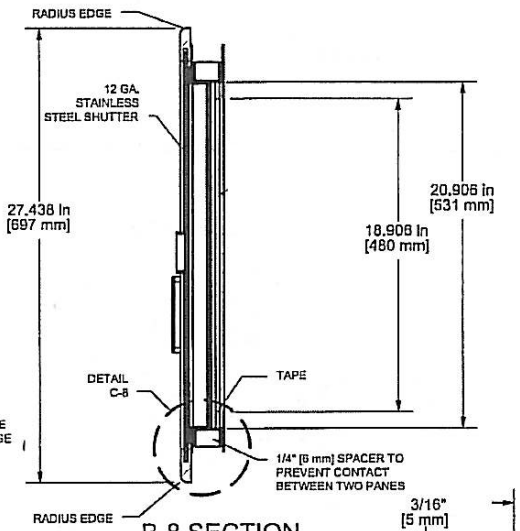


E-7 DETAIL TOP & BOTTOM END CHANNEL

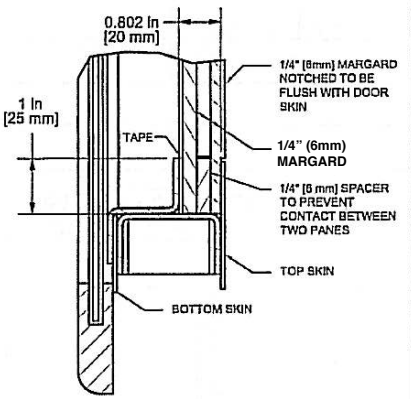
REVISIONS:	NOTES: SEE A-3 FOR ADDITIONAL ANCHOR OPTIONS		JOB:		
			CONTRACTOR:		
			DRAWN BY:	DATE:	
			W.O.#:	FILE NUMBER:	PG.#:



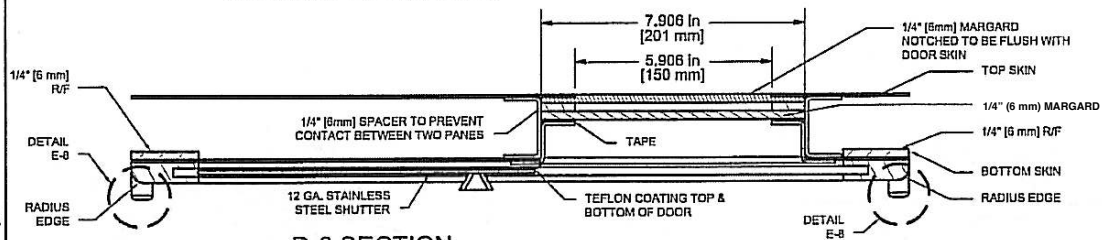
A-8 SLIDING SHUTTER



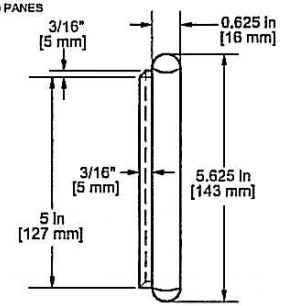
B-8 SECTION



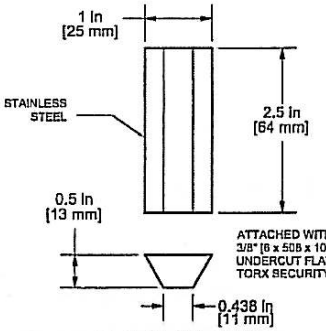
C-8 GLAZING DETAIL



D-8 SECTION

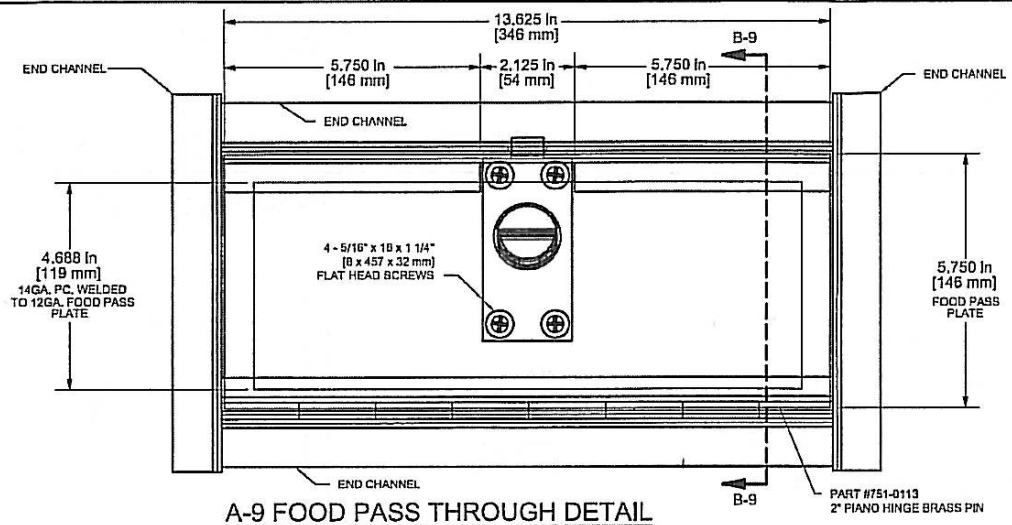


E-8 SLIDING DOOR HANDLE DETAIL

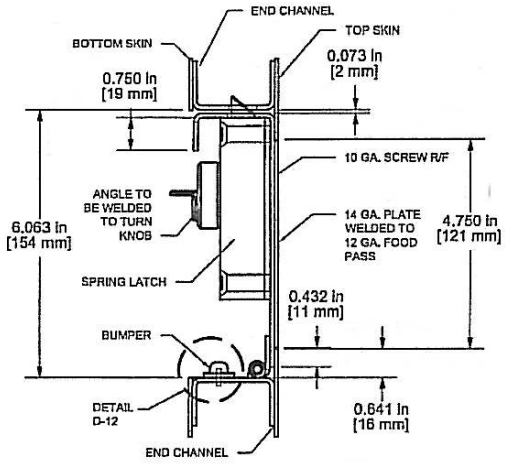


F-8 SHUTTER HANDLE DETAIL

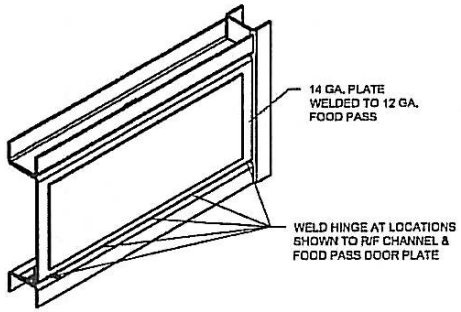
REVISIONS:	NOTES:		JOB:		
			CONTRACTOR:		
			DRAWN BY:	DATE:	
			W.O.#:	FILE NUMBER:	PG.#:



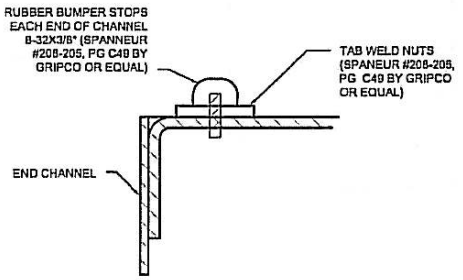
A-9 FOOD PASS THROUGH DETAIL



B-9 SECTION

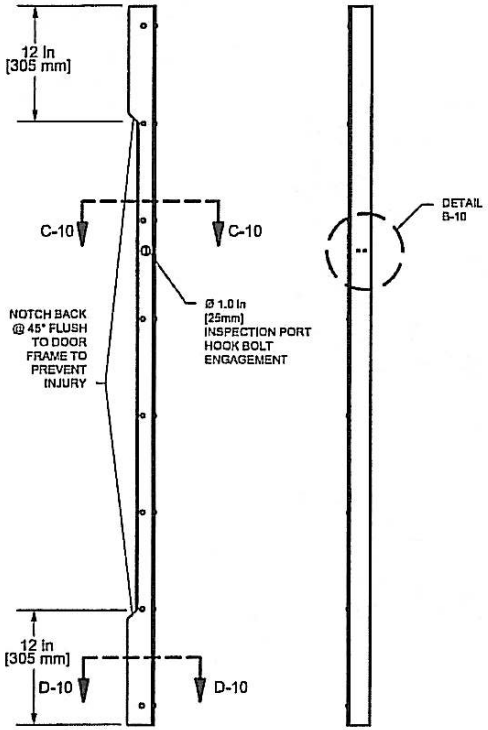


C-9 FOOD PASS THROUGH DETAIL

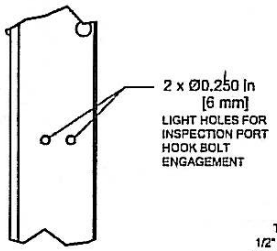


D-12 BUMPER DETAIL

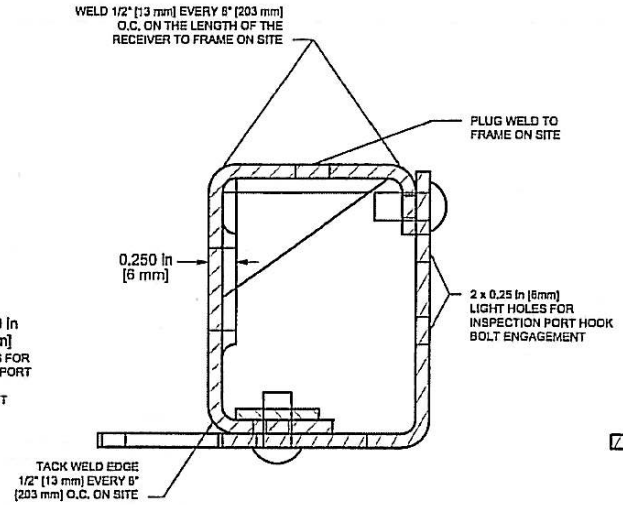
REVISIONS:	NOTES:		JOB:		
			CONTRACTOR:		
			DRAWN BY:	DATE:	
			W.O.#:	FILE NUMBER:	PG.#:



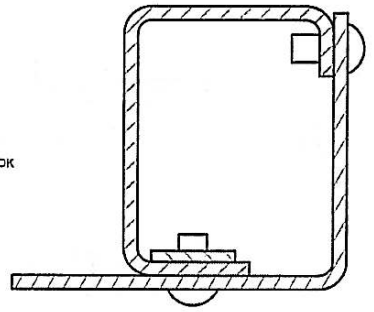
A-10 DOOR RECEIVER



B-10 DETAIL



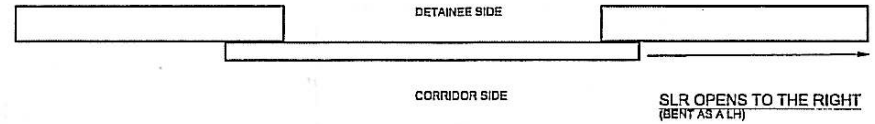
C-10 SECTION THROUGH DOOR RECEIVER



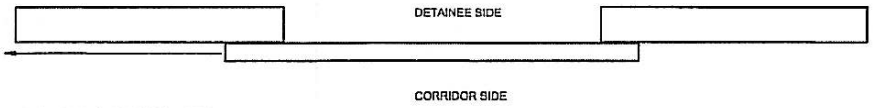
D-10 SECTION THROUGH DOOR RECEIVER

REVISIONS:	NOTES:		JOB:		
	REMOVE ALL BURRS AND SHARP EDGES AFTER WELDING		CONTRACTOR:		
			DRAWN BY:	DATE:	
			W.O.#:	FILE NUMBER:	PG.#:

A-11 SLIDING HANDING SHEET



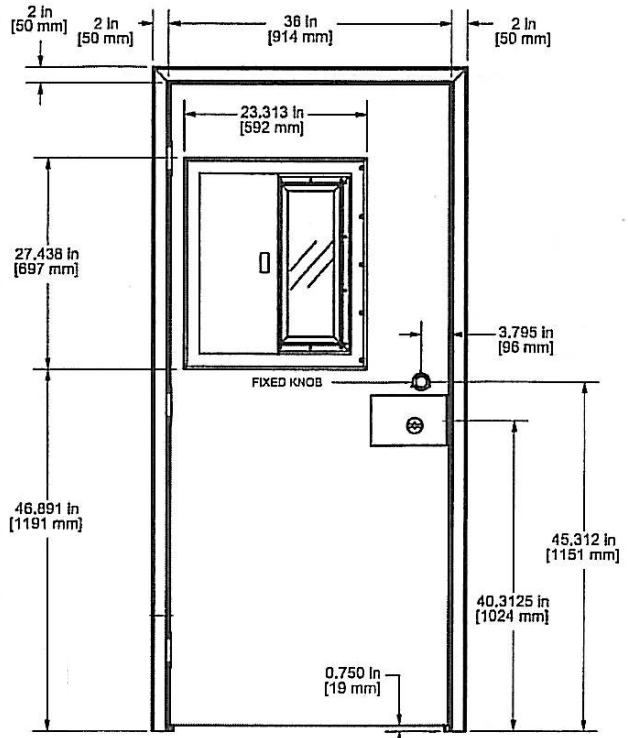
SLR OPENS TO THE RIGHT
(BENT AS A LH)



SLL OPENS TO THE LEFT
(BENT AS A RH)

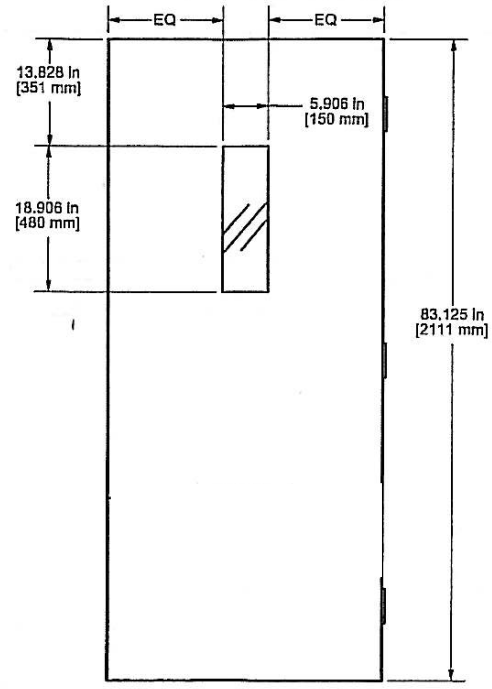
REVISIONS:	NOTES:		JOB:		
			CONTRACTOR:		
			DRAWN BY:	DATE:	
			W.O.#:	FILE NUMBER:	PG.#:

TYPE B DOOR (SWINGING)



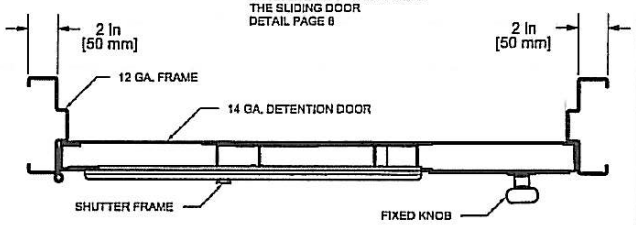
A-12 VIEW FROM CORRIDOR SIDE

12GA. FRAME & 14GA. STEEL STIFFENED DETENTION DOOR
LEVEL 3 NAAMM 863-98 AND ASTM - F1450-97 PERFORMANCE CRITERIA
FOR STATIC LOAD, RACK, IMPACT, & EDGE CRUSH TESTS
3'-0" x 7'-0" x 2" [914 x 2134 x 51 mm]

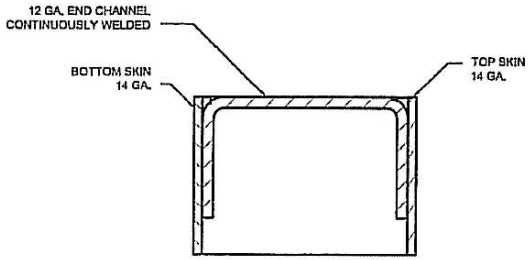


B-12 VIEW FROM DETAINEE SIDE

NOTE: LITE KIT IS THE SAME AS
THE SLIDING DOOR
DETAIL PAGE 8

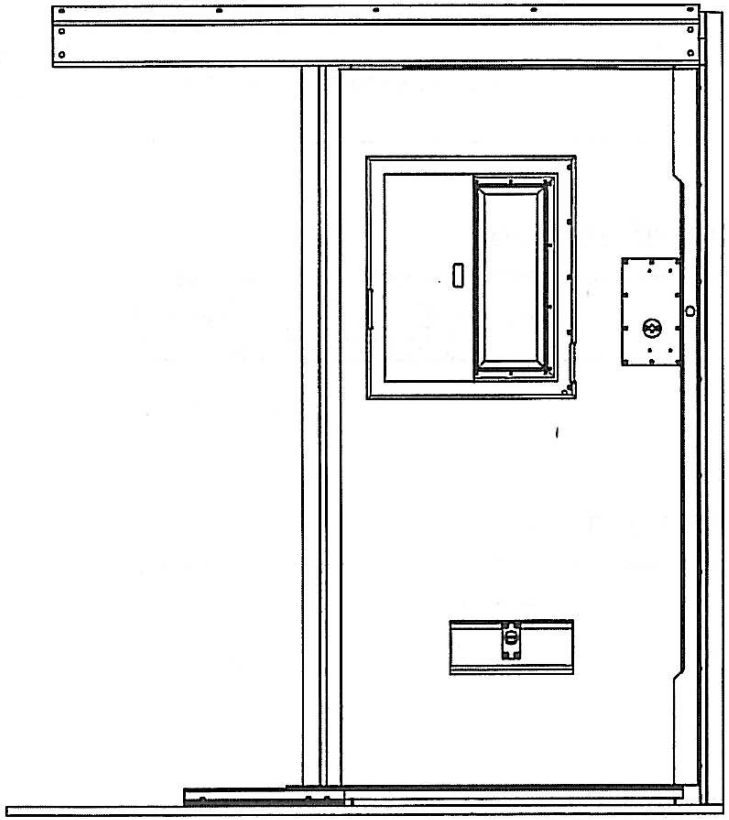


C-12 CROSS SECTION THROUGH
DOOR & FRAME

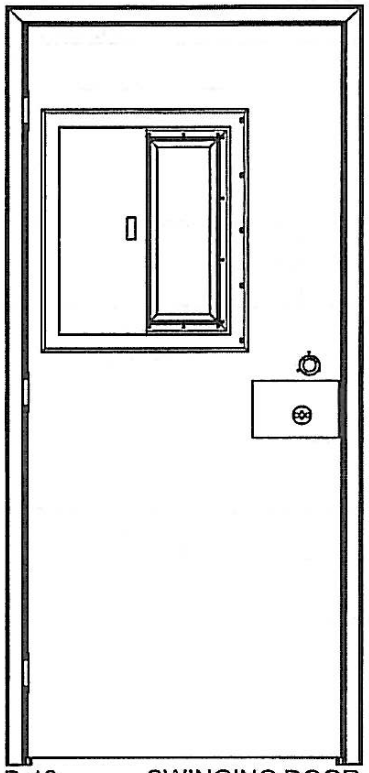


D-12 DETAIL TOP &
BOTTOM END CHANNEL

REVISIONS:	NOTES:		JOB:	
	THIS DRAWING IS THE EXCLUSIVE PROPERTY OF THE OWNER. NO USE WHATSOEVER OF THE INFORMATION CONTAINED HEREIN, NOR REPRODUCTION IN WHILE OR IN PART MAY BE MADE WITHOUT EXPRESSED WRITTEN PERMISSION. THIS DRAWING REMAINS THE PROPERTY OF THE OWNER AND MUST BE RETURNED ON DEMAND.		CONTRACTOR:	
			DRAWN BY:	DATE: 9/26/2007
			W.O.#:	FILE NUMBER: / PG.#:



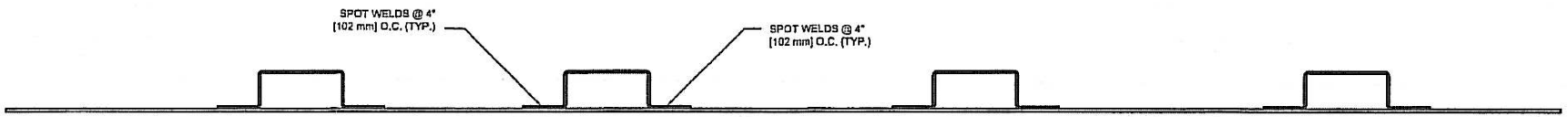
A-13 SLIDING DOOR



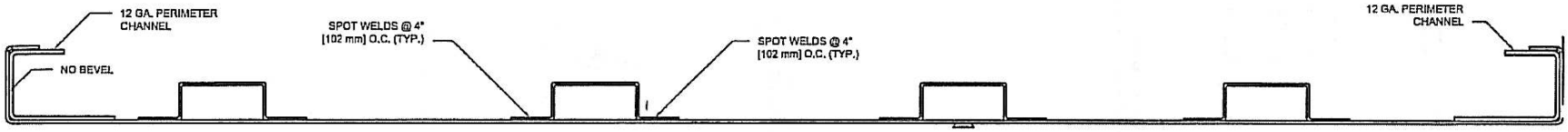
B-13 SWINGING DOOR

REVISIONS:	NOTES:		JOB:		
	THIS DRAWING IS THE EXCLUSIVE PROPERTY OF THE OWNER. NO USE WHATSOEVER OF THE INFORMATION CONTAINED HEREIN, NOR REPRODUCTION IN WHILE OR IN PART MAY BE MADE WITHOUT EXPRESSED WRITTEN PERMISSION. THIS DRAWING REMAINS THE PROPERTY OF THE OWNER AND MUST BE RETURNED ON DEMAND.		CONTRACTOR:		
			DRAWN BY:	DATE: 9/26/2007	
			W.O.#:	FILE NUMBER:	PG.#:

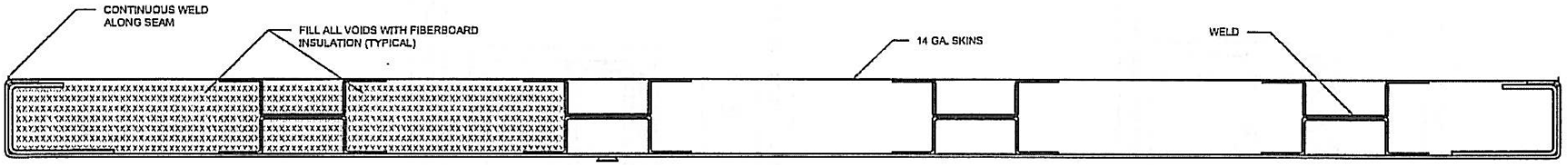
TYPE A DOOR (SLIDING)



A-14 TOP SKIN PROFILE



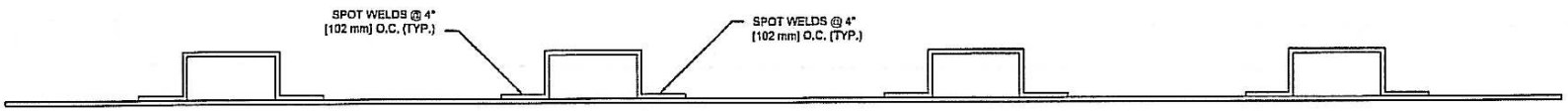
B-14 BOTTOM SKIN PROFILE



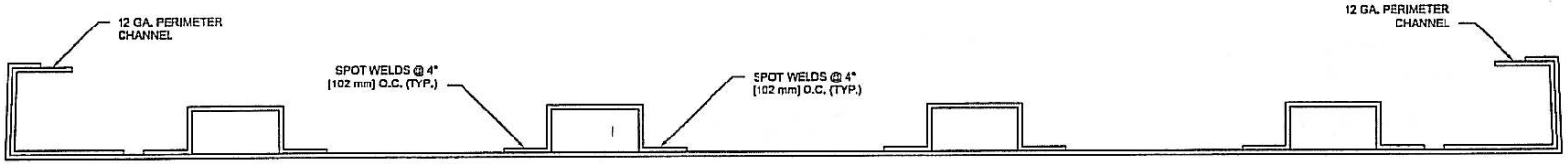
C-14 TOP & BOTTOM SKIN ASSEMBLY PROFILE

REVISIONS:	NOTES:		JOB:		
	THIS DOOR IS A SQUARE EDGE AS IT IS SLIDING		CONTRACTOR:		
			DRAWN BY:	DATE:	
			W.O.#:	FILE NUMBER:	PG.#:

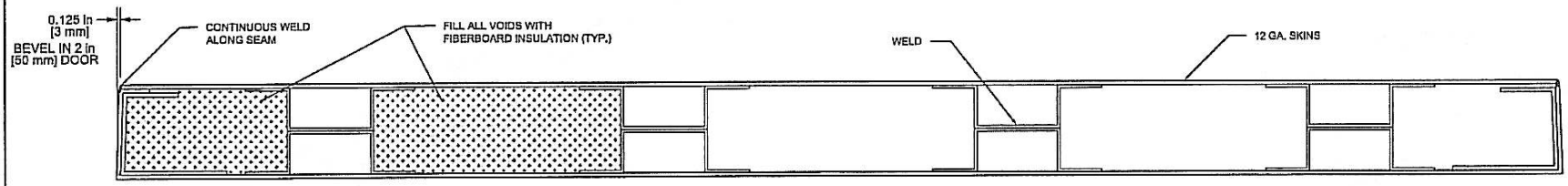
TYPE B DOOR (SWINGING)



A-15 TOP SKIN PROFILE



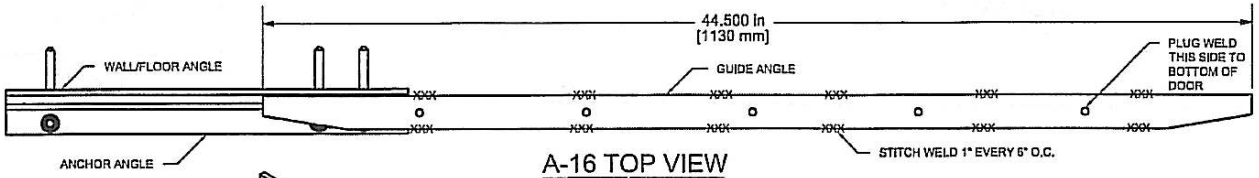
B-15 BOTTOM SKIN PROFILE



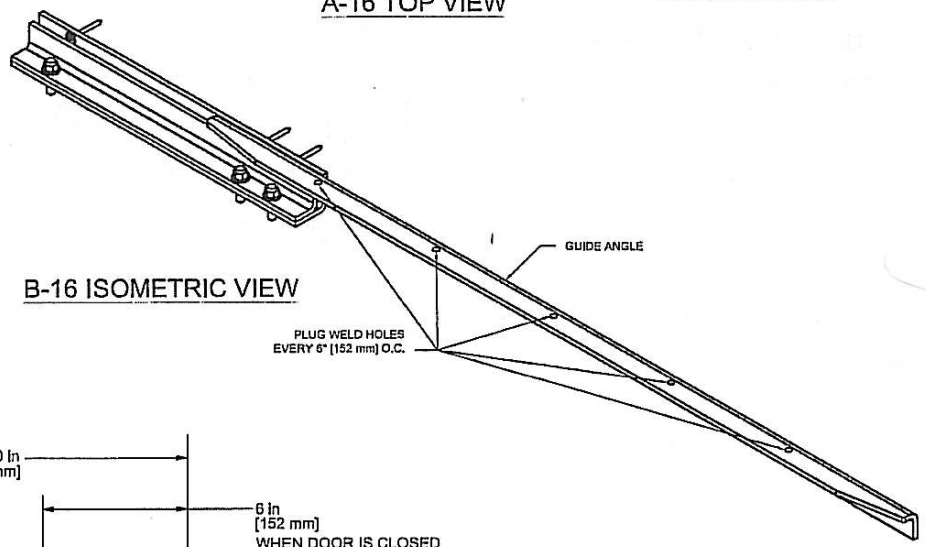
C-15 TOP & BOTTOM SKIN ASSEMBLY PROFILE

REVISIONS:	NOTES:		JOB:		
			CONTRACTOR:		
			DRAWN BY:	DATE:	
			W.O.#:	FILE NUMBER:	PG.#:

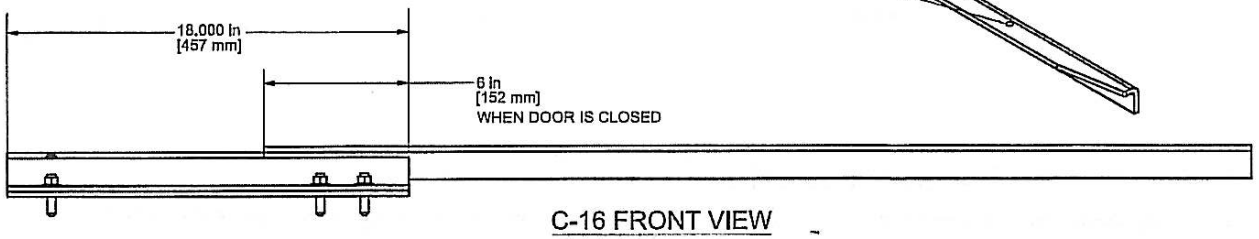
INSTALLATION OF WALL/FLOOR & ANCHOR ANGLE & GUIDE ANGLE



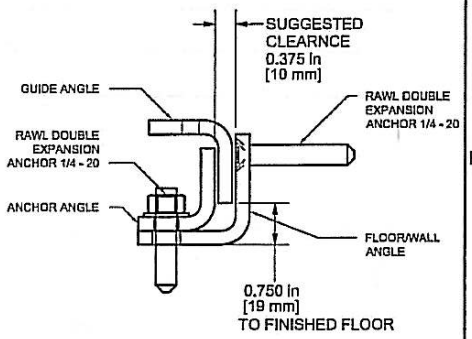
A-16 TOP VIEW



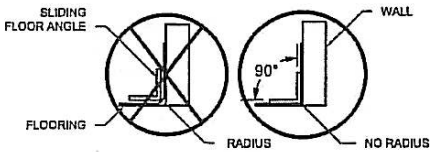
B-16 ISOMETRIC VIEW



C-16 FRONT VIEW



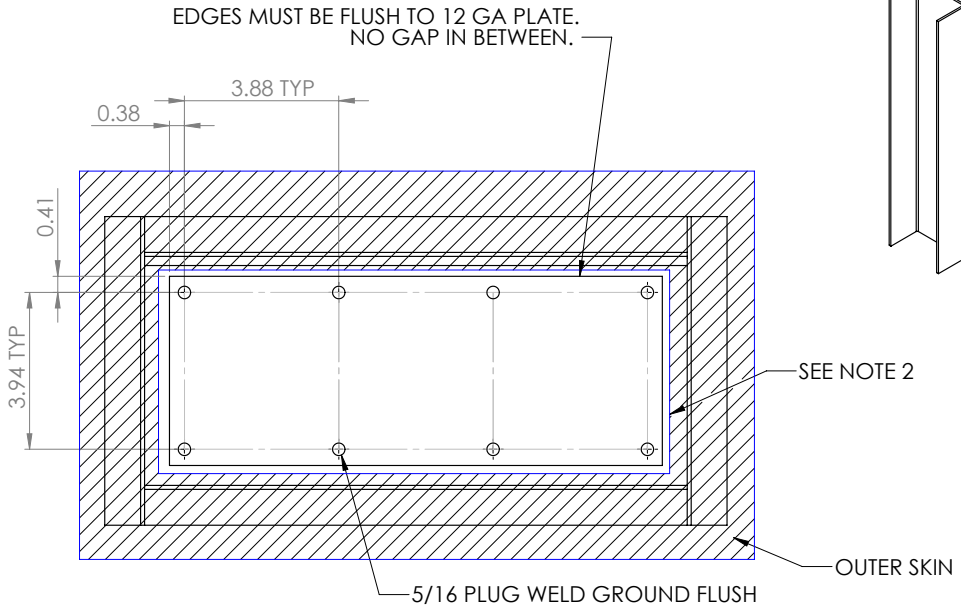
D-16 DETAIL

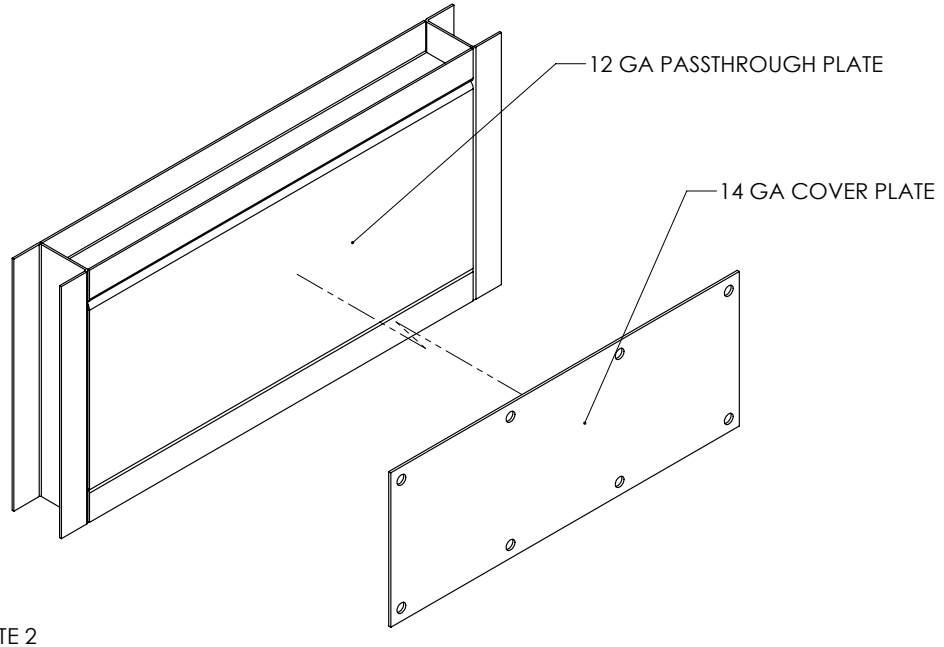


NOTE: FLOORING IS NOT TO HAVE A RADIUS WHERE IT MEETS THE WALL, FOR SLIDING UNITS.

E-16 FLOORING DETAIL

REVISIONS:	NOTES:		JOB:		
			CONTRACTOR:		
			DRAWN BY:	DATE:	
			W.O.#:	FILE NUMBER:	PG.#:



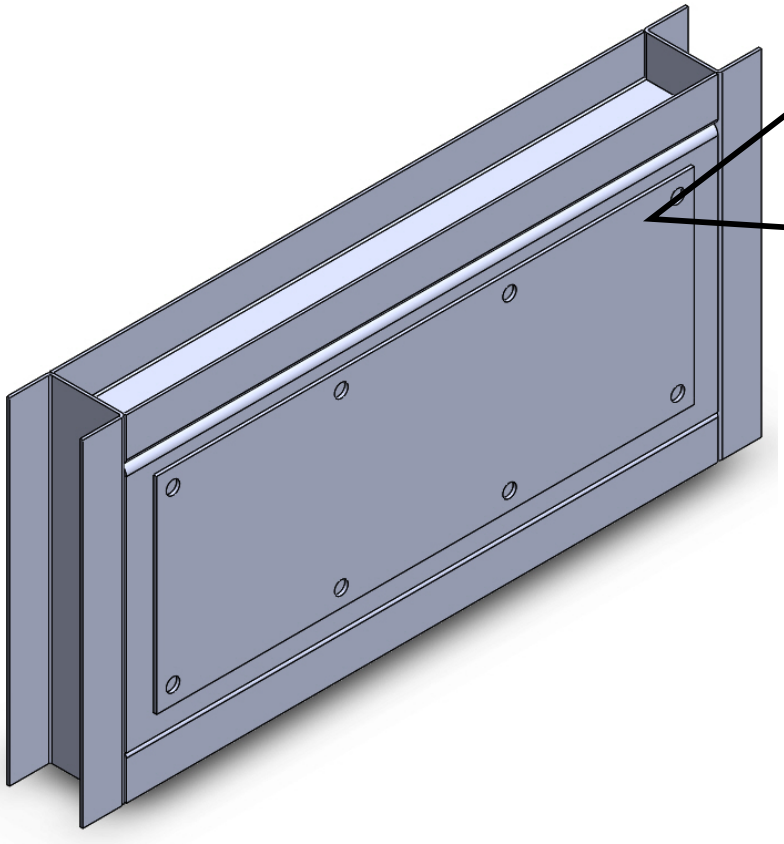


FOR ILLUSTRATION PURPOSES ONLY
REFER TO SEPT. 26, 2007 **OWNER** DOOR DRAWING PACKAGE

NOTES:
1. ALL WELDS MUST CONFORM TO BEST INDUSTRY PRATICE.
2. GAPS BETEWEEN THE FOOD PASS-THROUGH COVER PLATE AND OUTER SKIN MUST BE LESS THAN 2MM ALL AROUND.

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED:	APPLICATION:		TITLE: PASSTHROUGH COVER PLATE WELD DETAIL
DIMENSIONS ARE IN INCHES AND MILLIMETERS	NAME	DATE	
TOLERANCES: TWO PLACE DECIMAL ±0.01 THREE PLACE DECIMAL ±0.005	DRAWN	09-09-2016	SIZE B / DWG. NO. 28012710 / REV 1
	CHECKED MM	09-09-2016	
	SPECIFICATION:		SCALE: 1:5 / WEIGHT: / SHEET 1 OF 1



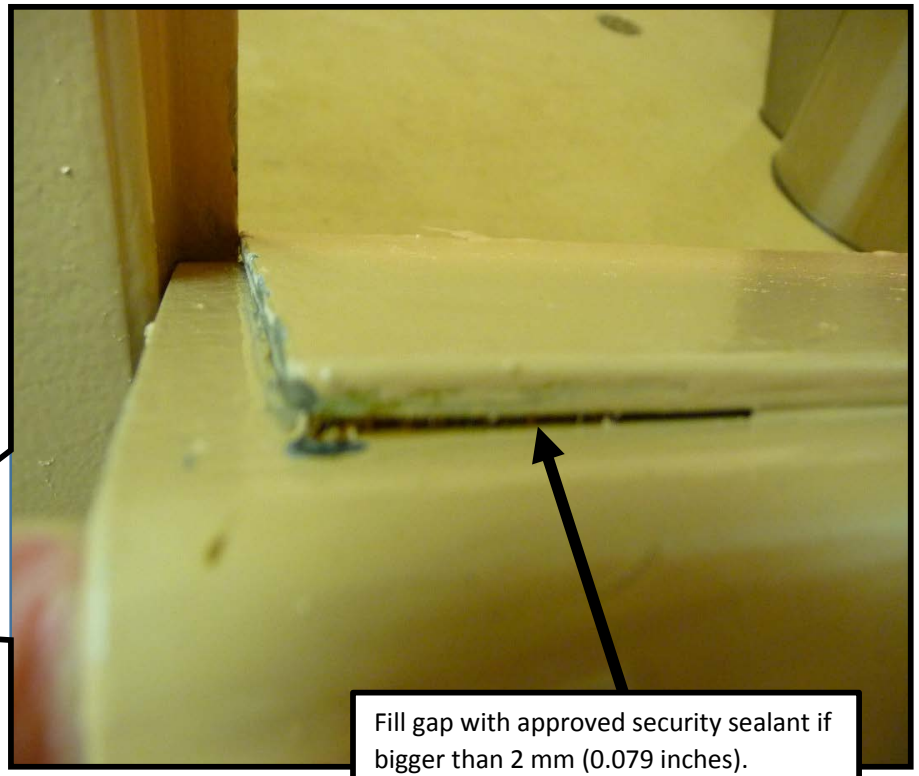


Illustration: 28012710-200
Food Pass-Through Door Finishing Plate Gap Verification

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 50 00 – Metal Fabrications

1.2 REFERENCE STANDARDS

.1 Aluminum Association (AA)

.1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.

.2 ASTM International

.1 ASTM A1008/A1008M-16, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

.2 ASTM D523-14, Standard Test Method for Specular Gloss.

.3 ASTM D822/D822M-13, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.4 ASTM E283-04(2012), Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen.

.5 ASTM E547-00(2016), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.105-M91, Quick-Drying Primer.

.2 CAN/CGSB-1.213-2004, Etch Primer (Pretreatment Coating or Tie Coat) for Steel and Aluminum.

.3 CAN/CGSB-1.181-99, Ready-Mixed, Organic Zinc-Rich Coatings.

.4 CSA International

.1 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.5 Environmental Choice Program (ECP)

.1 CCD-016-97(R2005), Thermal Insulation Materials.

.2 CCD-047-88(R2005), Architectural Surface Coatings.

.6 Green Seal Environmental Standards (GS)

.1 GS-11-2008, 2nd Edition, Paints and Coatings.

.7 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113-A2007, Architectural Coatings.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting one (1) week prior to beginning on-site installation, work of this Section, with Contractor's Representative and Consultant in accordance with Section 01 31 19- Project Meetings to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other construction sub-contractors.

.4 Review manufacturer's written installation instructions and warranty requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for doors, hardware, and accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate sizes, service rating, types, materials, operating mechanisms, glazing locations and details, hardware and accessories, required clearances and electrical connections.

.4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.5 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.6 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements in accordance with Section 01 74 21 Construction/ Demolition Waste Management and Disposal.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and pre-consumer content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates regional materials.

.4 Low-Emitting Materials:

.1 Submit listing of primers, paints and coatings used in building, comply with VOC and chemical component limits or restriction requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Submit maintenance data for cleaning and maintenance of doors for incorporation into manual in accordance with Section 01 78 00- Closeout Submittals.

.2 Warranty Documentation: Submit documents for a ten (10) year warranty against perforation due to rusting, five (5) year warranty against delamination, and one (1) year general warranty from date of substantial completion.

1.6 QUALITY ASSURANCE

.1 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect sectional metal doors, hardware and accessories from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Waste Management Plan related to Work of this Section and in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

.5 Packaging Waste Management: remove for reuse of crates, pallets, as specified in Waste Reduction Workplan, Construction Waste Management Plan in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 DESIGN CRITERIA

.1 Design exterior door assembly to withstand wind load of 1kPa with a maximum horizontal deflection of 1/240of opening width.

.2 Design door panel assemblies with thermal insulation factor 1.2 RSI.

.3 Design door assembly to withstand minimum 100,000 cycles per annum, and 20 years total life cycle.

2.2 MANUFACTURERS

.1 Approved Manufacturer/Model: Thermostop, Sentinel Series, St. Hubert, Quebec (Contact 1-866-678-0123, info@thermostop.com). Or consultant approved alternate.

2.3 MATERIALS

.1 Galvanized steel sheet: commercial quality Z275zinc coating.

.2 Steel sheet: commercial quality to ASTM A1008/A1008M, exposed (E), shop painted.

.3 Primer: to CAN/CGSB-1.105 for steel CAN/CGSB-1.181, for galvanized steel surfaces.

.1 VOC limit compliant with AS-11 SCAQMD Rule 1113.

.1 VOC limit: 150g/L maximum to CCD-047.

.2 Primer not to exceed toxicity concentrations.

.4 Insulation: Isocyanurate or rigid polyurethane, full thickness of panel.

.5 Cable: multi-strand galvanized steel aircraft cable.

2.4 DOORS

.1 Fabricate 75 mm thick insulated doors flush sections of interlocking steel roll formed sections as indicated.

.2 Fabricate panel frames from 1.6 mm CRS in a continuous box frame with 1.6 thick (16ga) vertical stiles at 300mm centres or hat channel stiffeners across the back of each panel.

.3 Overlap edge of door openings by 100mm each side and top.

.4 Bottom door section to have “T” bar full length of panel.

.5 Assemble components by means of coated rivet system or adhesive and self-tapping screws to manufacturer's recommendations. No exterior fasteners permitted.

.6 Apply shop coat of anti-corrosive primer after fabrication of door.

.1 VOC limit 250g/L maximum to SCAQMD Rule 1113 GS-11.

2.5 HEAVY DUTY INDUSTRIAL HARDWARE

.1 Track: standard lift hardware with 75mm size 2.50 mm core thickness galvanized steel track; tapered and mounted for wedge closing reinforced as required.

.2 Bearing Plates: designed by manufacturer with minimum 3.40 mm thick plates.

.3 Track Supports: 2.3 mm core thickness vertically continuous galvanized steel angle track supports bolted to doorframe.

.4 Spring counter balance: heavy duty oil tempered torsion spring with manufacturers standard brackets.

.1 Drum: 200 mm diameter die cast aluminum.

.2 Shaft: 32 mm diameter galvanized steel.

.5 Top roller carrier: galvanized Steel 2.10 mm(13 ga.) thick adjustable.

.6 Rollers: full floating grease packed hardened steel, ball bearing 75mm diameter solid steel tire.

.7 Roller brackets: adjustable, minimum 2.5 mm galvanized steel.

.8 End-Hinges: heavy duty, 2.90 mm (11ga) thick galvanized, bolted and spaced to door frame at 750mm per section.

.9 Counterbalance: duplex torsion spring system with precision pollard bearing.

.10 Cable: 6 mm diameter galvanized steel aircraft cable.

2.6 ACCESSORIES

.1 Overhead horizontal track and operator supports: galvanized steel, type and size to suit installation.

.2 Track guards: 5mm thick formed sheet 1500mm high track guards. Supply complete with Hilti-Hit Floor fastening, minimum 3 per guard.

.3 Pusher springs: 100,000 cycle rated.

.4 Two horizontal sliding side lock bolts on interior.

.5 Weatherstripping:

.1 Sills: double contact bulb type full width extruded neoprene weatherstrip adhered to “T” bar across bottom of door.

.2 Jambs and head: extruded aluminum and arctic grade vinyl weatherstrip to manufacturer's standard.

.6 Finish ferrous hardware items with minimum zinc coating of 300 g/m2 to CAN/CSA-G164.

.7 All other fasteners, brackets and miscellaneous hardware required for a complete installation to the scheduled opening and to provide details shown on drawings. No exposed fasteners on exterior face of door sections.

2.7 FINISH

.1 Pre-finish door sections in factory after fabrication to custom colour selected by Consultant.

.1 Interior: 0.2 mil white polyester wash coat.

.2 Exterior: two coat system consisting of 0.2 mil epoxy primer coat and 0.7 mil acrylic finish coat.

.3 Specular gloss: 30units +/- in accordance with ASTM D523.

.4 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:

.1 Outdoor exposure period 2500 hours.

.2 Humidity resistance exposure period 5000 hours.

2.8 OPERATORS

.1 Equip doors for operation by:

.1 Chain hoist with galvanized steel chain rope.

.2 Manual override on overhead door must be secured with padlock acceptable to the Owner, keyed the same as the man doors for the area.

.2 Cable fail safe device.

.1 Able to stop door immediately if cable breaks on door free fall. Braking capacity 500kg.

2.9 ELECTRICAL OPERATOR

.1 Electrical jack shaft side mounted type operator. Dorlec EHJ-383.

.2 Electrical motors, controller units, remote pushbutton stations, relays and other electrical components: to CSA approval.

.3 Power supply: 208 phase, 60 Hz.3 phase.

.1 Motor: ¾ HP high starting torque, class A, insulated.

.4 Controller units with integral motor reversing starter, solenoid operated brake 3 heater elements for overload protection, including pushbuttons and control relays as applicable.

.5 Standard garage operation:

.1 Interior Operation, Door 128B:

.1 Remote pushbutton station: NEMA 1, flush mounted, adjacent to each door, with "OPEN-STOP-CLOSE" "SECURITY LOCKOUT" designations on pushbuttons in English. 24V

.2 Exterior Operation, Door 128B:

.1 Remote pushbutton station: NEMA 4, mounted on exterior concrete pedestal, with "OPEN-STOP-CLOSE" "SECURITY LOCKOUT" designations on pushbuttons in English. Key operated Model Camden CI-1KX. Abloy CY403 Cylinder to be provided in accordance with Section 08 71 00 Hardware.

.6 Secure Bay Operation

.1 Pushbutton Operator: Schneider Electrical, mounted on exterior concrete pedestal with steel control post, with "OPEN-CLOSE" with stop button designations on pushbuttons in English. Type B 30 mm, Control Stations, Type KY293 Security Control Station. One Class 9007 AO2 snap switch for open position and one snap switch for close position. One Class 9001 Type KA1 contact block for stop button. Schlage cylinder, chrome finish.

.7 Safety switch: combination roll rubber with limit switches for full length of bottom rail of bottom section of door, to reverse door to open position when coming in contact with object on closing cycle.

.1 Safety switch mechanism complete with one (1) set of photo eyes and reflector.

.8 For jack shaft operators:

.1 Provide floor level disconnect device to allow for manual operation in event of power failure.

.2 Equip Operator with:

.1 Electrical interlock switch to disconnect power to operator when in manual operation.

.2 Built-in chain hoist for manual operation in event of power failure.

.3 Cable fail safe device:

.1 Solenoid brake able to stop door immediately if cable breaks on door free fall. Braking capacity 500 kg.

.9 For trolley operators:

.1 Attach operator to door with quick release device to disconnect door from operator in event of power failure.

.10 Automatic illumination complete with time delay, self-extinguishing.

.11 Door speed: 300mm per second.

.12 Control transformer: for 24 VAC control voltage.

.13 Mounting brackets: galvanized steel, size and gauge to suit conditions.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for sectional metal doors installation in accordance with manufacturer's written instructions.

.1 Visually review substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Install doors and hardware in accordance with manufacturer's instructions.

.3 Rigidly support rail and operator and secure to supporting structure.

.4 Scope nominally horizontal track 1:50, or to manufacturer’s slope recommendations, upwards from curved track at doors equipped with jackshaft operator.

.5 Touch-up steel doors with primer where finish damaged during fabrication.

.6 Install operator including electrical motors, controller units, pushbutton stations, relays and other electrical equipment required for door operation. Secure housing using Pin Torx fasteners.

.7 Lubricate and adjust door operating components to ensure smooth opening and closing of doors.

.8 Adjust weatherstripping to form a weather tight seal.

.9 Adjust doors for smooth operation.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written reports from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product within three (3) days of review.

.2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits to review Work at stages listed:

.1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.

.2 Upon completion of Work, after cleaning is carried out.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.1 Remove traces of primer; clean doors and frames.

.2 Clean glass and glazing materials with approved non-abrasive cleaner.

.3 Waste Management: separate waste materials for reuse in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by sectional metal door installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 92 00 - Joint Sealants

.2 Section 08 11 00 - Metal Doors and Frames

.3 Section 08 71 00 - Door Hardware

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)

.1 ANSI/BHMA A156.10-2017, Power Operated Pedestrian Doors.

.2 ANSI/BHMA A156.19-213, Power Assist and Low Energy Power Operated Doors.

.2 ASTM International

.1 ASTM B209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.2 ASTM B221M-13, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

.3 Green Seal Environmental Standards (GS)

.1 GS-11-2013, Paints and Coatings.

.4 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113-A2016, Architectural Coatings.

.2 SCAQMD Rule 1168-A2014, Adhesives and Sealants Applications.

.5 Underwriters' Laboratories of Canada (ULC)

.1 ULC/ORD C305-72, Panic Hardware.

.2 CAN/ULC-S524-14, Standard for the Installation of Fire Alarm Systems.

.3 CAN/ULC-S533-15, Egress Door Securing and Releasing Devices.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for hardware, and accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta. Canada.

.2 Indicate layout, dimensions, elevations, materials, finishes, hardware including mounting heights, anchors and reinforcements.

.3 Identify installation tolerances required, assembly conditions, routing of service lines, locations of operating components, controls and boxes.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that construction wastes were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content.

.3 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants, primers, paints and coatings used in building, showing compliance with VOC and chemical component limits or restriction requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Submit project record documents that accurately record locations of concealed equipment, services, and conduit.

.3 Operation and Maintenance Data: submit operation and maintenance data for door system for incorporation into manual.

.4 Parts List:

.1 Submit manufacturer's parts lists ; include servicing frequencies, instructions for adjustment and operation applicable to each type of component or hardware, and name, address and telephone number of nearest authorized service representative.

.5 Maintenance Contract:

.1 Supply complete service and maintenance of operating equipment for one (1)year from date of substantial performance of the work.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Supply wrenches and tools required for maintenance of equipment.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions, 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, in dry location, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect automatic entrance doors and frames from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Cover exposed metal surfaces with pressure sensitive heavy protection paper or strippable plastic coating.

.1 Use materials of type which will not leave residue or become bonded when exposed to sun.

.5 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 43 - Environmental Procedures

.6 Packaging Waste Management: remove for reuse by manufacturer and return of packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

1.7 WARRANTY

.1 Warranty: include coverage of repair or replacement of components or entire units which fail in materials workmanship. Failures include but are not necessarily limited to, structural failures including excessive deflection, excessive leakage or air infiltration, faulty operation of operators speed control and hardware, deterioration of metals, metal finishes, and other materials beyond normal weathering.

Part 2 Products

2.1 SYSTEMS

.1 Design Requirements:

.1 Design automatic entrance doors as emergency exits, as required as means of egress from the building.

.2 Design automatic entrances to comply with applicable requirements of ANSI/BHMA A156.10.

.3 Design power assist and low energy power operated doors to applicable requirements of ANSI/BHMA A156.19.

.2 Performance Requirements:

.1 Automatic door equipment to accommodate high frequency pedestrian traffic.

.2 Operator Equipment: CSA approved.

.3 Automatic Locks and Panic Hardware to Non-Fire Rated Exit Doors: ULC listed and labelled.

.4 Supply manual operation for opening and closing of doors during electrical power failure and when power is manually switched off.

.5 Include fully adjustable operators for hold open time, opening and closing speeds, checking speeds and cancellation on activation of fire alarm and smoke detection system, security system and building door control system.

.6 Eliminate possibility of water accumulating and freezing in door power units.

.7 Design equipment to operate at ambient temperatures between-40 degrees C and 170 degrees C.

2.2 HARDWARE

.1 Automatic Door Equipment to be coordinated and installed with hardware in accordance with Section 08 71 00 - Hardware.

2.3 MATERIALS

.1 Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

.1 Headers 6063-T6.

.2 Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221M.

.3 Sheet and Plate: ASTM B209M.

.2 Sealants and Joint Fillers: Refer to Division 7, Section 07 92 00 - Joint Sealants.

.3 Header Case: Header case shall not exceed 6” (152mm) square in section and shall be fabricated from extruded aluminum with structurally integrated end caps, designed to conceal door operators and controls. The operator shall be sealed against dust, dirt and corrosion within the header case. Access to the operator and electronic control box shall be provided by a full length removable cover, edge rabbeted to the header to ensure a flush fit. Removable cover shall be secured to prevent unauthorized access.

.4 Door Arms: A combination of door arms and linkage shall provide positive control of door through entire swing; units shall permit use of butt hung, center pivot, and offset pivot-hung doors.

.5 Fasteners and Accessories: Manufacturer’s standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

.6 Signage: Provide signage in accordance with ANSI/BHMA A156.19.

2.4 SWINGING DOOR OPERATORS

.1 Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.

.2 Electromechanical Operators: Self-contained unit powered by a 3/16 horsepower, permanent-magnet DC motor; through a high torque reduction gear system.

.1 Operation: Power opening and spring closing.

.2 Operator Type: Low energy; readily convertible to full energy; no tools required to change type.

.3 Handing: Non-handed; no tools required to change handing.

.4 Capacity: Rated for door panels wighing up to 350 pounds.

.5 Mounting: Visible

.6 Features:

.1 Adjustable opening and closing speeds

.2 Adjustable opening and closing force

.3 Adjustable back-check

.4 Adjustable hold-open time between 0 and 30 second

.5 Reverse on obstruction.

.6 Variable rate open/closed speed control.

.7 Closed loop speed control with active braking and acceleration.

.8 Variable obstruction recycle time delay.

.9 Optional Switch to open/Switch to close operation.

.10 When operators are provided in pairs, adjustable features are independently adjustable for each operator.

.3 Field Adjustable Spring Closing Operation: The operator shall close the door by spring energy employing the motor, as a dynamic brake closing speed control. The closing spring shall be a helical compression spring, adjustable for positive closing action. The spring shall be adjustable, without removing the operator from the header, to accommodate a wide range of field conditions.

.4 Independent Adjustable Closing and Latching Speed Control: The operator shall employ a rheostat module to allow for independent field adjustment of closing and latching speeds using the motor as a dynamic brake.

.5 Field Adjustable Open Stop: The operator shall provide a field adjustable open stop to accommodate opening angles from 80 to 135 degrees without the need for additional components.

.6 Consistent Cycle: The operator shall deliver an even, consistent open force across the entire transition from door fully closed to door fully open.

.7 Additionally, the range of the force shall be field adjustable to accommodate a wide range of on-site conditions.

.8 Quiet Performance: The operator shall be designed to output audible noise ratios less than or equal to 50 dB.

.9 Manual Use: The operator shall function as a manual door closer in the direction of swing with or without electrical power. The operator shall deliver an even, consistent open force across the entire transition from door fully closed to door fully open.

.10 Electrical Service to door operators shall be provided in accordance with Electrical scope. Minimum service to 120 VAC, 10 Amps for doors with operators in pairs, 5 Amps for single doors.

2.5 DOOR OPERATOR CONTROL SYSTEMS

.1 Supply controls with detection patterns and sensitivity, for both operation and safety, of sizes and quantities required to suit project, but not smaller than requirements of ANSI/BHMA A156.10.

.2 Electrical Control System: Electrical control system shall include a microprocessor controller and position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position. Systems utilizing external magnets and magnetic switches are not acceptable.

.3 Life Cycle Data Counter: The microprocessor control shall incorporate a non-re-settable counter to track door operation cycles.

.4 Controller Protection: The microprocessor controller shall incorporate the following features to ensure trouble free operation:

.1 Automatic Reset Upon Power Up.

.2 Main Fuse Protection.

.3 Electronic Surge Protection.

.4 Internal Power Supply Protection.

.5 Resettable sensor supply fuse protection.

.6 Software "Watchdog" protection in the case of software malfunction.

.5 Push Button Interface with LED: The controller shall have push button switches with LED readout to allow for selection or change of the following parameters: timer logic, single door, activation options, normal back check, push-to-open assist on/off.

.6 Soft Start/Stop: A "soft-start' 'soft stop' motor driving circuit shall be provided for smooth normal opening and recycling.

.7 Safety Search Circuitry: Provide system to recycle the swinging panels when an obstruction is encountered during the closing cycle. If an obstruction is detected, the system shall search for that object on the next closing cycle by reducing door closing speed prior to the preciously encountered obstruction location, and will continue to close in check speed until doors are fully closed, at which time the doors will reset to normal speed. If obstruction is encountered again, the door will come to a full stop. The doors shall remain stopped until obstruction is removed and operate signal is given, resetting the door to normal operation.

.8 Programmable Controller: Microprocessor controller shall be programmable and shall be designed for connection to a local configuration tool. Local configuration tool shall be software driven. The following parameters may be adjusted via the configuration tool.

.1 Operating speed and forces as required to meet ANSI/BHMA A156.10.

.2 Firmware update.

.3 Trouble shooting

.1 I/O Status.

.2 Electrical component monitoring including parameter summary.

.4 Entrance profile copy/paste: Software for local configuration tool shall be available as a free download from the automatic door operators manufacturer's internet site.

.9 Emergency Breakout Switch: A cam actuated emergency breakout switch shall be provided to disconnect power to the motor when an in-swinging door is manually pushed in the emergency out direction. The operator will then automatically reset and power will be resumed.

.10 Control Switch: Automatic door operators shall be equipped with a three position function switch to control the operator of the door. Control switch shall provide three modes of operation, Automatic, Off and Hold-Open.

.11 Power Switch: Automatic door operators shall be equipped with a two position On/Off switch to control power to the door.

.12 Key Switch surface, jamb mounted, on inside of opening.

2.6 ACTVATION DEVICES

.1 Activation for Low Energy Doors:

.1 Activation for Low Energy Doors:

.1 Push Plates: Provide 4 ½ inch (114mm) square SPDT push plates with UL listed switch. Face plates to be stainless steel. Face plates shall be engraved with the international symbol for accessibility and "Push to Open".

.1 Interior and exterior push plates shall be mounted on frame in single gang electrical boxes and hardwired to door operator controls.

2.7 ALUMINUM FINISHES

.1 Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designing finishes. Finish designations prefixed by AA comply with system established by aluminum Association for designing finishes.

.2 Class II, Clear Anodic Finish: AA-M10C22A31 Mechanical Finish: as fabricated; Chemical Finish: etched, medium matte; Anodic Coating Architectural Call II, clear coating 1.40 mils minimum complying with AAMA 611-98 and the following:

.1 AAMA 607.1

.2 Applicator must be fully compliant with all applicable environmental regulations and permits, including wastewater and heavy metal discharge.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for automatic entrances installation in accordance with manufacturer's written instructions.

.1 Visually review substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Coordinate operators and controls with the install of doors and frames in accordance with Section 08 11 00 - Metal Doors and Frames.

.3 Co-ordinate installation of components with related and adjacent work.

.4 Set work plumb, square, level, free from warp, twist and superimposed loads.

.5 Securely anchor work in required position. Do not restrict thermal movement.

.6 Apply isolation coating to separate aluminum and primed or galvanized steel surfaces.

.7 Install hardware using templates provided. Refer to Section 08 71 00 - Door Hardware for installation requirements.

.8 Install door operator system in accordance with manufacturer's instructions, including piping controls, control wiring.

.9 Set header assemblies and operating brackets, level and true to location, with adequate anchorage for permanent support.

3.3 SEALANT APPLICATION

.1 Install perimeter seal and air vapour membrane as detailed.

.2 Comply with requirements of Section 07 92 00 - Joint Sealants for sealants, fillers and gaskets to be installed during installation of doors and frames.

.3 Conceal sealant within aluminum work except where exposed use is permitted by Consultant.

.4 Set sill members in bed of sealant.

3.4 ADJUSTING

.1 After repeated operation of completed installation equivalent to three (3) days of use by normal traffic (100 to 300 cycles), readjust door operators and controls for optimum, smooth operating condition and safety and for weather tight closure. Lubricate hardware, operating equipment and other moving parts.

.2 Adjust revolving doors to ensure tight fit at contact points with enclosure.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Remove traces of primer, caulking; clean doors and frames.

.3 Clean aluminum surfaces promptly after installation. Exercise care to avoid damage to coatings.

.4 Clean glass and glazing materials with approved non-abrasive cleaner.

.5 Remove protective material from prefinished aluminum surfaces.

.6 Wash exposed surfaces with mild solution of detergent and warm water, using soft, clean wiping cloths. Remove dirt from corners. Wipe surfaces clean.

.7 Remove excess sealant by moderate use of solvent, of type acceptable to sealant manufacturer.

.8 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by aluminum door and frame installation.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Delegated Design Professional Engineer: The professional engineer hired or contracted to the fabricator or manufacturer to produce delegated design submittals and shop drawings to meet the requirements of the Project, and registered in the Province of Alberta, and who is not the Consultant.

.2 Equal Dimensions: Curtain wall assemblies indicating equal dimensions on the drawings shall be calculated to align with in-place structural elements followed by even division of the space between structural elements. This shall mean that curtain wall materials are evenly spaced between adjacent structural members, not necessarily evenly spaced across the entire wall assembly.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate installation of system with work specified in other Sections to ensure proper placement and installation of vapour barrier, insulation and flashing in order that air, vapour and thermal barrier of building is intact and moisture will be diverted to the exterior, and as follows:

.1 Coordinate installation of sealants so that ambient and surface temperatures are greater than 5°C from time of application until sealants have cured.

.2 Coordinate connection of curtain wall system structural connections at floor slabs to vertical members.

.3 Coordinate design of curtain wall elements to tie into adjacent building envelope elements.

.4 Delegated Design Requirements: Coordinate design of glazed curtain wall with glass thicknesses and composition in accordance with referenced standards and requirements of this Section.

1.3 RELATED REQUIREMENTS

.1 Section 07 21 13 – Board Insulation

.2 Section 07 84 00 – Fire Stopping

.3 Section 07 92 00 – Joint Sealansts

.4 Section 08 81 00 – Glass and Glazing

.5 American Architectural Manufacturers Assocation

.1 AAMA 611-14, Voluntary Specification for Anodized Architectural Aluminum.

.2 AAMA 1503-09, Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

.6 American National Standard

.1 ANSI H35.1/H35.1M-2017, American National Standard Alloy and Temper Designation Systems for Aluminum, 2017.

.7 ASTM International

.1 ASTM B209-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.2 ASTM B221-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

.3 ASTM B308/B308M-10, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.

.4 ASTM B429/B429M-10e1, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

.5 ASTM E283-04(2012), Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

.6 ASTM E331-00(2016), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

.7 ASTM E783-02(2010), Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

.8 ASTM E1105-15, Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

.8 CSA Group

.1 CSA G40.21-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59.2-M1991(R2013), Welded Aluminum Construction.

1.4 SUBMITTALS

.1 Submit required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Action Submittals: Submit the following before starting any work of this Section:

.1 Product Data: Submit product data indicating construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated, in addition to the following specific requirements:

.1 Mechanical Fasteners: Indicate sizes, shear, and pull over loading capacity where applicable.

.2 Corrosion Protection: Indicate thickness and type of corrosion protection coating.

.2 Shop Drawings: Submit shop drawings prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of glazed aluminum curtain wall systems clearly indicating all construction details including; but not limited to, the following:

.1 Connections and anchor requirements

.2 Type, size and spacing of fastening devices

.3 Design loads

.4 Connections to adjacent air and vapour membranes

.5 Internal drainage

.6 Sealant locations

.7 Seal of a professional engineer registered in the Province of the Work for details requiring structural design for load bearing, or life/health safety.

.3 Samples: Submit samples for each type of exposed finish required, in manufacturer's standard sizes for Consultant's verification of specified finishes including; but not limited to, the following:

.1 Submit fabricated sample of each vertical to horizontal intersection of specified systems, made from 450 mm lengths of full size components indicating details of the following:

.1 Joinery

.2 Anchorage

.3 Expansion provisions

.4 Glazing

.5 Flashing and drainage

.3 Informational Submittals: Provide the following:

.1 Qualification Statement: Submit evidence of welder qualifications specified in this Section when requested by Consultant.

.2 Source Quality Control Submittals: Submit delegated design professional engineer's design notes and calculations upon request of the Consultant.

.3 Delegated Design Submittals: Submit letters of commitment and compliance as follows:

.1 Provide Letter of Commitment in conjunction with shop drawings, signed and sealed by the professional engineer required by the Work of this Section indicating the following are designed to the intent of the Building Code:

.1 Curtain wall connections to building structure

.2 Curtain wall reinforcement

.3 Deflection of members

.4 Glass thickness as it relates to glass area

.2 Provide Letter of Compliance, signed and sealed by the professional engineer required by the Work of this Section indicating that connections, reinforcement and deflection criteria, and glass thickness of installed system is in compliance with the intent of the Building Code and reviewed shop drawings before declaration of Substantial Performance

1.5 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: Installer shall be capable of assuming delegated design engineering responsibility, performing Work of this Section and who is acceptable to manufacturer for the type of work specified.

.2 Delegated Design Professional: Retain a Professional Engineer, registered in the Province of Alberta, to design fabrication and erection of the Work of this Section in accordance with applicable Building Code and Contract Documents requirements including, but not limited to, the following:

.1 Seal and signature to shop drawings and design submittals

.2 Site review of installed components

.2 Certifications: Provide the following during the course of the Work:

.1 Compliance Certification: Provide certificates from manufacturer indicating tested performance requirements required by Authorities Having Jurisdiction.

.2 Letters of Commitment and Compliance: Provide documents prepared by the delegated design professional engineer as recommended by APEGGA's Responsibilities for Engineering Services for Building Projects.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: Deliver, handle and store prefabricated units in accordance with manufacturer's directions.

.3 Storage and Handling Requirements: Store units at site on raised wood pallets protected from the elements and corrosive materials, and as follows:

.1 Do not remove from crates or other protective covering until ready for installation.

.2 Store all glass units vertically on end with solid bearing full thickness of sealed units.

.3 Store pre-fabricated frame assemblies blocked off the ground to prevent warping, twisting, undue strain on assembly or physical abuse and damage.

1.7 SITE CONDITIONS

.1 Site Measurements: Verify dimensions of other construction by site measurements before fabrication and indicate measurements on shop drawings where aluminum curtain wall systems are indicated to fit to other construction.

.2 Established Dimensions: Establish dimensions and proceed with fabricating aluminum curtain wall without site measurements where site measurements cannot be made without delaying the Work, coordinated with other construction to ensure that actual dimensions correspond to established dimensions.

.1 Ambient Conditions: Confirm installation requirements for ambient and surface temperatures of sealants with manufacturer and apply sealants when temperatures are greater than manufacturer's stated minimum from time of application until sealants have cured.

1.8 WARRANTY

.1 Provide manufacturers written warranty, signed and issued in the name of Owner, to replace the following items for defective material and workmanship for the time stated from date of Substantial Performance:

.1 Framing, panels and glazing: Failure of performance requirements specified in item 2.2.3.5 below; Two (2) years.

.2 Sealed glass units: misting, dusting and seal failure; as indicated in Section 08 81 00 – Glass and Glazing.

.3 Joint sealants, caulking: Failure to maintain seal; Two (2) years.

.4 Aluminum brake shapes: oil-canning and delaminations; Two (2) years.

.5 Finishes: Failure specified finishes not attributable to normal weathering; Twenty (20) years.

Part 2 Products

2.1 MANUFACTURERS

.1 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 Kawneer Canada Ltd.: Kawneer 1602 series.

2.2 DESIGN CRITERIA

.1 Retain a professional engineer registered in province of Alberta, experienced in structural design in glass and aluminum to design curtain wall units and connections; to ensure the adequacy of the structural aspects of the design, manufacture, and installation of complete assembly; this engineer is called the "delegated design professional engineer" as defined in item 1.1.1 above.

.2 Design curtain wall framing system capable of withstanding design loads within limits and under design loads indicated in this Section, and as follows:

.1 Dead Loads: Account for weights of materials and construction accessories.

.2 Structural Loads:

.1 Wind Loads: 0.40 kPa 1/30 year occurrence in accordance with the Building Code.

.3 Deflection of Framing Members:

.1 Deflection Normal to Wall Plane: Limited to L/175 of clear span for spans up to 4100 mm, and to L/240 of clear span plus 6 mm or spans greater than 4100 mm or an amount that restricts edge deflection of individual glazing lites to 16 mm, whichever is less.

.2 Deflection Parallel to Glazing Plane: Limited to amount not exceeding an amount that reduces glazing bite to less than 75% of design dimension and that reduces edge clearance between framing members and glazing or other fixed components to less than 3 mm.

.3 Limit length of cantilever deflection to 2/175 length of the cantilevered member where framing members overhang an anchor point.

.3 Performance Requirements: Design, engineer, test, fabricate, deliver, install and guaranty construction necessary to provide and install aluminum curtain wall systems including anchorage capable of withstanding without failure, the effects of the following:

.1 Structural loads listed above.

.2 Environmental movements and performance criteria listed below.

.3 Movements of supporting structure indicated on Drawings including; but not limited to, storey drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

.4 Dimensional tolerances of building frame and other adjacent construction.

.5 Failure of the system will be considered as:

.1 Deflection exceeding specified limits.

.2 Thermal stresses transferred to building structure.

.3 Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.

.4 Noise or vibration created by wind and thermal and structural movements.

.5 Loosening or weakening of fasteners, attachments, and other components.

.6 Sealant failure.

.4 Environmental Conditions: Design curtain wall systems to account for the following environmental conditions:

.1 Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient temperatures, accounting for surface temperatures of materials due to both solar heat gain and night time sky heat loss:

.1 Temperature Change (Range):

.1 Exterior Ambient: -40°C to +35°C

.2 Interior Ambient: +16°C to +29°C

.3 Adjust calculations to account for colour treatments or coatings on curtain wall framing members.

.2 Allow for thermal movement with no buckling of frame members, stress on glass, glazing edge seal failure, sealant failure, excess stress on curtain wall framing, anchors and fasteners, or reduction of performance.

.2 Condensation Resistance: Design thermal break to limit frosting and condensation on interior of window metal surfaces to not over 5% of area when conditions are:

.1 Exterior Air Temperature: -32°C

.2 Interior Air Temperature: 22°C ±1.2°C

.3 Interior Relative Humidity: 15%

.3 Air Infiltration: Design system for maximum air leakage of 0.03 L/m^2 of fixed wall area when tested in accordance with ASTM E283 at a minimum static air pressure differential of 300 Pa.

.4 Water Penetration Under Static Pressure: Design system for zero water penetration when tested in accordance with ASTM E331 at a minimum differential static pressure of 20% of positive design wind load; but not less than 475 Pa.

.5 Average Thermal Conductance: Design system having average insulation factor of not more than 2.6 $W/m^2 \cdot K$ when tested in accordance with AAMA 1503.

2.3 MATERIALS

.1 Aluminum: Materials recommended by manufacturer for type of use and finish indicated, and as follows:

.1 Sheet and Plate: In accordance with ASTM B209/B209M, and ANSI H35.1, and AA1100-H14, AA5005-H32 or H34, anodizing quality.

.2 Extruded Bars, Rods, Profiles, and Tubes: In accordance with ASTM B221/B221M, and ANSI H35.1, AA6063-T5 or T6, anodizing quality.

.3 Extruded Structural Pipe and Tubes: In accordance with ASTM B429, and ANSI H35.1 AA6061-T6 or AA6063-T6, anodizing quality.

.4 Structural Profiles: In accordance with ASTM B308/B308M, anodizing quality.

.5 Welding Rods and Bare Electrodes: CSA W59.2.

.2 Formed Aluminum Flashings: Tension levelled, aluminum sheet in accordance with ASTM B209 and ANSI H35.1 alloy designation 3003-H14 and as follows:

.1 Thickness: Minimum 1.00 mm, unless noted otherwise.

.2 Aluminum Flashing: Finish to match adjacent aluminum frames.

.3 Sill Flashings: Provide end dams, 25 mm high, to sill flashings that fit behind jamb flashings to stop water from draining between the adjacent flashings.

.3 Steel Reinforcement: Coat steel with manufacturer's standard corrosion resistant primer applied immediately after surface preparation and pre-treatment, and as follows:

.1 Rolled Sheet or Strip: CSA G40.20/G40.21.

.2 Structural Shapes, Plates and Bars: CSA G40.20/G40.21.

.4 Brackets and Reinforcements: Manufacturer's standard high strength aluminum with non-staining, nonferrous shims for aligning system components.

.5 Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

.1 Use self locking devices where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration.

.2 Reinforce members as required to receive fastener threads.

.3 Use only concealed fasteners, unless use of exposed fasteners has been accepted in writing by the Consultant.

.4 Finish exposed portions to match framing system.

.5 Use slip joint linings, spacers, and sleeves at movement joints of material and type recommended by manufacturer.

.6 Anti-Rotation Channels: Extruded aluminum or bent metal anti-rotation channel designed to mechanically retain air seal membrane to the face of the tubular back section.

.7 Anchors: Three way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

.8 Concealed Flashing: Manufacturer's standard corrosion resistant, non-staining, non-bleeding flashing compatible with adjacent materials.

.9 Transition Membranes: Full length mechanically anchored, extruded silicone rubber transition membrane to perimeter of SSG frame profile to provide continuous air/vapour retarder to adjacent wall construction:

.1 Basis-of-Design Materials: Tremco Proglaze ETA Engineered Transition Assembly

.10 Glazing Gaskets: Manufacturer's standard sealed corner pressure glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers; as recommended by manufacturer for joint type.

.11 Pressure Plates: Manufacturer’s standard fibreglass pressure plates the full length of framing.

2.4 FRAMING SYSTEMS: UNITIZED

.1 Frame Type: To profiles and thicknesses required to meet performance criteria; but not less than 3 mm thickness, and as follows:

.1 Frame Dimensions: Nominal 65 mm wide x 100 mm deep back section having a 28 mm glazing throat.

.2 Cover Depth: Nominal 65 mm wide x 19 mm depth, square profile.

.3 Acceptable Materials:

.1 Kawneer 1600 UT.

.2 Aluminum Flashing: 2.1 mm thick minimum prefinished aluminum flashing to match aluminum framing exterior aluminum curtain wall caps.

2.5 GLAZING SYSTEMS

.1 Glass: Specified in Section 08 81 00 – Glass and Glazing.

.2 Glazing Gaskets: Manufacturer's standard sealed corner pressure glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

.3 Standard Glazing Sealants: As recommended by manufacturer for joint type.

.4 Glazing Sealants: As recommended by manufacturer for joint type.

2.6 ACCESSORY MATERIALS

.1 Perimeter Fire Containment Systems: Specified in Section 07 84 00 – Fire Stopping.

.2 Insulating Materials: Specified in Section 07 21 13 – Board Insulation.

.3 Bituminous Paint: Cold applied asphalt mastic paint in accordance with SSPC-Paint 12 requirements except containing no asbestos, formulated for 0.762 mm thickness per coat.

.4 Sunshade: based on Kawneer Versoleil outrigger sunshades, Airfoil blade profile.

2.7 FABRICATION

.1 Form aluminum shapes before finishing.

.2 Fabricate components that have the following characteristics when assembled:

.1 Sharp profiles, straight and free of defects or deformations.

.2 Accurately fitted joints with ends coped or mitred.

.3 Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

.4 Physical and thermal isolation of glazing from framing members.

.5 Accommodations for thermal and mechanical movements of glazing and framing to prevent glazing-to-glazing contact and to maintain required glazing edge clearances.

.6 Provisions for re-glazing.

.3 Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish; remove weld spatter and welding oxides from exposed surfaces by de-scaling or grinding.

.4 Clearly mark fabricated components to identify their locations in accordance with Shop Drawings.

.5 Refer to Section 07 92 00 – Joint Sealants.

2.8 ALUMINUM EXTRUSION FABRICATIONS

.1 Aluminum Extrusion Units: Fabricate extruded aluminum running units with formed or extruded aluminum joint covers for installation behind main members where possible. Fabricate mitred and welded corner units.

2.9 ALUMINUM FINISHES

.1 Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

.2 Aluminum Coloured Anodized Finish:

.1 Exterior: Class I Finish: Architectural Class I, integrally coloured or electrolytically deposited colour coating 0.018 mm or thicker in accordance with AAMA 611.

.2 Interior: Class II Finish: Architectural Class II, integrally coloured or electrolytically deposited colour coating 0.010 mm or thicker in accordance with AAMA 611.

2.10 INSULATED SPANDREL PANELS

.1 Spandrel Glass: Double-glazed in accordance with Section 08 81 00 – Glass and Glazing.

.2 Back Pan:

.1 Aluminum Sheet: in accordance with ASTM B209. 1.6 mm (0.063") thickness, formed into a pan shape to fit glazing throat with back of pan flush with inside face of back section.

.2 Finish: Matching curtain wall framing in areas where exposed, mill finish in non-exposed areas.

.3 Insulation: Rigid mineral fibre insulation held in place with manufacturer's standard system to back face of back pan."

2.11 ACOUSTIC WINDOW - SECURE

.1 Engineered, fixed aluminum framed, acoustically sealed fixed glazed window unit with integral horizontal pivoting aluminum louvres, factory glazed and sealed as per accepted manufacturer: Unicel Architectural Corp (1-800-668-1580).

.1 Extruded aluminum perimeter frame, 63 mm nominal width, depth to suit glazing thickness.

.2 Unit tested sound transmission co-efficient to be STC 48 or greater for complete unit assembly.

.3 Lexan Marguard Polycarbonate 6 mm thick as manufactured by G.E. Plastics. Inner glazing panel, cut and installed in accordance with manufacturers recommendations.

.4 50 mm air space.

.5 Lexan Marguard Polycarbonate 6 mm thick as manufactured by G.E. Plastics. Inner glazing panel, cut and installed in accordance with manufacturers.

.6 Horizontal pivoting louvre system, hand operated tilting mechanism concealed in frame, with knob operator on room 140 side.

.7 Duracron White K-1285 finish to complete frame.

.8 Seal both side of window with paintable acoustic sealant.

2.12 ACOUSTIC WINDOW

.1 Aluminum Frame:

.1 Aluminum back section: nominal 65 mm x 100 mm

.2 Aluminum cap: nominal 95 mm x 19 mm.

.3 Glazing thickenss: 6 mm tempered with 0.76 mm PVB interlayer. 3mm glazing-interlayer- 3 mm glazing

.4 Acoustic Accessories:

.1 Neoprene coated fiberous absorber

.2 Perforated metal painted black complete with neoprene gasket.

.3 Acoustic duct liner, black.

.4 Acoustic sealant.

2.13 ROOM 103 MILLWORK WINDOWS

.1 Based on the Kawneer profile 1040 for sliding windows. Window profiles will be fastened to adjacent construction materials and are not to slide. Profile approximately 45 mm x 58 mm.

.2 Glazing is to be in accordance with Section 08 81 00 – Glass and Glazing.

Part 3 Execution

3.1 EXAMINATION

.1 Examine areas for compliance with requirements for installation tolerances and other conditions affecting performance of work; report any conflicts or coordination issues to Contractor.

.2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION: GENERAL

.1 Install in accordance with manufacturer's written instructions.

.2 Install components free from damage or irregularities.

.3 Fit joints to produce hairline joints free of burrs and distortion.

.4 Rigidly secure non-movement joints.

.5 Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

.6 Weld components in concealed locations to minimize distortion or discoloration of finish:

.1 Protect glazing surfaces from welding.

.2 Protect work of other sections from welding.

.7 Seal joints watertight, except where manufacturer’s standard details indicate a requirement for open joints.

.8 Metal Protection:

.1 Protect aluminum against galvanic action by painting contact surfaces with primer, by applying sealant or tape, or installing nonconductive spacers where aluminum contacts dissimilar metals.

.2 Protect aluminum against corrosion by painting contact surfaces with bituminous paint where aluminum contacts concrete or masonry.

.9 Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

.10 Install components plumb and true in alignment with established lines and grades.

.11 Install glass in accordance with manufacturer’s standard glazing recommendations.

.12 Install sealants in accordance with Section 07 92 00 – Joint Sealants.

.13 Install insulation materials in accordance with manufacturer’s standard practices.

.14 Install perimeter fire containment systems as specified in Section 07 84 00 – Fire Stopping.

.15 Erection Tolerances: Install glazed aluminum curtain wall systems in accordance with the following maximum tolerances:

.1 Plumb: 3 mm in 3050 mm; 6 mm in 12 m cumulative.

.2 Level: 3 mm in 3050 mm; 6 mm in 12 m cumulative.

.3 Alignment:

.1 Limit offset from true alignment to 1.5 mm where surfaces abut in line or are separated by reveal or protruding element up to 13 mm wide,

.2 Limit offset from true alignment to 3 mm where surfaces are separated by reveal or protruding element from 13 mm to 25 mm wide,

.3 Limit offset from true alignment to 6 mm where surfaces are separated by reveal or protruding element of 25 mm wide or greater.

.4 Location: Limit variation from plane to 3 mm in 3660 mm; 13 mm over total length.

.16 Snap covers, profiles as indicated, and pressure plates shall be continuous from top to bottom of frame, with horizontals abutting between. Deep mullion caps to be corner mitred with horizontal shallow cap abutting deep mullion cap. All 19 mm and 50 mm deep caps, unless noted otherwise. Mechanically fasten glazing caps to pressure plates, one (1) fastener for each section.

3.3 ERECTION TOLERANCES

.1 Install aluminum framed curtain wall systems in accordance with the following maximum tolerances:

.1 Location and Plane: Limit variation from true location and plane to 3 mm in 3660 mm; 6 mm over total length.

.2 Alignment:

.3 Limit offset from true alignment to 1.5 mm where surfaces abut in line.

.4 Limit offset from true alignment to 0.8 mm where surfaces meet at corners

.5 Diagonal Measurements: Limit difference between diagonal measurements to 3 mm.

3.4 SITE QUALITY CONTROL

.1 Engage a qualified independent testing and inspecting agency to perform site tests and inspections and prepare test reports.

.2 Tests and inspections of representative areas will determine compliance of installed systems with specified requirements and in successive stages through out installation.

.3 Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

.4 Air Infiltration: Test for air leakage at 1.5 times the rate specified for laboratory testing under Performance Requirements, but not more than 0.03 L/s/m^2 of fixed wall area in accordance with ASTM E783 at a minimum static air pressure difference of 75 Pa.

.5 Water Penetration: Test for water penetration in accordance with ASTM E1105 at a minimum uniform and cyclic static-air-pressure difference of 0.67 times the static air pressure difference specified for laboratory testing under Performance Requirements, but not less than 200 Pa, with no evidence water penetration.

.6 Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

.7 Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 ADJUSTING

.1 Adjust operating hardware for smooth operation in accordance with hardware manufacturers' written instructions.

3.6 CLEANING

.1 Clean aluminum frames and glazing in accordance with Section 01 74 11 – Cleaning.

.2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

3.7 PROTECTION

.1 Protect aluminum finishes and glazing during erection against disfiguration, contamination or damage by abuse or harmful materials.

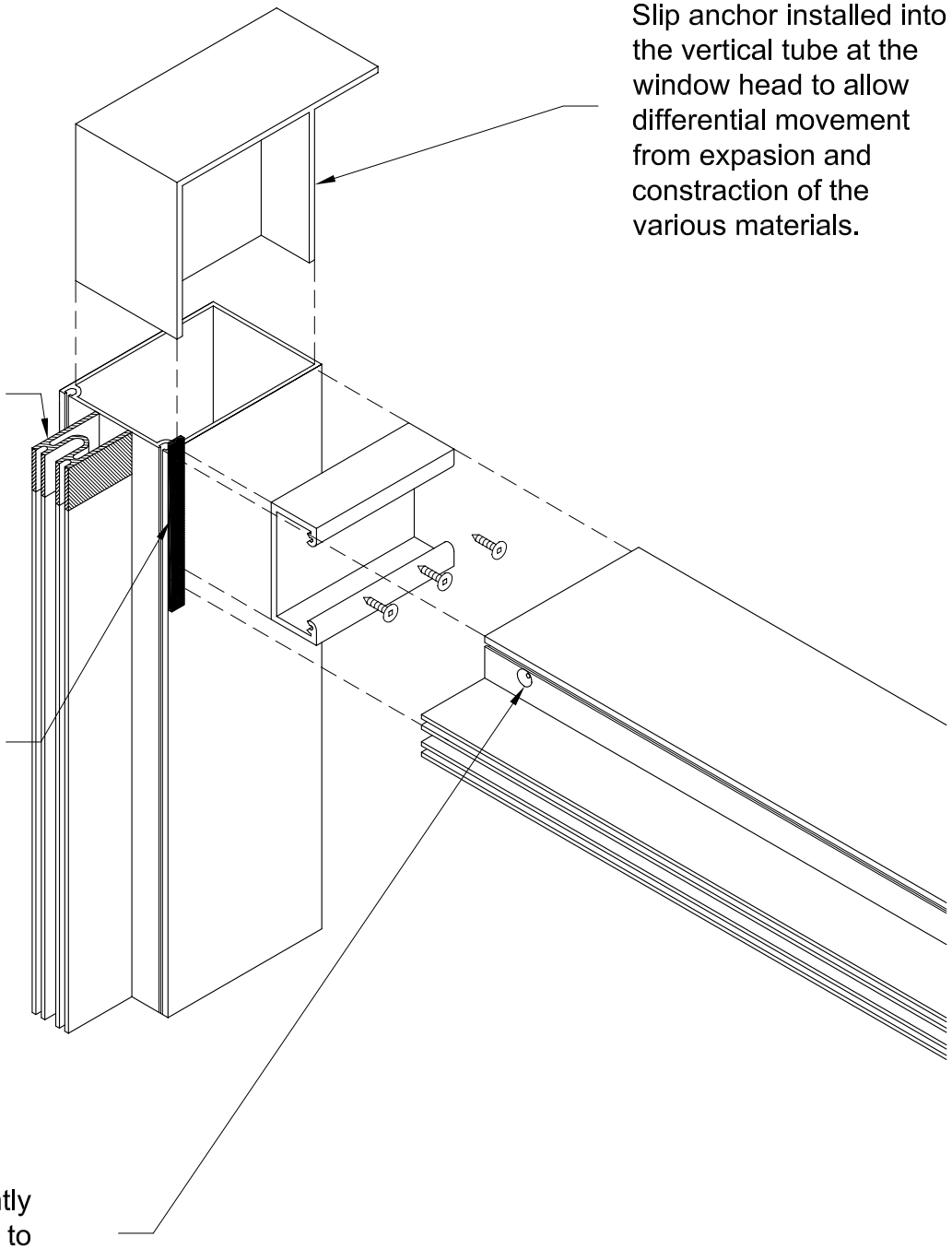
.2 Install protective cover where exposure to damage is critical.

.3 Mark each light with large cross or other symbol to make glass obvious and noticeable to other trades after glass is installed, using substance that will not stain, mark or "shadow" glass either by itself or by reaction with sunlight, moisture or the environment; masking tape is not considered as a suitable material; replace glass units marked with masking tape.

END OF SECTION

Slip anchor installed into the vertical tube at the window head to allow differential movement from expasion and constraction of the various materials.

Portion of the screw spline removed to allow for membrane tie-in to the tube face of the section.

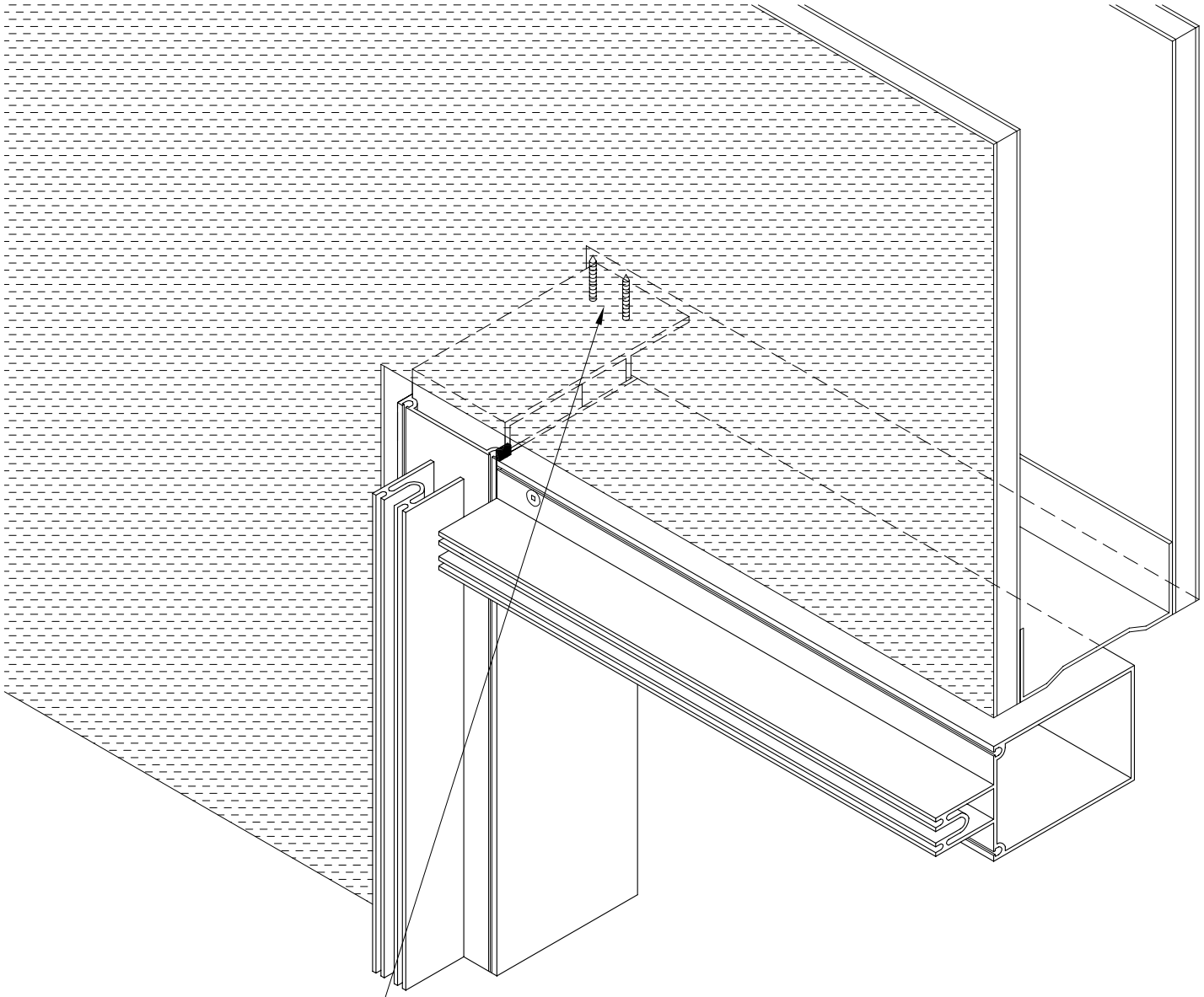


Butt joint between the horizontal and the vertical mullions should be sealed with butyl tape*.

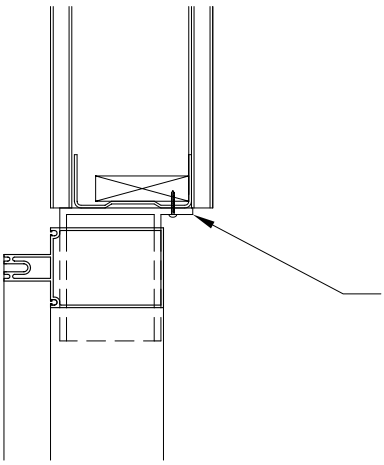
Predrilled holes for screw attachment should be slightly offset from the shear block to ensure a tight joint between the two box sections.

(* Butyl tape is preferred over silicone sealant because silicone will set up over time and if the seal fails it will not re-seal. Butyl will remain tacky and will re-seal when the temperature of the frame is increased.)

Alberta INFRASTRUCTURE AND TRANSPORTATION	INSTALLATION SEQUENCE ISOMETRIC WINDOW HEAD DETAILS		BUILDING SCIENCES SECTION	DETAIL NUMBER 1
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE



Window frame tilted up into the rough opening and the slip anchor at the head is fastened into the structure. The frame is positioned so the tube face of the box curtain-wall section is in plane with the exterior sheathing.



Flange on the slip anchor needs to extend far enough beyond the frame to allow for fastening into the head of the rough opening after the frame is set in place.

Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW HEAD DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER 2

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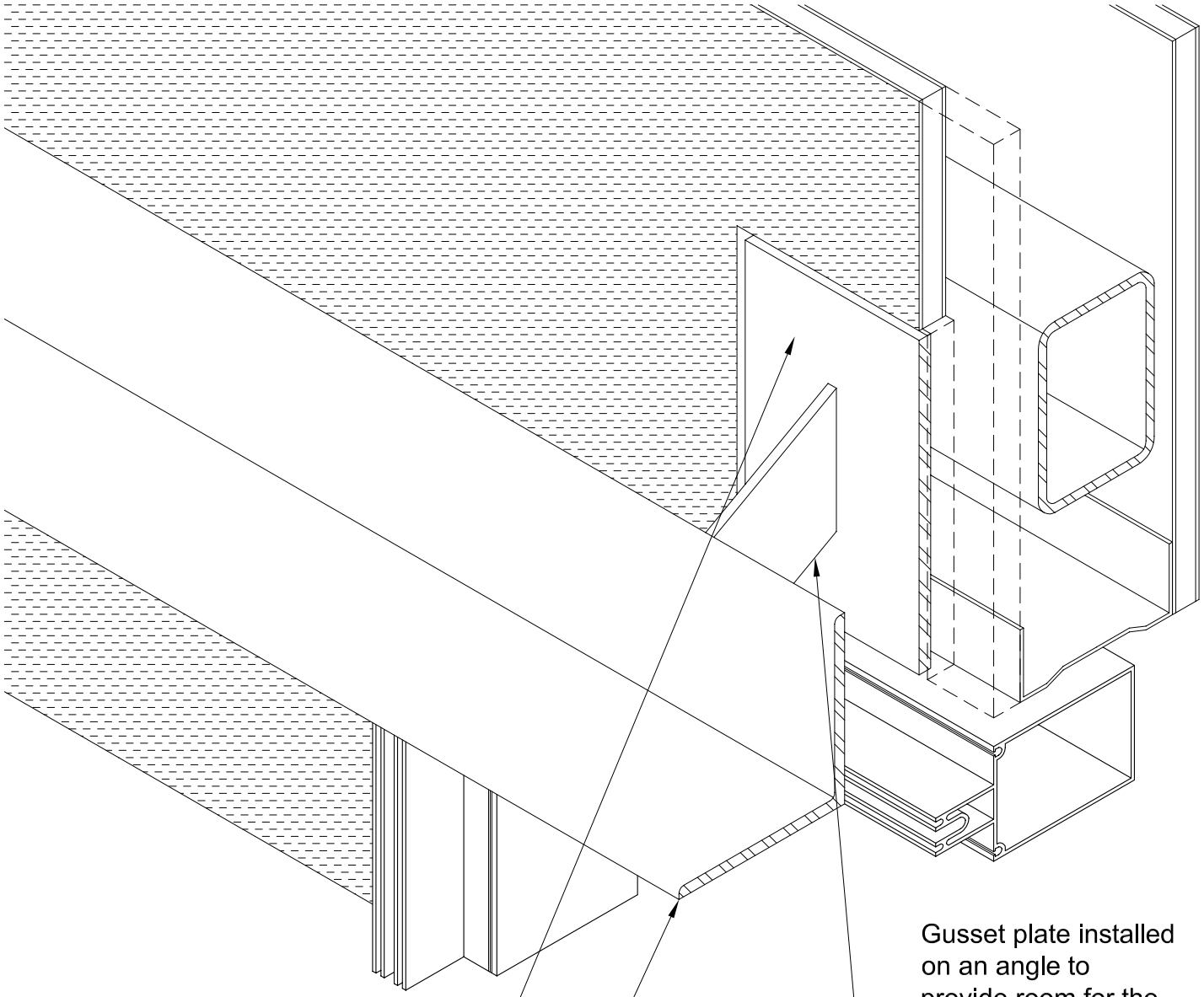
PETER BAKER	01-01-2005		



Gusset plate installed on an angle to provide room for the air barrier membrane tie-in to the window frame.

Metal plate at the plane of the sheathing used to maintain the continuity of the air seal. Metal plate should extend 50 mm on all side of the gusset to allow for a proper tie-in of the air barrier membrane (see structural penetration details).

Shelf angle to support the masonry veneer.

Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW HEAD DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER 3

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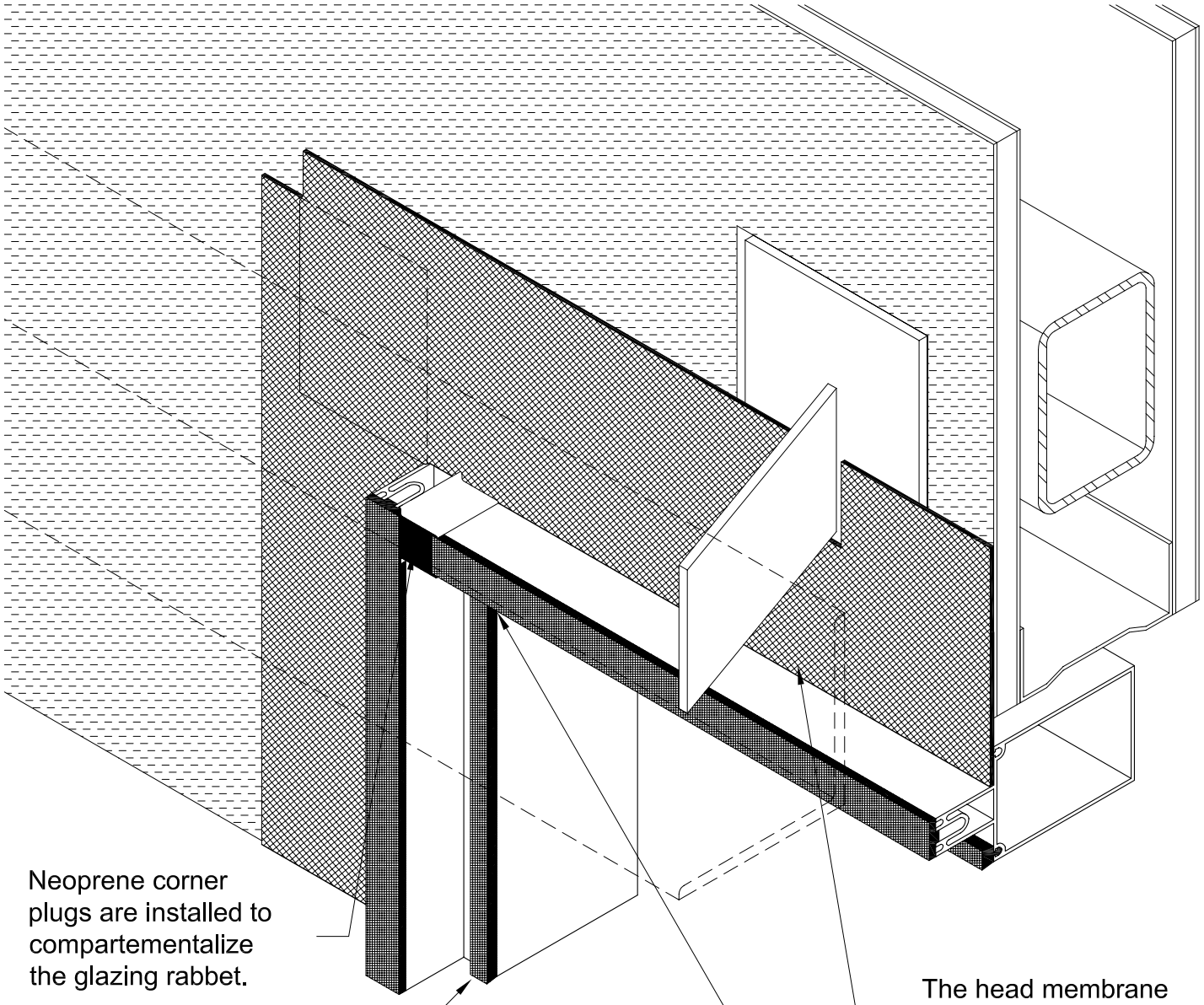
PETER BAKER	01-01-2005		



Neoprene corner plugs are installed to compartementalize the glazing rabbet.

The installed length of the gaskets must be greater than the opening to accomodate shrinkage.

The head membrane tie-in is installed and lapped over top of the jamb membrane tie-in.

Corner junctions of the gaskets should be sealed with sealant ot heat welded.

Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW HEAD DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER 4

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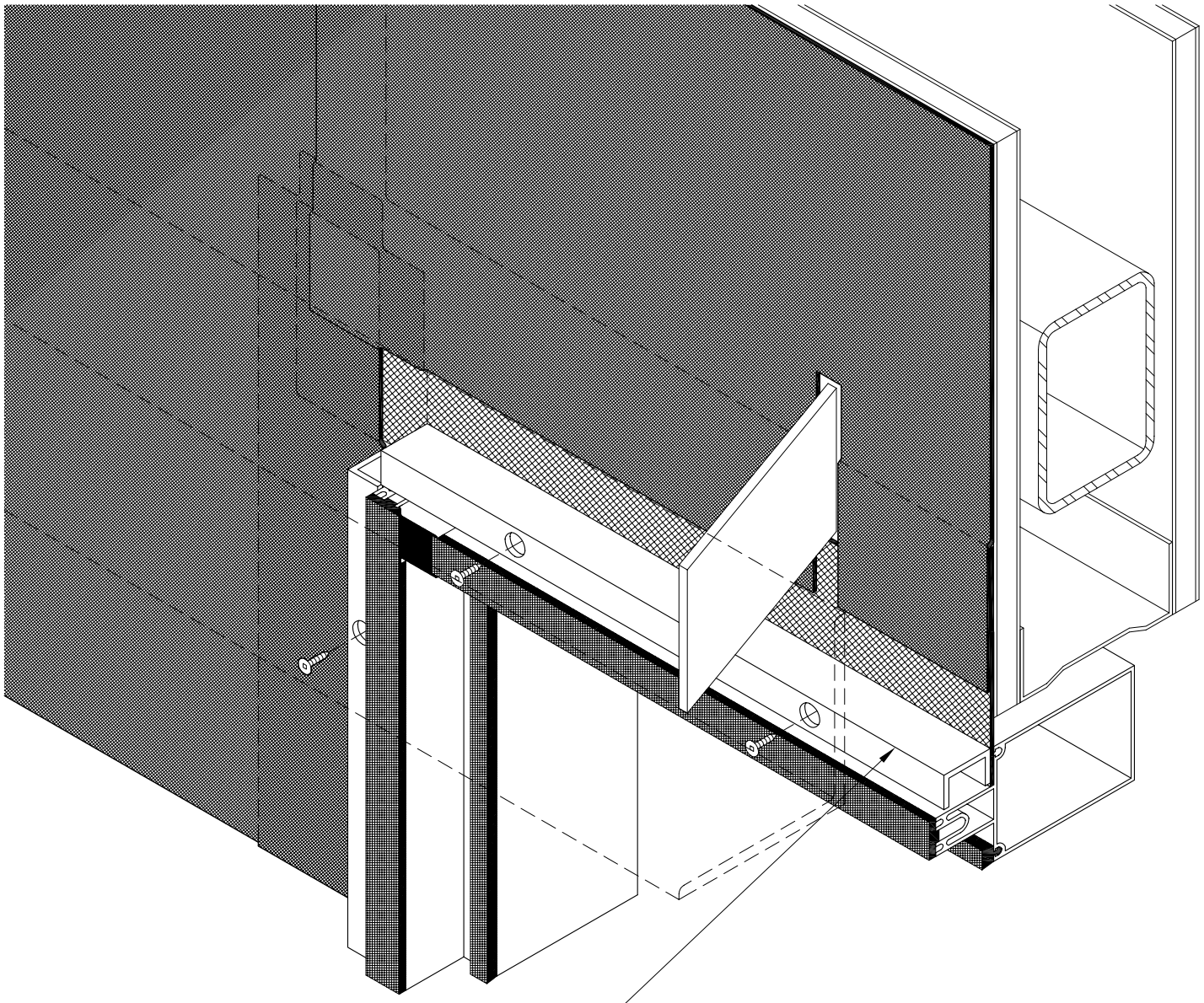

Aluminum anti-rotation channels installed to mechnically fasten the membrane tie-in to the tube face of the box section

Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW HEAD DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER 5

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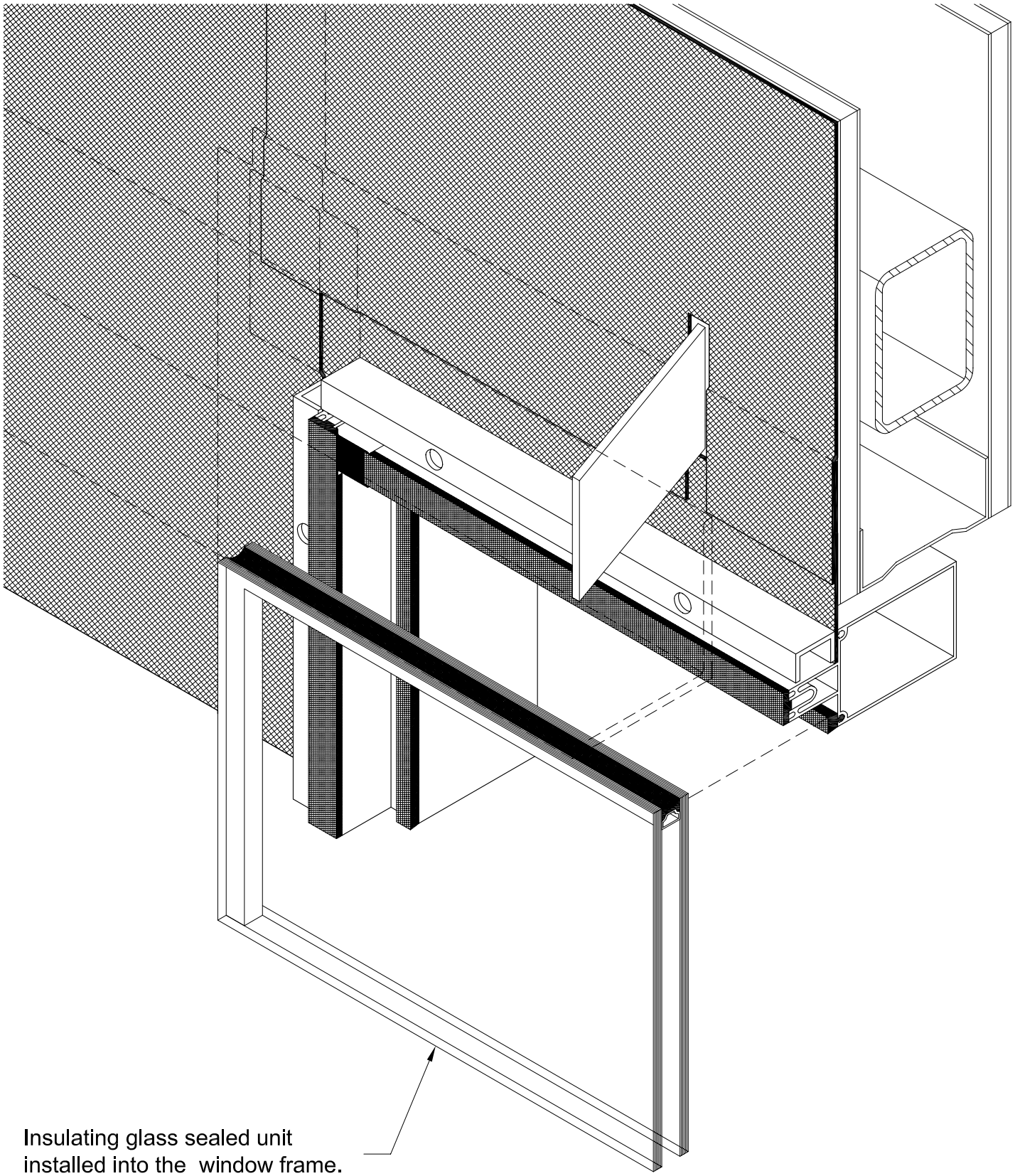

Insulating glass sealed unit
installed into the window frame.

Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW HEAD DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER
6

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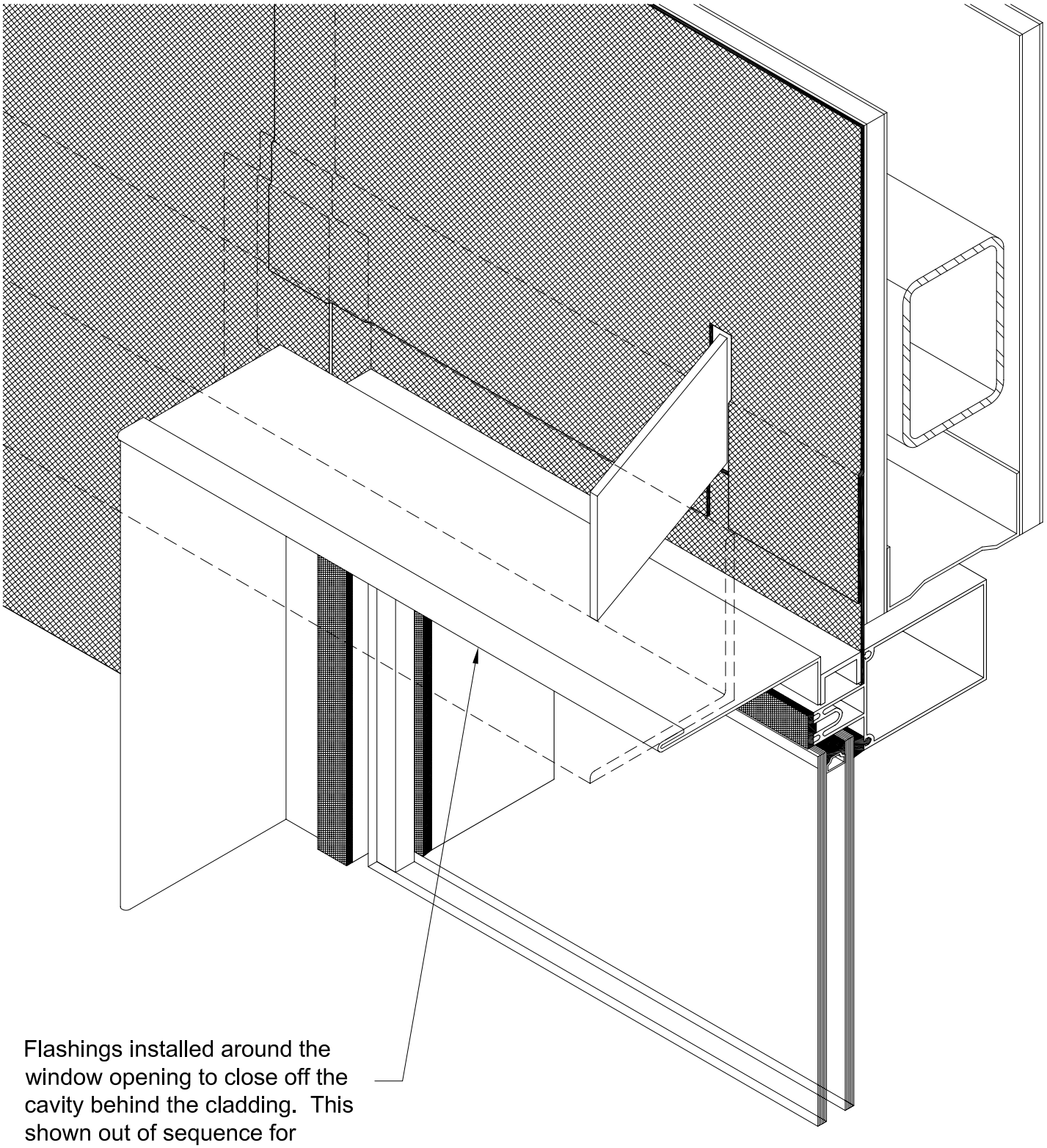

Flashings installed around the window opening to close off the cavity behind the cladding. This shown out of sequence for purposes of clarity. The flashing is usually installed after the cladding is in place.

Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW HEAD DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER 7

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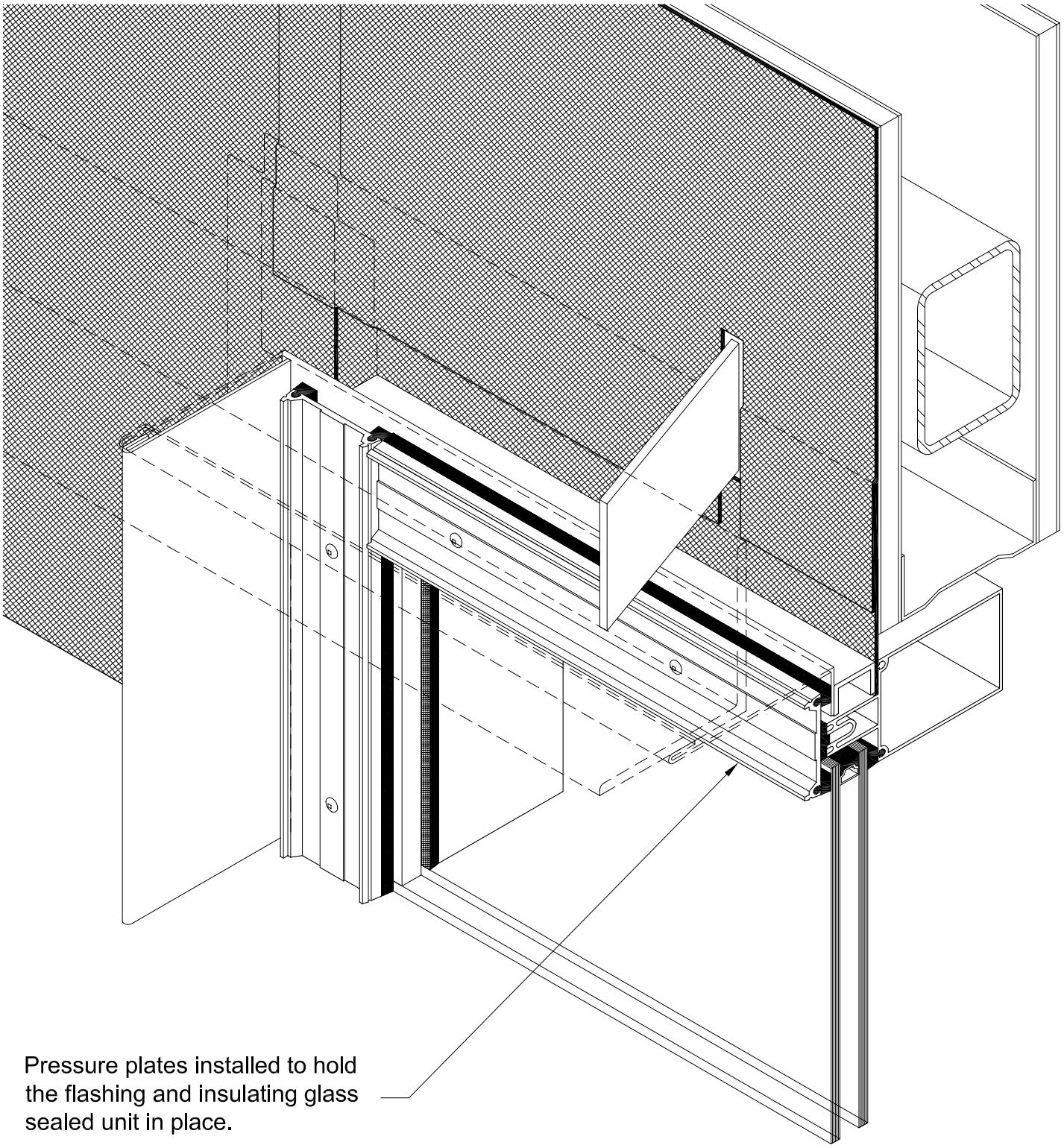
PETER BAKER	01-01-2005		



Pressure plates installed to hold the flashing and insulating glass sealed unit in place.

Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW HEAD DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER
8

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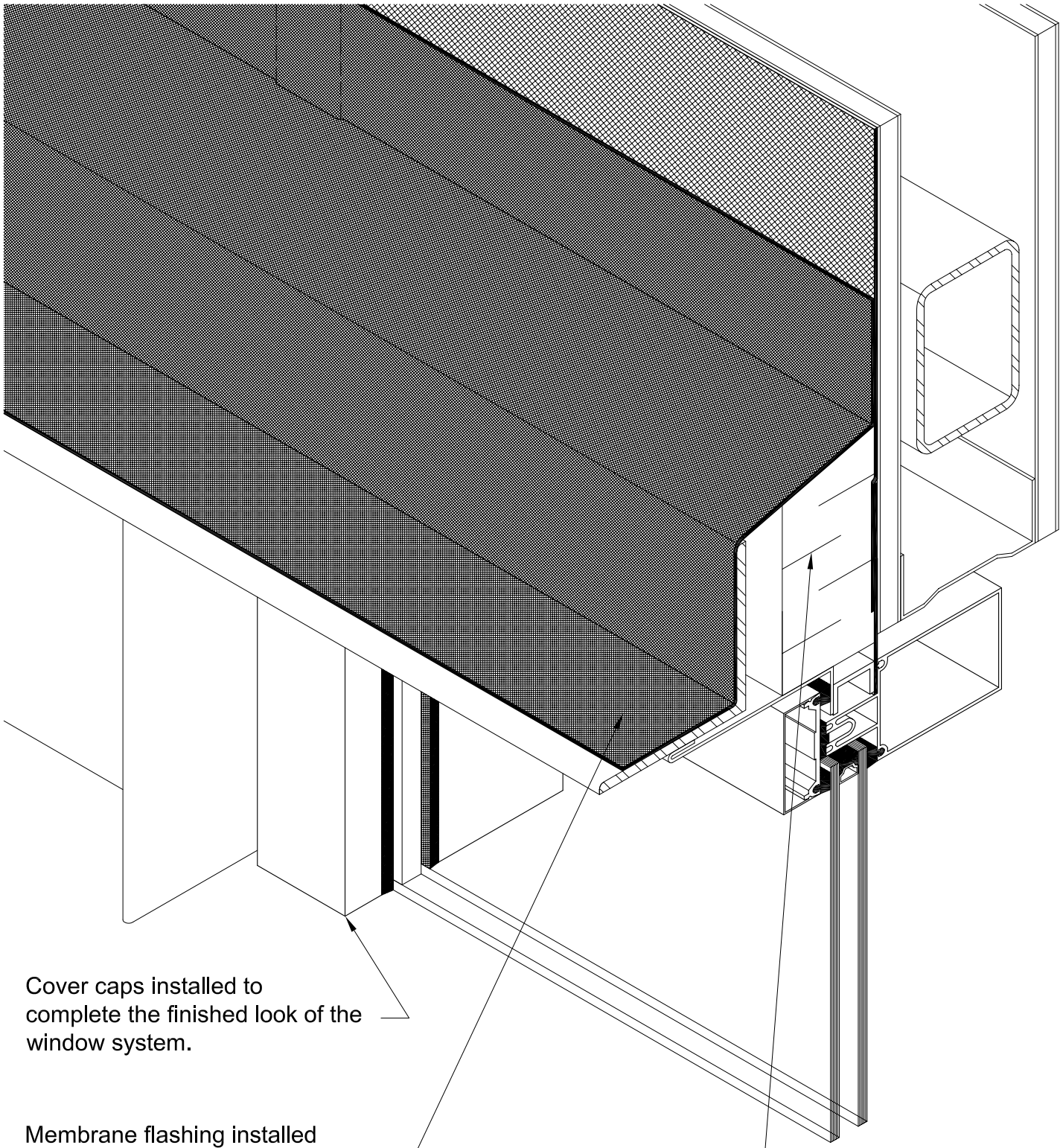

Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW HEAD DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER 9

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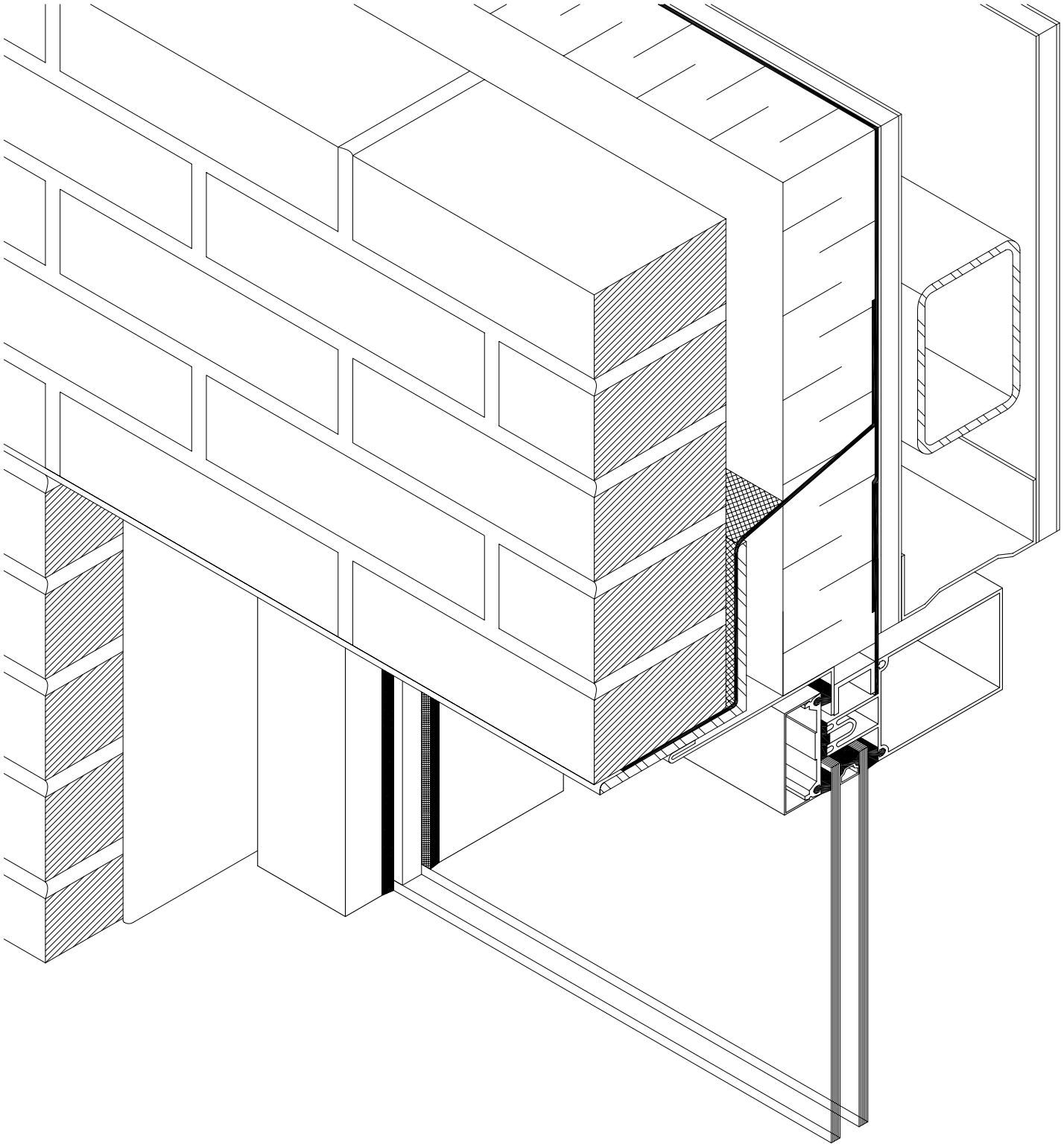

Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW HEAD DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER
10

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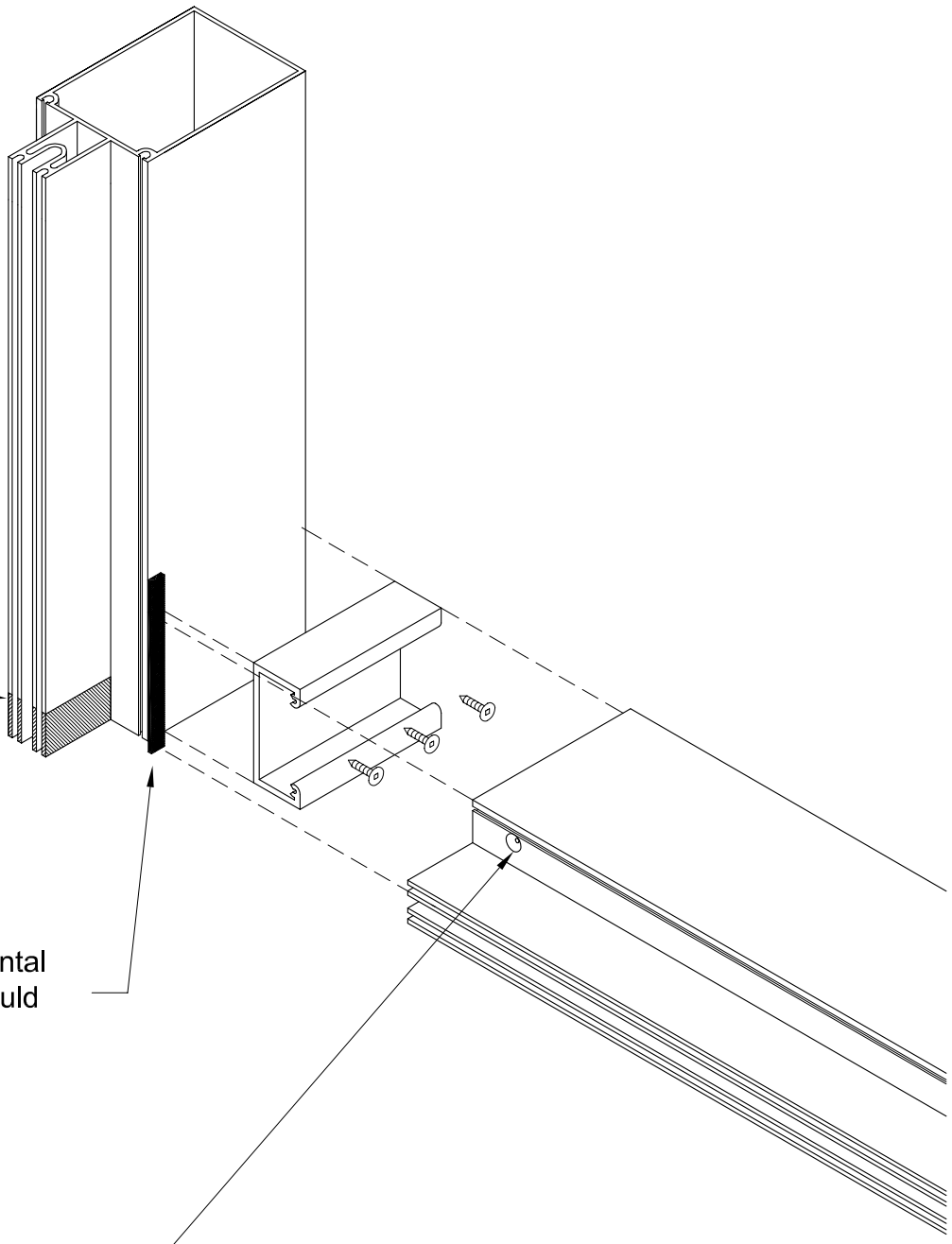


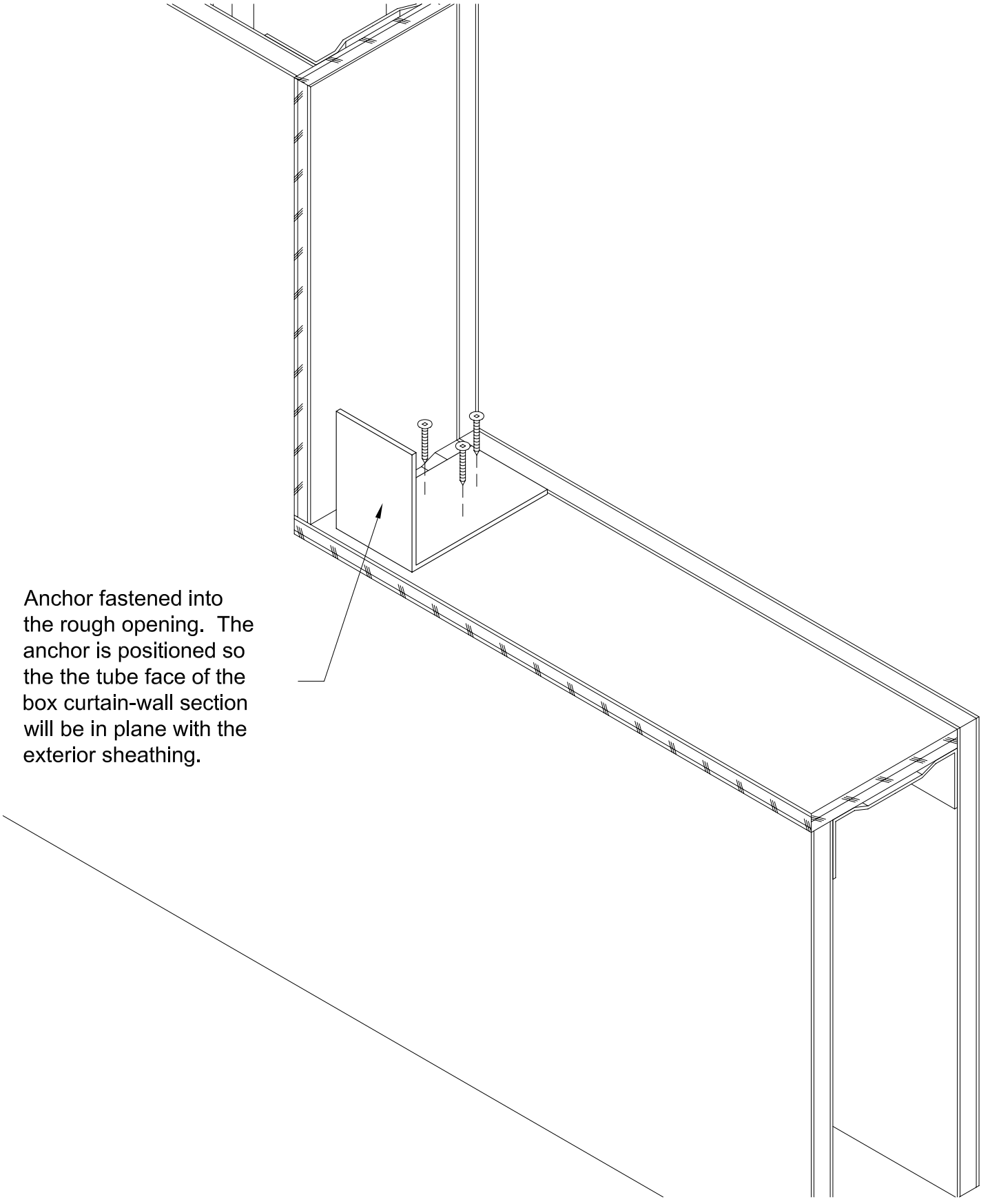
Portion of the screw spline removed to allow for membrane tie-in to the tube face of the section.

Butt joint between the horizontal and the vertical mullions should be sealed with butyl tape*.

Predrilled holes for screw attachment should be slightly offset from the shear block to ensure a tight joint between the two box sections. Cap bead with butyl sealant.

(* Butyl tape is preferred over silicone sealant because silicone will set up over time and if the seal fails it will not re-seal. Butyl will remain tacky and will re-seal when the temperature of the frame is increased.)

Alberta INFRASTRUCTURE AND TRANSPORTATION	INSTALLATION SEQUENCE ISOMETRIC WINDOW SILL DETAILS		BUILDING SCIENCES SECTION	DETAIL NUMBER 1
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE



Anchor fastened into the rough opening. The anchor is positioned so the the tube face of the box curtain-wall section will be in plane with the exterior sheathing.

Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW SILL DETAILS

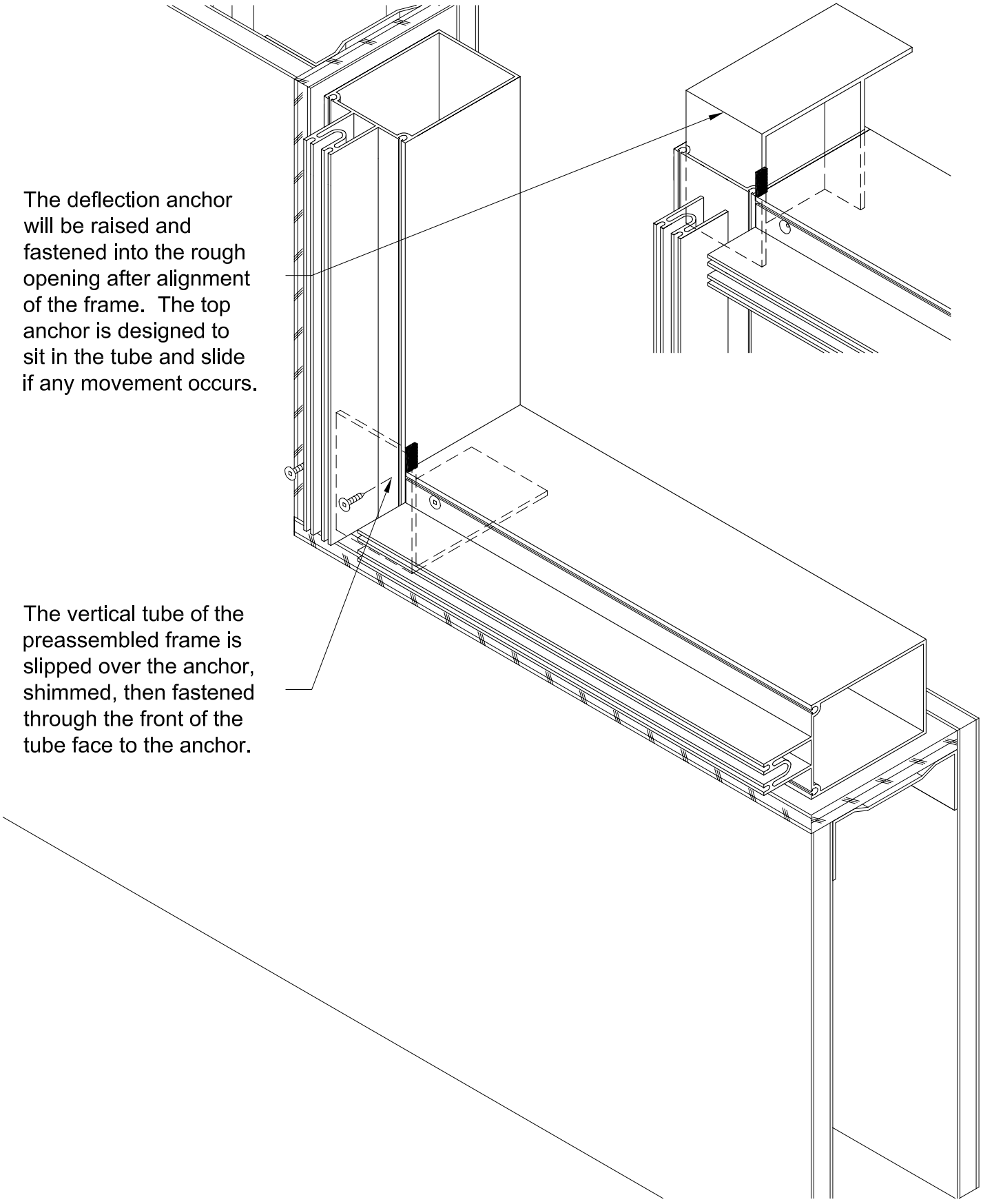
BUILDING SCIENCES SECTION

DETAIL NUMBER 2

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		

The deflection anchor will be raised and fastened into the rough opening after alignment of the frame. The top anchor is designed to sit in the tube and slide if any movement occurs.

The vertical tube of the preassembled frame is slipped over the anchor, shimmed, then fastened through the front of the tube face to the anchor.



Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW SILL DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER 3

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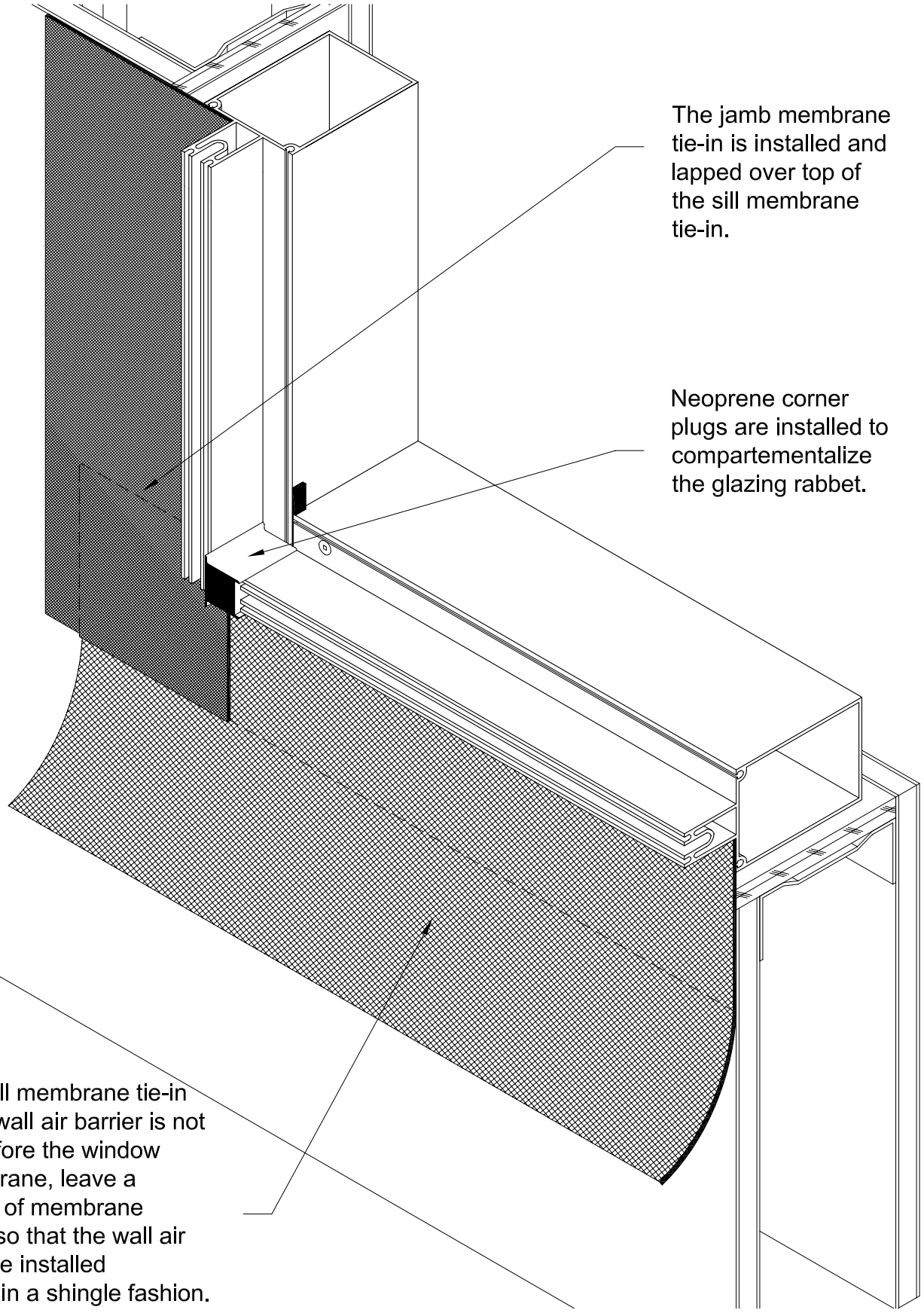

The jamb membrane tie-in is installed and lapped over top of the sill membrane tie-in.

Neoprene corner plugs are installed to compartementalize the glazing rabbet.

Install the sill membrane tie-in first. If the wall air barrier is not installed before the window tie-in membrane, leave a 100mm flap of membrane unadhered so that the wall air barier can be installed underneath in a shingle fashion.

Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW SILL DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER 4

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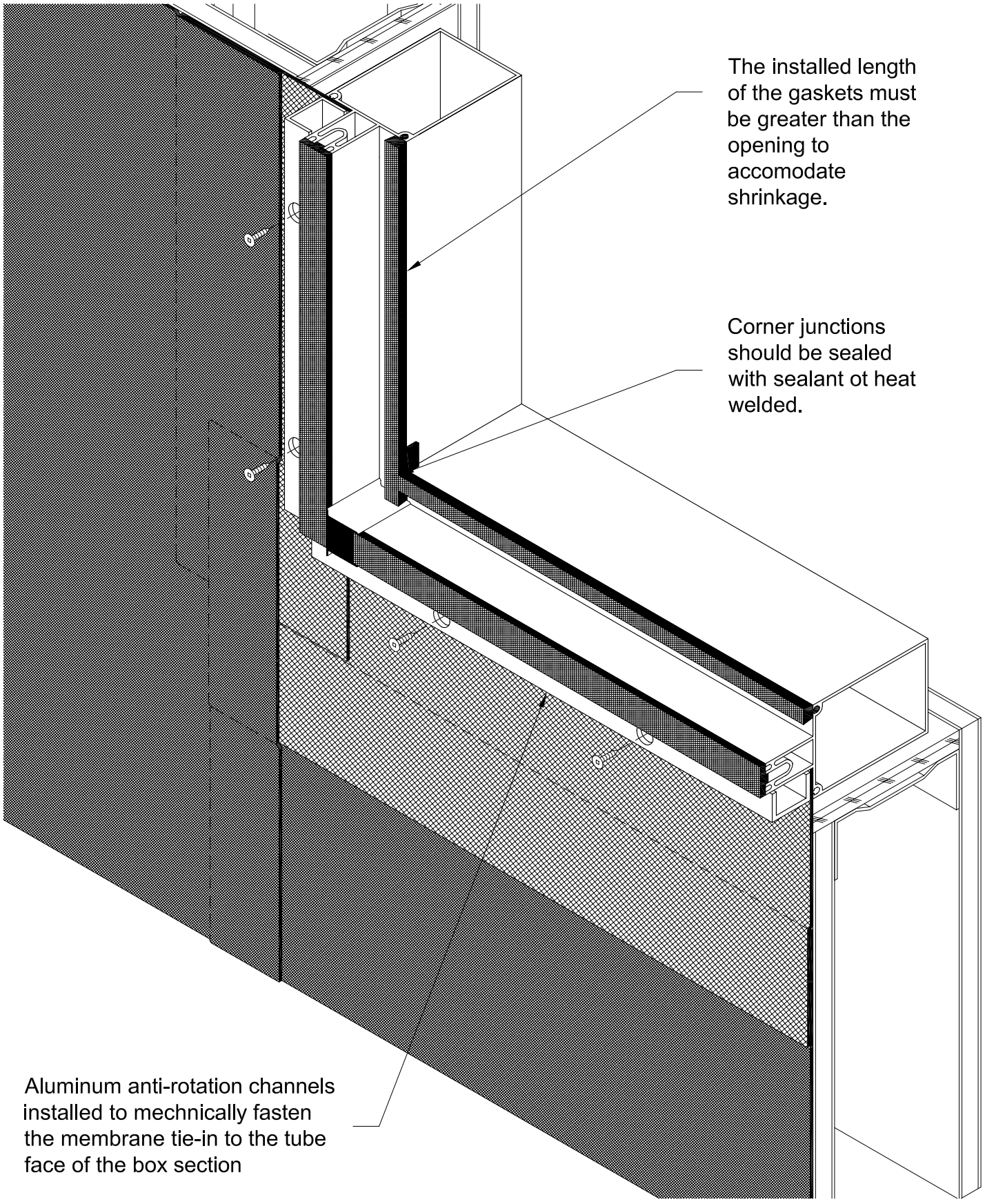

Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW SILL DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER 5

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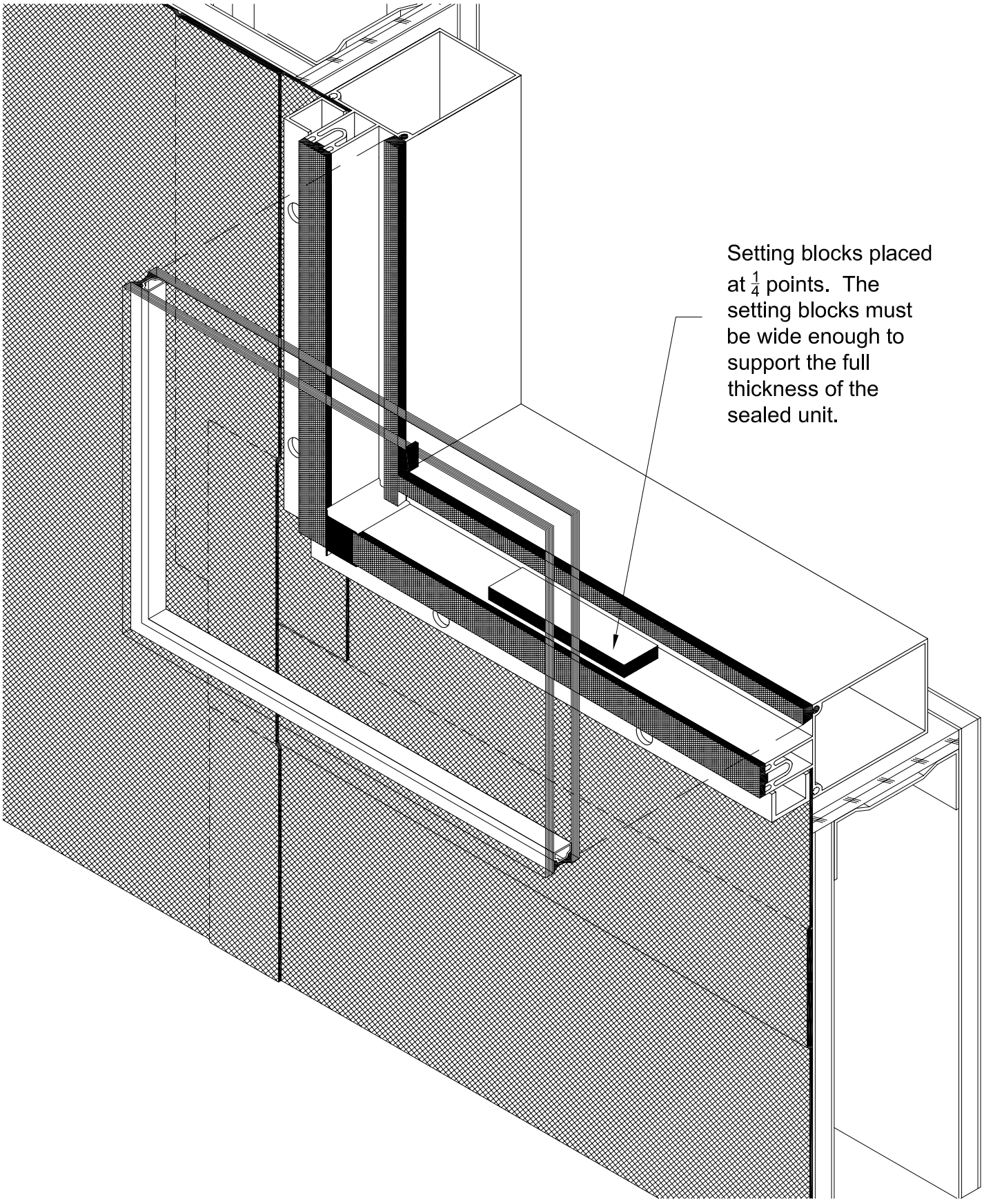

Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW SILL DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER 6

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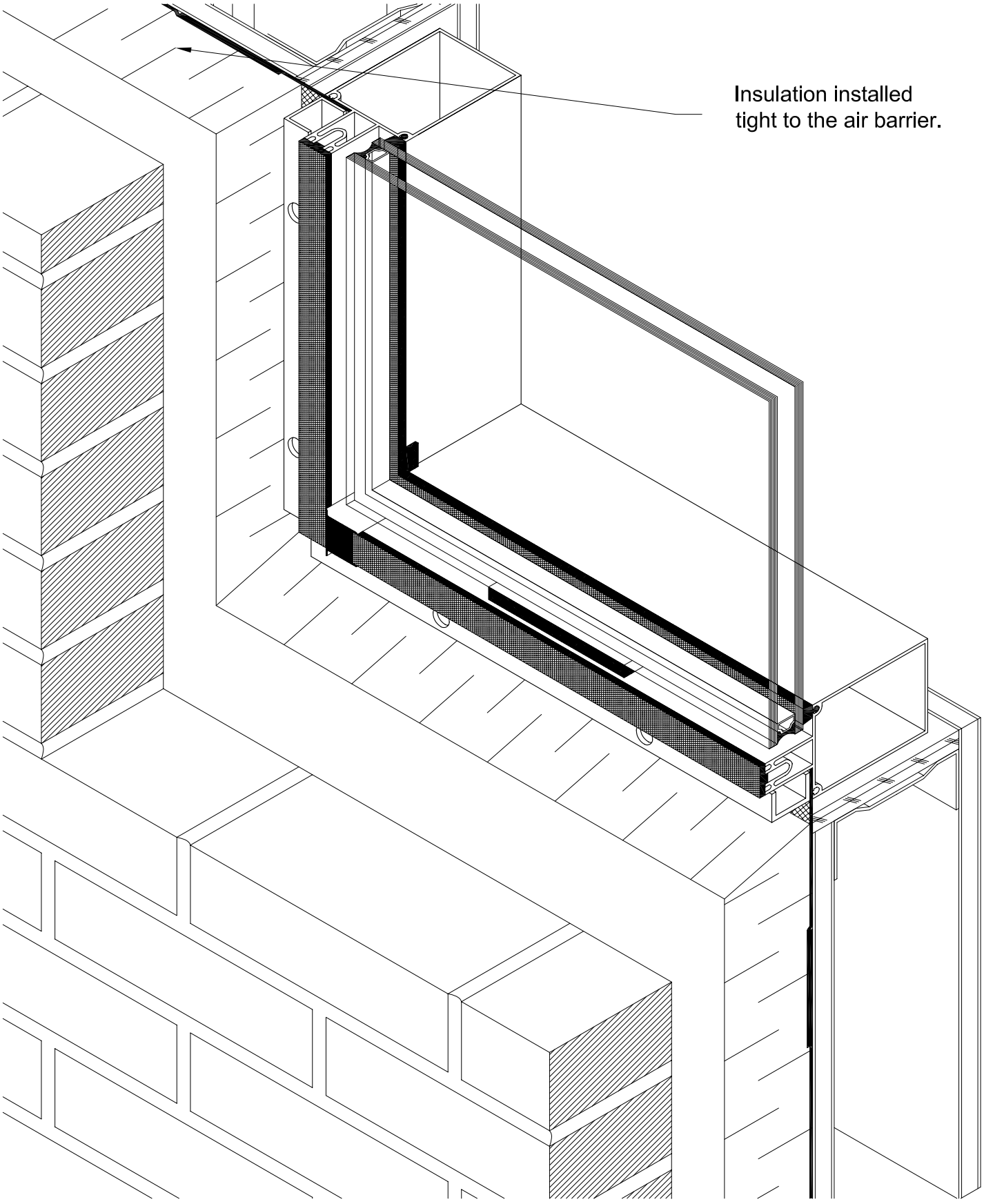

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INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW SILL DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER
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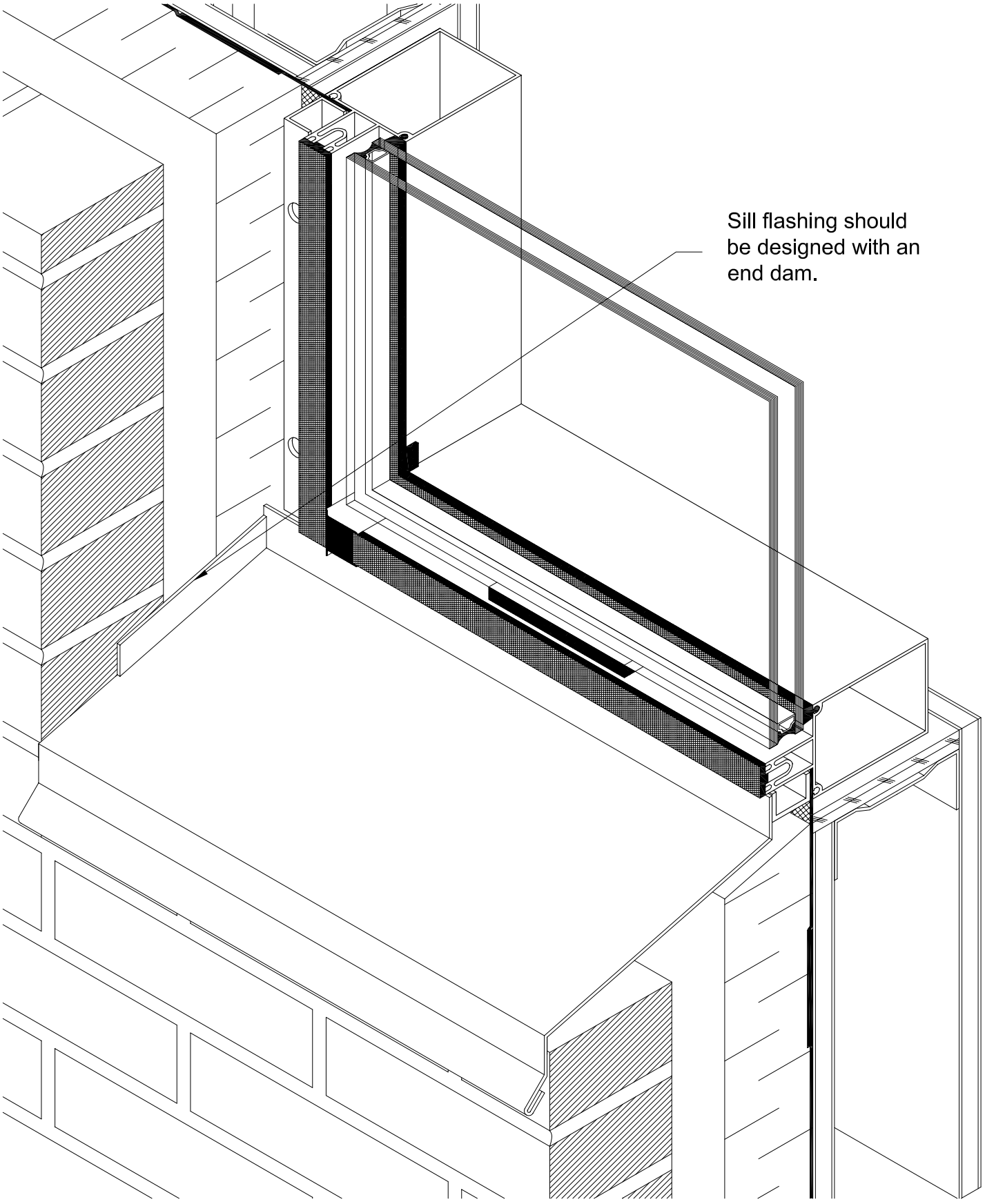

Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW SILL DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER
8

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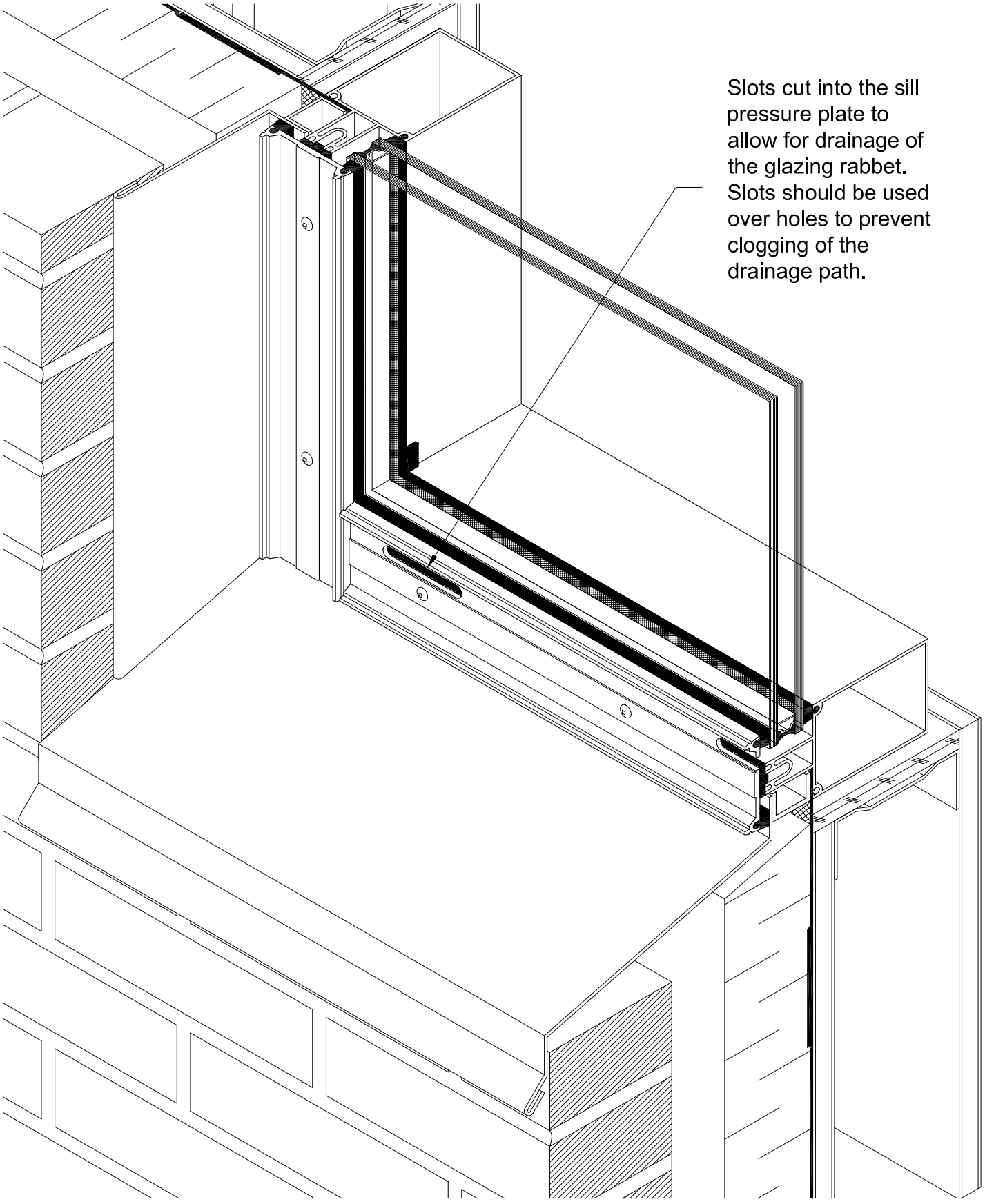

Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW SILL DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER 9

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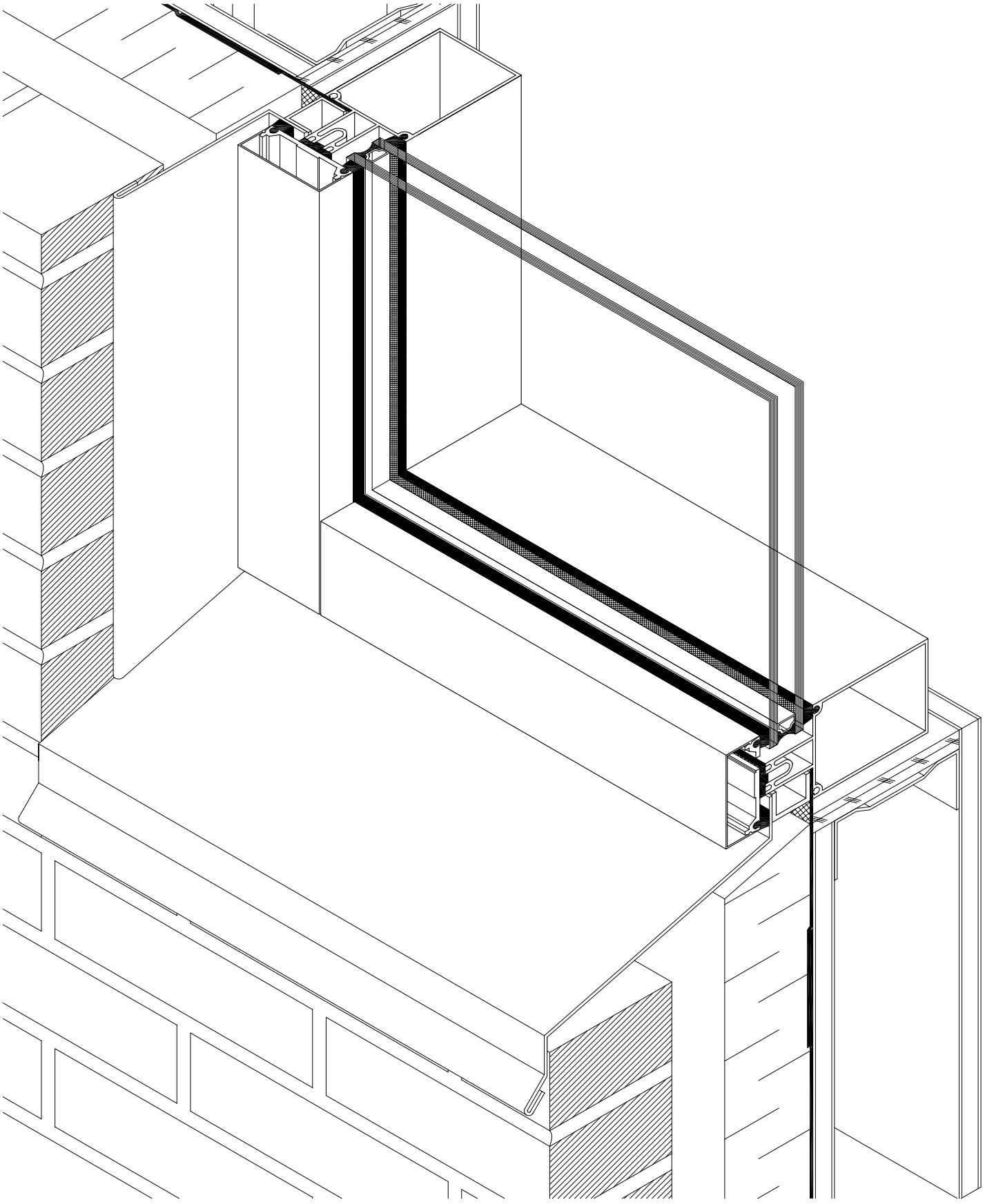

Alberta
INFRASTRUCTURE AND TRANSPORTATION

INSTALLATION SEQUENCE

ISOMETRIC WINDOW SILL DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER
10

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PETER BAKER	01-01-2005		

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 08 11 00 – Metal Doors and Frames

.2 Section 08 14 16 - Flush Wood Doors

.3 Section 08 42 29 – Automatic Entrances

.4 Section 28 00 00: Electrical wiring for magnetic strikes, electric releases and electric locks.

1.2 REFERENCES

.1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)

.1 ANSI/BHMA A156.1-2000, American National Standard for Butts and Hinges.

.2 ANSI/BHMA A156.2-2003, Bored and Preassembled Locks and Latches.

.3 ANSI/BHMA A156.3-2001, Exit Devices.

.4 ANSI/BHMA A156.4-2000, Door Controls - Closers.

.5 ANSI/BHMA A156.5-2001, Auxiliary Locks and Associated Products.

.6 ANSI/BHMA A156.6-2005, Architectural Door Trim.

.7 ANSI/BHMA A156.8-2005, Door Controls - Overhead Stops and Holders.

.8 ANSI/BHMA A156.10-1999, Power Operated Pedestrian Doors.

.9 ANSI/BHMA A156.13-2002, Mortise Locks and Latches Series 1000.

.10 ANSI/BHMA A156.15-2006, Release Devices - Closer Holder, Electromagnetic and Electromechanical.

.11 ANSI/BHMA A156.16-2002, Auxiliary Hardware.

.12 ANSI/BHMA A156.18-2006, Materials and Finishes.

.2 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)

.1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.

.4 After approval samples will be returned for incorporation in Work.

.4 Hardware List:

.1 Submit contract hardware list.

.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions: submit manufacturer's installation instructions.

.7 Sustainable Design Submittals:

.1 Sustainable Submittals: in accordance with Section 01 35 43 – Environmental Procedures.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements, inaccordance with Section 01 74 21 Construciton Demolition Waste Management and Disposal.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer, pre-consumer content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.

1.5 MAINTENANCE MATERIALS SUBMITTALS

.1 Extra Stock Materials:

.1 Supply maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Tools:

.1 Supply 2 sets of wrenches for door closers, locksets, and fire exit hardware.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.4 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect door hardware from nicks, scratches, and blemishes.

.3 Protect prefinished surfaces with wrapping.

.4 Replace defective or damaged materials with new.

.5 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 43 – Environmental Procedures.

.6 Packaging Waste Management: remove for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 HARDWARE ITEMS

.1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

.1 Locks and latches:

.1 Mortise locks and latches: to ANSI/BHMA A156.13, series 1000 mortise lock, grade 1, designed for function and keyed as stated in Hardware Schedule.

.2 Lever handles keyed as stated in Hardware Schedule. Rooms # 133, 134, 140 to 174 with Knob Trim.

.3 Roses, Escutcheons keyed as stated in Hardware Schedule. Normal strikes: box type, lip projection not beyond jamb.

.4 Cylinders: key into keying system as noted as directed.

.2 Butts and hinges:

.1 Butts and hinges: to ANSI/BHMA A156.1, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.

.3 Exit devices: to ANSI/BHMA A156.3, type & function, grade 1, as stated in Hardware Schedule.

.1 Auxiliary item: door co-ordinator, type 21, for pairs of doors with overlapping astragals.

.4 Door Closers and Accessories:

.1 Door controls/closers: to ANSI/BHMA A156.4, designated by letter C and numeral identifiers listed in Hardware Schedule, size

.2 Door controls - overhead holders: to ANSI/BHMA A156.8, designated by letter C and numeral identifiers listed in Hardware Schedule.

.3 Detention/Security rated door closer to be used in Rooms 140 – 144, 147-174 as noted in the hardware schedule.

.5 Door Operators:

.1 Power-operated pedestrian doors: to ANSI/BHMA A156.10.

.2 Power assist and low energy power operated doors: to ANSI/BHMA A156.19.

.6 Architectural door trim: to ANSI/BHMA A156.6, listed in Hardware Schedule.

.1 Door protection plates: kick plate type 1.27 mm stainless steel

.2 Push plates: 1.27 mm thick stainless steel.

.3 Push/Pull units: stainless steel.

.7 Door bottom seal: heavy duty, door seal of extruded aluminum frame and solid closed cell neoprene weather seal, recessed in door bottom, closed ends, clear anodized finish.

.8 Thresholds: full width of door opening, extruded aluminum mill finish,.

.9 Weatherstripping:

.1 Head and jamb seal:

.1 Extruded aluminum frame and closed cell neoprene insert, clear anodized finish.

.2 Adhesive backed neoprene material.

.2 Door bottom seal:

.1 Extruded aluminum frame and closed cell neoprene clear anodized finish.

.10 Door Viewers

.1 Where a door viewer is required, install either of the following types, 1.4 m above the floor level, in perimeter pedestrian doors, fire doors (where a larger opening would negate the ULC rating), and doors which are security barriers dividing functions (e.g. cell block to general office).

.1 Loxem 190- Manufactured by: VSI Hardware Industries (USA) or Taymour Industries (Canada)

.2 Madison No. 20 R35-Manufactured by: Madison Products Company Limited

.3 Ives No. U698- Manufactured by: Leigh Metal Products Ltd.

.4 ASD metallic industrial DS238. Advanced Safety Devices (2 3/8" Viewing Diameter and Door Cut-out). NOTE: This product cannot be used where a Fire rated door required.

.5 Metallic Industrial Grade Door Viewer - 2 3/8" Viewing Diameter and Door Cutout . NOTE: The plastic Door Viewer is not approved for use.

.11 Astragal: overlapping extruded aluminum finished to match doors.

2.3 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.5 Use fasteners compatible with material through which they pass.

2.4 KEYING

.1 Hardware to match existing type, material and finish, and to be keyed into existing system.

.2 Provide BLANK keys in duplicate for every lock in this Contract, except for cell locks where a total of six (6) working keys are required. Supply all blank keys, BLANK both sides. ie:(35-131)

.3 Provide six pin design cylinders keyed 000000. Forward cylinders prepaid to Owner. Cylinders having removable cores must not be used.

.4 Provide three (3) masterkeys for each MK or GMK group.

.5 Stamp keying code numbers on keys and cylinders.

.6 To order and purchase the restricted cylinders/keys in IIFF profile, supplier shall request a “Purchase Authorization” letter from the Alberta Abloy representative.

.7 Keyway shall be supplied in Secure Abloy CY415T Cylinders. For security reasons, forward all keys (and bitting list) by hand address and contact to be confirmed by Owner

.8 Hardware supplier will supply a sufficient number of unrestricted keyway cylinders to the Contractor to secure the perimeter of the building and one storage room. The Contractor will return the cylinders to the supplier upon turnover of the building.

.9 Owner will provide keying and final installation of secure keyways. Contractor to ensure continuous locking / security of building and simultaneous removal of construction cylinders coinciding with Owner installation of secure keyways.

Part 3 Execution

3.1 INSTALLATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Supply manufacturers' instructions for proper installation of each hardware component.

.4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).

.5 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.6 Install key control cabinet.

.7 Use only manufacturer's supplied fasteners.

.1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.2 Tamper proof fasteners to be used in Area 140 to 174 on all hardware devices.

3.2 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to ensure tight fit at contact points with frames.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.

.3 Remove protective material from hardware items where present.

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 SECURITY SYSTEM INSTALLATION INSTRUCTIONS

.1 Install electric strikes, consoles, and switches according to manufacturer’s instructions.

.2 Tag all wires and label each connection in tabular form indicating unit, location, lead, sig name, colour, pin and marker.

.3 Commission system ensuring all doors function properly and according to approved schematics.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by door hardware installation.

3.6 SCHEDULE

Heading # 1

1	Sgl	Dr # 101A	Exterior from 101 1/900 x 2150 x 45mm HMD x PSF Type D3/F8		LHR
1	ea.	Continuous Hinges	SL11HD x D.H. w/PT Prep		628
1	ea.	Power Transfer	PT5	CPT	626
1	ea.	Exit Devices	QEL98L-NL RX/LX x 996L-R	LR	630
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Operators	Horton 4100LE c/w Header	OP	628
1	ea.	Safety Sensor	Paralax II	SEN	
1	ea.	Network Relay/Sequencer	CX22	SEQ	
2	ea.	Switches	482A1U / 482A1U / 712T	PB	Blue
1	ea.	Power Supply	632RF	PS	PCP
1	set	Gasketing	By Door Supplier		
1	ea.	Door Bottoms	By Door Supplier		
1	ea.	Threshold	DS5000 x D.W.		627
1	ea.	Security Astragal	DS179SP-LPASA ELH Mode - OP/LR-L-EDF13		

Heading # 2

1	Sgl	Dr # 101B	101 from 103 1/900 x 2150 x 45mm HMD x PSF Type D3/F5		LHR
1	ea.	Continuous Hinges	SL11HD x D.H. w/PT Prep		628
1	ea.	Power Transfer	PT5	CPT	626
1	ea.	Exit Devices	QEL98L-NL RX/LX x 996L-R	LR	630
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Operators	Horton 4100LE c/w Header	OP	628
1	ea.	Safety Sensor	Paralax II	SEN	
1	ea.	Network Relay/Sequencer	CX22	SEQ	
2	ea.	Switches	482A1U / 482A1U / 712T	PB	Blue
1	ea.	Power Supply	632RF	PS	PCP
1	set	Gasketing	By Door Supplier		
1	ea.	Door Bottoms	By Door Supplier		
1	ea.	Threshold	DS5000 x D.W. ELH Mode - OP/LR-L-EDF13		627

Heading # 3

1	Sgl	Dr # 102	103 from 102 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		LHR
3	ea.	Hinges	LH1368CB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9080P-06C - ANSI F07	EU	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Cush		689
1	ea.	Overhead Stop	GJ100S		626
1	ea.	Kickplate	GSH80A-254 x D.W. M/F07		630

Heading # 4

1	Sgl	Dr # 103	103 from 119 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		LHR
3	ea.	Hinges	LH1379BB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Door Stop	GSH233B		626
1	ea.	Door Viewer	DS238 (Dr # 103 - note: viewing side Room # 119) M/F15		626

Heading # 5

1	Sgl	Dr # 104	105 from 104 2/900 x 2150 x 45mm HMD x PSF Type D1/F1		RHR
3	ea.	Hinges	LH1379BB 114 x 101mm		652
1	ea.	Classroom Lockset	L9456P-06C - ANSI F13		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Cush		689
1	ea.	Kickplate	GSH80A-254 x D.W. M/F13		630

Heading # 6

1	Sgl	Dr # 105A	103 to 105 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51	LH
2	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9080P-06C - ANSI F07	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Cush	689
1	ea.	Kickplate	GSH80A-254 x D.W. When STC Rated Door, acoustic seal by door supplier M/F07	630

Heading # 7

1	Sgl	Dr # 105B	105 from 138 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51	RHR
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	626

Heading # 8

1	Sgl	Dr # 106	138 to 106 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 0 Min Rated	RH
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Storeroom Lockset	L9080P L/Trim Both Sides - ANSI F07K	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F07K	630

Heading # 9

1	Sgl	Dr # 107	138 to 107 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51	RH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	626

Heading # 10

1	Sgl	Dr # 108A	103 to 108 2/900 x 2150 x 45mm HMD x PSF Type D1/F1	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9080P-06C - ANSI F07	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Cush	689
1	ea.	Kickplate	GSH80A-254 x D.W. M/F07	630

Heading # 11

1	Sgl	Dr # 108B	108 to 138 1/900 x 2150 x 45mm HMD x PSF Type D1/F1	RHR
3	ea.	Hinges	LH1379BB 114 x 101mm NRP	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	626

Heading # 12

1	Sgl	Dr 109A	103 to 109 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51		LH
3	ea.	Hinges	LH1368BB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9080P-06C - ANSI F07	EU-L	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Door Stop	GSH233B M/F07		626
		Note:	STC Rated Door, acoustic seal by door supplier		

Heading # 13

1	Sgl	Dr # 109B	109 from 119 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51		LHR
3	ea.	Hinges	LH1379BB 114 x 101mm		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Door Stop	GSH233B M/F15		626

Heading # 14

1	Sgl	Dr 110A	103 to 110 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51		LH
3	ea.	Hinges	LH1368BB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9080P-06C - ANSI F07	EU-L	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Door Stop	GSH233B		626
			ELH Mode - F07		
		Note:	STC Rated Door, acoustic seal by door supplier		

Heading # 15

1	Sgl	Dr # 110B	110 from 115 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51		LHR
3	ea.	Hinges	LH1379BB 114 x 101mm		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Door Stop	GSH233B		626
			M/F015		

Heading # 16

1	Sgl	Dr # 111A	103 to 111 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51		RH
3	ea.	Hinges	LH1379BB 114 x 101mm		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Reg / Cush		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Wall Stop	GSH240B/250B		626

		Note:	When STC Rated Door, acoustic seal by door supplier M/F13	
Heading # 17				
1	Sgl	Dr # 111B	111 to 115 1/900 x 2150 x 45mm HMD x PSF Type D1/F1	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Classroom Lockset	L9456P-06C - ANSI F13	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg / Cush	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Wall Stop	GSH240B/250B M/F13	626
Heading # 18				
1	Sgl	Dr # 112	114 to 112 1/900 x 2150 x 45mm SCWD x PSF Type D1/F1 - 0 Min Rated	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Office Lockset	L9050P-06C - ANSI F04	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Stop	GSH233B M/F04	626
Heading # 19				
1	Sgl	Dr # 116	114 to 116 1/900 x 2150 x 45mm SCWD x PSF Type D1/F3	RH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Office Lockset	L9050P-06C - ANSI F04	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	OH Stop	GJ100S M/F04	626

Heading # 20

1	Sgl	Dr # 117	114 to 117 1/900 x 2150 x 45mm SCWD x PSF Type D1/F3	RH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Office Lockset	L9050P-06C - ANSI F04	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	OH Stop	GJ100S M/F04	626

Heading # 21

1	Sgl	Dr # 121	120 to 121 1/900 x 2150 x 45mm HMD x PSF Type D1/F1	RH
3	ea.	Hinges	LH1368BB 114 x 101mm	652
1	ea.	Door Pull	GSH4612-2	630
1	ea.	Push Plate	GSH81A-5 x 20	630
1	ea.	Door Closer	4041-Cush / Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
		Note:	Add Door Stop, switch Reg Closer Arm on inswing door	

Heading # 22

1	Sgl	Dr # 122	120 to 122 1/900 x 2150 x 45mm HMD x PSF Type D1/F1	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Privacy Lockset	L9044S-06C - ANSI F22	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Wall Stop	GSH233 M/F22	652

Heading # 23

1	Sgl	Dr # 123	120 to 123 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		LH
3	ea.	Hinges	LH1368BB 114 x 101mm		652
1	ea.	Door Pull	GSH4612-2		630
1	ea.	Push Plate	GSH81A-5 x 20		630
1	ea.	Door Closer	4041-Cush / Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
		Note:	Add Door Stop, switch Reg Closer Arm on inswing door		

Heading # 24

1	Sgl	Dr # 124	120 to 124 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		LH
3	ea.	Hinges	LH1368BB 114 x 101mm		652
1	ea.	Latchset	L9010-06C - ANSI F01		626
1	ea.	Door Closer	4041-Reg / Cush		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Door Stop	GSH233B M/F01		626

Heading # 25

1	sgl	Dr # 126A	Exterior from 126 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		RHR
3	ea.	Hinges	LH1368BB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		652
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Thresholds	DS5000 x D.W.		627
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Security Astragal	DS179SP-LPASA		
1	ea.	Security Door Contact	TA4108 M/F15	DPS	BLK

Heading # 26

1	sgl	Dr # 126C	Exterior from Courtyard 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		RHR
3	ea.	Hinges	LH1368BB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		652
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Thresholds	DS5000 x D.W.		627
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Security Astragal	DS179SP-LPASA		
1	ea.	Security Door Contact	TA4108 M/F15	DPS	BLK

Heading # 27

1	Sgl	Dr # 127A	Exterior from 127 1/900 x 2150 x 45mm HMD x PSF Type D1/F6		RHR
2	ea.	Hinges	LH1399BB 114 x 101mm NRP		630
1	ea.	Hinges	LH1399BB 114 x 101mm ETH (8/28 ga)	ETH	630
1	ea.	Storeroom Lockset	L9492P-06C - ANSI eF15-RX DM LEU	EU	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Power Supply	PS902-900-FA	PS	PCP
1	ea.	Card Reader	Reader & Components complete by Security Contractor	CR	
1	ea.	Door Closer	4041-Cush		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Door Viewer	DS238		626
1	ea.	Security Astragal	DS179SP-LPASA EL Mode - CR/EU-L		

Heading # 28

1	Sgl	Dr # 127B	127 from 120 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		RHR
2	ea.	Hinges	LH1368BB 114 x 101mm		652
1	ea.	Hinge	LH1368BB 114 x 101mm ETH (8/28 ga)	ETH	630
1	ea.	Storeroom Lockset	L9492P-06C - ANSI eF15-RX DM LEU	EU	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device – Keyed Alike		
1	ea.	Power Supply	PS902-900-FA	PS	PCP
1	ea.	Card Reader	Reader & Components complete by Security Contractor	CR	
1	ea.	Door Closer	4041-Cush		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Door Viewer	DS238		626
1	ea.	Security Astragal	DS179SP-LPASA EL Mode – CR/EU-L		

Heading # 29

1	Sgl	Dr # 128A	Exterior from 128 1/900 x 2150 x 45mm HMD x PSF Type D1/F6		LHR
3	ea.	Hinges	LH1399BB 114 x 101mm NRP		630
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Door Closer	4041-Cush		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Door Viewer	DS238		626
1	ea.	Security Astragal	DS179SP-LPASA M/F15		

Heading # 30

1	OHD	Dr # 128B	Exterior from 128 1/3600 x 3150 x 45mm Type D30		
			Complete by Door Supplier		

Heading # 31

1	Sgl	Dr # 128C	128 from 127 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 60 Min Rated	LHR
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	652

Heading # 32

1	Sgl	Dr # 129	127 from 129 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 45 Min Rated	RHR
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	652

Heading # 33

1	Sgl	Dr # 130	120 to 130 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 0 Min Rated	RH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	626

Heading # 34

1	Sgl	Dr # 132	120 to 132 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 45 Min Fire Rated		LH
3	ea.	Hinges	LH1379BB 114 x 101mm		652
1	ea.	Storeroom Lockset	L9080P-06C - ANSI F07	EU-L	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Cush		689
1	ea.	Kickplate	GSH80A-254 x D.W. M/F07		630

Heading # 35

1	Sgl	Dr # 133	132 to 133 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 45Min Rated		RH
3	ea.	Hinges	LH1379BB 114 x 101mm		652
1	ea.	Classroom Lockset	L9050P-06C - ANSI F05		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Reg / Cush		689
1	ea.	Kickplate	GSH80A-254 x D.W. M/F05		630

Heading # 36

1	Sgl	Dr # 134	132 to 134 4/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 45 Min Rated		LH
3	ea.	Hinges	LH1379BB 114 x 101mm		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Door Stop	GSH233B M/F15		626

Heading # 37

1	Sgl	Dr # 135	120 to 135 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 45Min Rated	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Classroom Lockset	L9456P-06C - ANSI F13	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg / Cush	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Wall Stop	GSH240B/250B M/F13	626

Heading # 38

1	Sgl	Dr # 136	120 to 136 2/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 45 Min Rated	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	626

Heading # 39

1	Sgl	Dr # 137	120 to 137 2/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 45 Min Rated	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	626

Heading # 40

1	Sgl	Dr # 139	138 to 139 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 0 Min Rated	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	626
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	652
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W. M/F15	630

Heading # 41

1	Sgl	Dr # 140	140 from 138 4/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 45 Min Rated	LHR
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Classroom Lockset	L9466P-06C L/Trim Both Sides - ANSI F14K	626
2	ea.	Abloy Cylinder	Secure Abloy CY415T	626
2	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B	626
2	ea.	Door Viewers	U698 M/F14	626

Heading # 42

1	Sgl	Dr # 141	138 from 141 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51 45 Min Rated	LHR
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9080P-06C - ANSI F07	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Cush	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
		Note:	When STC Rated Door, acoustic seal by door	

			supplier M/F07		
Heading # 43					
1	Sgl	Dr # 142	143 from 142 1/800 x 2150 x 45mm HMD x PSF Type D1/F1 – STC51.		LHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS		630
1	ea.	Deadlock	L9464P - ANSI F18		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Flush Pull	GSH921		630
1	ea.	Door Closer	4041-Cush (Security Closer)		689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets)		630
		Note:	When STC Rated Door, acoustic seal by door supplier M/F18		
Heading # 44					
1	Sgl	Dr # 143A	Exterior from 143 1/900 x 2150 x 45mm IHMD x PSF Type D1/F1		RHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS		630
1	ea.	Classroom Lockset	L9466P-06C L/Trim Both Sides - ANSI F14K		626
2	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Flush Pull	GSH921		630
1	ea.	Door Closer	4041-Cush (Security Closer)		689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets)		630
1	ea.	Thresholds	DS5000 x D.W.		627
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Security Astragal	DS179SP-LPASA		600
1	ea.	Security Door Contact	TA4108	DPS	BLK
1	ea.	Door Viewer	DS238		626
1	ea.	Security Astragal	DS179SP-LPASA M/F14K		

Heading # 45

1	Sgl	Dr # 143B	Exterior from 143 1/900 x 2150 x 45mm IHMD x PSF Type D1/F1		RHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS		630
1	ea.	Classroom Lockset	L9466P-06C L/Trim Both Sides - ANSI F14K		626
2	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Flush Pull	GSH921		630
1	ea.	Door Closer	4041-Cush (Security Closer)		689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets)		630
1	ea.	Thresholds	DS5000 x D.W.		627
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Security Astragal	DS179SP-LPASA		600
1	ea.	Security Door Contact	TA4108	DPS	BLK
1	ea.	Door Viewer	DS238		626
1	ea.	Security Astragal	DS179SP-LPASA M/F14K		

Heading # 46

1	Sgl	Dr # 144	143 from 144 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51		LHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS		630
1	ea.	Classroom Lockset	L9466P-06C L/Trim Both Sides - ANSI F14K		626
2	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Flush Pull	GSH921		630
1	ea.	Door Closer	4041-Cush (Security Closer)		689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F14K		630

Heading # 47

1	Sgl	Dr # 145	Exterior to 145 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		LHR
3	ea.	Hinges	LH1368BB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		652
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Thresholds	DS5000 x D.W.		627
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Security Astragal	DS179SP-LPASA		
1	ea.	Security Door Contact	TA4108 M/F15	DPS	BLK

Heading # 48

1	Sgl	Dr # 146	145 to 146 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51 45 Min Rated		LH
3	ea.	Hinges	LH1379BB 114 x 101mm		652
1	ea.	Storeroom Lockset	L9080P-06C - ANSI F07		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Cush		689
1	ea.	Kickplate	GSH80A-254 x D.W. M/F07		630

Heading # 49

1	Sgl	Dr # 147	143 from 147 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 0 Min Rated	RHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Storeroom Lockset	L9080P L/Trim Both Sides - ANSI F07K	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F07K	630

Heading # 50

1	Sgl	Dr # 148	143 from 148 1/900 x 2150 x 45mm HMD x PSF Type D5/F1	RHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Storeroom Lockset	L9080P L/Trim Both Sides - ANSI F07K	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F07K	630

Heading # 51

1	Sgl	Dr # 149A	Exterior from 149 1/900 x 2150 x 45mm IHMD x PSF Type D1/F1	RHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Classroom Lockset	L9466P-06C L/Trim Both Sides - ANSI F14K	626
2	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike	
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets)	630
1	ea.	Thresholds	DS5000 x D.W.	627
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.	627
1	ea.	Door Sweeps	DS138 x D.W.	627
1	ea.	Door Viewer	DS238	626
1	ea.	Security Astragal	DS179SP-LPASA M/F14K	

Heading # 52

1	OHD	Dr # 149B	Exterior from 149	
1	OHD	Dr # 149C	Exterior from 149 5/3600 x 3150 x 45mm Type D30	
			Complete by Door Supplier	

Heading # 53

1	Sgl	Dr # 149D	149 from 143 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 60 Min Rated	RHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Classroom Lockset	L9466P-06C L/Trim Both Sides - ANSI F14K	626
2	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets)	630
2	ea.	Door Viewers	U698 M/F14K	626

Heading # 54

1	Sldg	Dr # 150	143 to 150	
1	Sldg	Dr # 152	143 to 152	
1	Sldg	Dr # 153	143 to 153	
1	Sldg	Dr # 155	143 to 155	
1	Sldg	Dr # 156	143 to 156	
1	Sldg	Dr # 158	143 to 158	
1	Sldg	Dr # 159	143 to 159	
			7/900 x 2150 x 45mm IHMD x PSF Type D4/	
			Complete by Detention Door Supplier	

Heading # 55

1	Sgl	Dr # 151	143 from 151	LHR
			1/800 x 2150 x 45mm HMD x PSF Type D6/F4	
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Deadlock	L9464P - ANSI F18	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets)	630
			M/F18	

Heading # 56

1	Sgl	Dr # 154	143 from 154	RHR
			1/800 x 2150 x 45mm HMD x PSF Type D6/F4	
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Deadlock	L9464P - ANSI F18	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets)	630
			M/F18	

Heading # 57

1	Sgl	Dr # 157	143 from 157 1/800 x 2150 x 45mm HMD x PSF Type D6/F4	LHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Deadlock	L9464P - ANSI F18	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F18	630

Heading # 58

1	Sgl	Dr # 160	143 from 160 1/800 x 2150 x 45mm HMD x PSF Type D6/F4	LHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Deadlock	L9464P - ANSI F18	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F18	630

Heading # 59

1	Sldg	Dr # 161	143 to 161	
1	Sldg	Dr # 162	143 to 162	
1	Sldg	Dr # 164	143 to 164	
1	Sldg	Dr # 165	143 to 165	
1	Sldg	Dr # 167	143 to 167	
1	Sldg	Dr # 168	143 to 168 6/900 x 2150 x 45mm IHMD x PSF Type D4/	

Complete by Detention Door Supplier

Heading # 60

1	Sgl	Dr # 163	143 from 163 1/800 x 2150 x 45mm HMD x PSF Type D6/F4	LHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Deadlock	L9464P - ANSI F18	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F18	630

Heading # 61

1	Sgl	Dr # 166	143 from 166 1/800 x 2150 x 45mm HMD x PSF Type D6/F4	LHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Deadlock	L9464P - ANSI F18	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F18	630

Heading # 62

1	Sgl	Dr # 169	143 from 169 1/800 x 2150 x 45mm HMD x PSF Type D6/F4	RHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Deadlock	L9464P - ANSI F18	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F18	630

Heading # 63

1	Sldg	Dr # 170	143 to 170 14/900 x 2150 x 45mm IHMD x PSF Type D4/	
			Complete by Detention Door Supplier	

Heading # 65

1	Sldg	Dr # 171	143 to 171 1/900 x 2150 x 45mm IHMD x PSF Type D5/	
1	ea.	Deadlock	L9464P - ANSI F18	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
			Complete by Detention Door Supplier	

Heading # 66

1	Sgl	Dr # 172	140 to 172 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 0 Min Rated	LHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Storeroom Lockset	L9080P L/Trim Both Sides - ANSI F07K	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets)	630

Heading # 67

1	Sgl	Dr # 173	140 to 173 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 0 Min Rated	LH
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Storeroom Lockset	L9080P L/Trim Both Sides - ANSI F07K	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F07K	630

Heading # 68

1	Sgl	Dr # 174	140 from 174 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		LHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS		630
1	ea.	Storeroom Lockset	L9080P L/Trim Both Sides - ANSI F07K		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Flush Pull	GSH921		630
1	ea.	Door Closer	4041-Cush (Security Closer)		689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F07K		630

Heading # 69

1	Sgl	Dr # SS1	Exterior from SS1 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		RHR
3	ea.	Hinges	LH1368BB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		652
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Thresholds	DS5000 x D.W.		627
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Security Astragal	DS179SP-LPASA		
1	ea.	Security Door Contact	TA4108 M/F15	DPS	BLK

Heading # 70

1	Sgl	Dr # SS2	Exterior from SS2 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		RHR
3	ea.	Hinges	LH1368BB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		652
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Thresholds	DS5000 x D.W.		627
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Security Astragal	DS179SP-LPASA		
1	ea.	Security Door Contact	TA4108 M/F15	DPS	BLK

END OF SECTION

3.6 SCHEDULE

Heading # 1

1	Sgl	Dr # 101A	Exterior from 101 1/900 x 2150 x 45mm HMD x PSF Type D3/F8		LHR
1	ea.	Continuous Hinges	SL11HD x D.H. w/PT Prep		628
1	ea.	Power Transfer	PT5	CPT	626
1	ea.	Exit Devices	QEL98L-NL RX/LX x 996L-R	LR	630
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Operators	Horton 4100LE c/w Header	OP	628
1	ea.	Safety Sensor	Paralax II	SEN	
1	ea.	Network Relay/Sequencer	CX22	SEQ	
2	ea.	Switches	482A1U / 482A1U / 712T	PB	Blue
1	ea.	Power Supply	632RF	PS	PCP
1	set	Gasketing	By Door Supplier		
1	ea.	Door Bottoms	By Door Supplier		
1	ea.	Threshold	DS5000 x D.W.		627
1	ea.	Security Astragal	DS179SP-LPASA ELH Mode - OP/LR-L-EDF13		

Heading # 2

1	Sgl	Dr # 101B	101 from 103 1/900 x 2150 x 45mm HMD x PSF Type D3/F5		LHR
1	ea.	Continuous Hinges	SL11HD x D.H. w/PT Prep		628
1	ea.	Power Transfer	PT5	CPT	626
1	ea.	Exit Devices	QEL98L-NL RX/LX x 996L-R	LR	630
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Operators	Horton 4100LE c/w Header	OP	628
1	ea.	Safety Sensor	Paralax II	SEN	
1	ea.	Network Relay/Sequencer	CX22	SEQ	
2	ea.	Switches	482A1U / 482A1U / 712T	PB	Blue
1	ea.	Power Supply	632RF	PS	PCP
1	set	Gasketing	By Door Supplier		
1	ea.	Door Bottoms	By Door Supplier		
1	ea.	Threshold	DS5000 x D.W. ELH Mode - OP/LR-L-EDF13		627

Heading # 3

1	Sgl	Dr # 102	103 from 102 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		LHR
3	ea.	Hinges	LH1368CB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9080P-06C - ANSI F07	EU	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Cush		689
1	ea.	Overhead Stop	GJ100S		626
1	ea.	Kickplate	GSH80A-254 x D.W. M/F07		630

Heading # 4

1	Sgl	Dr # 103	103 from 119 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		LHR
3	ea.	Hinges	LH1379BB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Door Stop	GSH233B		626
1	ea.	Door Viewer	DS238 (Dr # 103 - note: viewing side Room # 119) M/F15		626

Heading # 5

1	Sgl	Dr # 104	105 from 104 2/900 x 2150 x 45mm HMD x PSF Type D1/F1		RHR
3	ea.	Hinges	LH1379BB 114 x 101mm		652
1	ea.	Classroom Lockset	L9456P-06C - ANSI F13		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Cush		689
1	ea.	Kickplate	GSH80A-254 x D.W. M/F07		630

Heading # 6

1	Sgl	Dr # 105A	103 to 105 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51	LH
2	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9080P-06C - ANSI F07	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Cush	689
1	ea.	Kickplate	GSH80A-254 x D.W. When STC Rated Door, acoustic seal by door supplier M/F07	630

Heading # 7

1	Sgl	Dr # 105B	105 from 138 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51	RHR
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	626

Heading # 8

1	Sgl	Dr # 106	138 to 106 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 0 Min Rated	RH
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Storeroom Lockset	L9080P L/Trim Both Sides - ANSI F07K	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F07K	630

Heading # 9

1	Sgl	Dr # 107	138 to 107 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51	RH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	626

Heading # 10

1	Sgl	Dr # 108A	103 to 108 2/900 x 2150 x 45mm HMD x PSF Type D1/F1	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9080P-06C - ANSI F07	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Cush	689
1	ea.	Kickplate	GSH80A-254 x D.W. M/F07	630

Heading # 11

1	Sgl	Dr # 108B	108 to 138 1/900 x 2150 x 45mm HMD x PSF Type D1/F1	RHR
3	ea.	Hinges	LH1379BB 114 x 101mm NRP	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	626

Heading # 12

1	Sgl	Dr 109A	103 to 109 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51		LH
3	ea.	Hinges	LH1368BB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9080P-06C - ANSI F07	EU-L	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Door Stop	GSH233B M/F07		626
		Note:	STC Rated Door, acoustic seal by door supplier		

Heading # 13

1	Sgl	Dr # 109B	109 from 119 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51		LHR
3	ea.	Hinges	LH1379BB 114 x 101mm		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Door Stop	GSH233B M/F15		626

Heading # 14

1	Sgl	Dr 110A	103 to 110 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51		LH
3	ea.	Hinges	LH1368BB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9080P-06C - ANSI F07	EU-L	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Door Stop	GSH233B		626
			ELH Mode - F07		
		Note:	STC Rated Door, acoustic seal by door supplier		

Heading # 15

1	Sgl	Dr # 110B	110 from 115 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51		LHR
3	ea.	Hinges	LH1379BB 114 x 101mm		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Door Stop	GSH233B		626
			M/F015		

Heading # 16

1	Sgl	Dr # 111A	103 to 111 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51		RH
3	ea.	Hinges	LH1379BB 114 x 101mm		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Reg / Cush		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Wall Stop	GSH240B/250B		626

		Note:	When STC Rated Door, acoustic seal by door supplier M/F13	
Heading # 17				
1	Sgl	Dr # 111B	111 to 115 1/900 x 2150 x 45mm HMD x PSF Type D1/F1	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Classroom Lockset	L9456P-06C - ANSI F13	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg / Cush	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Wall Stop	GSH240B/250B M/F13	626
Heading # 18				
1	Sgl	Dr # 112	114 to 112 1/900 x 2150 x 45mm SCWD x PSF Type D1/F1 - 0 Min Rated	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Office Lockset	L9050P-06C - ANSI F04	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Stop	GSH233B M/F04	626
Heading # 19				
1	Sgl	Dr # 116	114 to 116 1/900 x 2150 x 45mm SCWD x PSF Type D1/F3	RH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Office Lockset	L9050P-06C - ANSI F04	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	OH Stop	GJ100S M/F04	626

Heading # 20

1	Sgl	Dr # 117	114 to 117 1/900 x 2150 x 45mm SCWD x PSF Type D1/F3	RH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Office Lockset	L9050P-06C - ANSI F04	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	OH Stop	GJ100S M/F04	626

Heading # 21

1	Sgl	Dr # 121	120 to 121 1/900 x 2150 x 45mm HMD x PSF Type D1/F1	RH
3	ea.	Hinges	LH1368BB 114 x 101mm	652
1	ea.	Door Pull	GSH4612-2	630
1	ea.	Push Plate	GSH81A-5 x 20	630
1	ea.	Door Closer	4041-Cush / Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
		Note:	Add Door Stop, switch Reg Closer Arm on inswing door	

Heading # 22

1	Sgl	Dr # 122	120 to 122 1/900 x 2150 x 45mm HMD x PSF Type D1/F1	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Privacy Lockset	L9044S-06C - ANSI F22	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Wall Stop	GSH233 M/F22	652

Heading # 23

1	Sgl	Dr # 123	120 to 123 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		LH
3	ea.	Hinges	LH1368BB 114 x 101mm		652
1	ea.	Door Pull	GSH4612-2		630
1	ea.	Push Plate	GSH81A-5 x 20		630
1	ea.	Door Closer	4041-Cush / Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
		Note:	Add Door Stop, switch Reg Closer Arm on inswing door		

Heading # 24

1	Sgl	Dr # 124	120 to 124 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		LH
3	ea.	Hinges	LH1368BB 114 x 101mm		652
1	ea.	Latchset	L9010-06C - ANSI F01		626
1	ea.	Door Closer	4041-Reg / Cush		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Door Stop	GSH233B M/F01		626

Heading # 25

1	sgl	Dr # 126A	Exterior from 126 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		RHR
3	ea.	Hinges	LH1368BB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		652
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Thresholds	DS5000 x D.W.		627
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Security Astragal	DS179SP-LPASA		
1	ea.	Security Door Contact	TA4108 M/F15	DPS	BLK

Heading # 26

1	sgl	Dr # 126C	Exterior from Courtyard 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		RHR
3	ea.	Hinges	LH1368BB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		652
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Thresholds	DS5000 x D.W.		627
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Security Astragal	DS179SP-LPASA		
1	ea.	Security Door Contact	TA4108 M/F15	DPS	BLK

Heading # 27

1	Sgl	Dr # 127A	Exterior from 127 1/900 x 2150 x 45mm HMD x PSF Type D1/F6		RHR
2	ea.	Hinges	LH1399BB 114 x 101mm NRP		630
1	ea.	Hinges	LH1399BB 114 x 101mm ETH (8/28 ga)	ETH	630
1	ea.	Storeroom Lockset	L9492P-06C - ANSI eF15-RX DM LEU	EU	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Power Supply	PS902-900-FA	PS	PCP
1	ea.	Card Reader	Reader & Components complete by Security Contractor	CR	
1	ea.	Door Closer	4041-Cush		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Door Viewer	DS238		626
1	ea.	Security Astragal	DS179SP-LPASA EL Mode - CR/EU-L		

Heading # 28

1	Sgl	Dr # 127B	127 from 120 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		RHR
2	ea.	Hinges	LH1368BB 114 x 101mm		652
1	ea.	Hinge	LH1368BB 114 x 101mm ETH (8/28 ga)	ETH	630
1	ea.	Storeroom Lockset	L9492P-06C - ANSI eF15-RX DM LEU	EU	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device – Keyed Alike		
1	ea.	Power Supply	PS902-900-FA	PS	PCP
1	ea.	Card Reader	Reader & Components complete by Security Contractor	CR	
1	ea.	Door Closer	4041-Cush		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Door Viewer	DS238		626
1	ea.	Security Astragal	DS179SP-LPASA EL Mode – CR/EU-L		

Heading # 29

1	Sgl	Dr # 128A	Exterior from 128 1/900 x 2150 x 45mm HMD x PSF Type D1/F6		LHR
3	ea.	Hinges	LH1399BB 114 x 101mm NRP		630
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Door Closer	4041-Cush		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Door Viewer	DS238		626
1	ea.	Security Astragal	DS179SP-LPASA M/F15		

Heading # 30

1	OHD	Dr # 128B	Exterior from 128 1/3600 x 3150 x 45mm Type D30		
			Complete by Door Supplier		

Heading # 31

1	Sgl	Dr # 128C	128 from 127 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 60 Min Rated	LHR
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	652

Heading # 32

1	Sgl	Dr # 129	127 from 129 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 45 Min Rated	RHR
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	652

Heading # 33

1	Sgl	Dr # 130	120 to 130 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 0 Min Rated	RH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	626

Heading # 34

1	Sgl	Dr # 132	120 to 132 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 45 Min Fire Rated	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Cush	689
1	ea.	Kickplate	GSH80A-254 x D.W. M/F07	630

Heading # 35

1	Sgl	Dr # 133	132 to 133 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 45Min Rated	RH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Classroom Lockset	L9050P-06C - ANSI F05	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg / Cush	689
1	ea.	Kickplate	GSH80A-254 x D.W. M/F05	630

Heading # 36

1	Sgl	Dr # 134	132 to 134 4/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 45 Min Rated	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	626

Heading # 37

1	Sgl	Dr # 135	120 to 135 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 45Min Rated	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Classroom Lockset	L9456P-06C - ANSI F13	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg / Cush	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Wall Stop	GSH240B/250B M/F13	626

Heading # 38

1	Sgl	Dr # 136	120 to 136 2/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 45 Min Rated	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	626

Heading # 39

1	Sgl	Dr # 137	120 to 137 2/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 45 Min Rated	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B M/F15	626

Heading # 40

1	Sgl	Dr # 139	138 to 139 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 0 Min Rated	LH
3	ea.	Hinges	LH1379BB 114 x 101mm	626
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15	652
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W. M/F15	630

Heading # 41

1	Sgl	Dr # 140	140 from 138 4/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 45 Min Rated	LHR
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Classroom Lockset	L9466P-06C L/Trim Both Sides - ANSI F14K	626
2	ea.	Abloy Cylinder	Secure Abloy CY415T	626
2	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Reg	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
1	ea.	Door Stop	GSH233B	626
2	ea.	Door Viewers	DS238 M/F14	626

Heading # 42

1	Sgl	Dr # 141	138 from 141 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51 45 Min Rated	LHR
3	ea.	Hinges	LH1379BB 114 x 101mm	652
1	ea.	Storeroom Lockset	L9080P-06C - ANSI F07	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Door Closer	4041-Cush	689
1	ea.	Kickplate	GSH80A-254 x D.W.	630
		Note:	When STC Rated Door, acoustic seal by door	

			supplier M/F07		
Heading # 43					
1	Sgl	Dr # 142	143 from 142 1/800 x 2150 x 45mm HMD x PSF Type D1/F1 – STC51.		LHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS		630
1	ea.	Deadlock	L9464P - ANSI F18		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Flush Pull	GSH921		630
1	ea.	Door Closer	4041-Cush (Security Closer)		689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets)		630
		Note:	When STC Rated Door, acoustic seal by door supplier M/F18		
Heading # 44					
1	Sgl	Dr # 143A	Exterior from 143 1/900 x 2150 x 45mm IHMD x PSF Type D1/F1		RHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS		630
1	ea.	Classroom Lockset	L9466P-06C L/Trim Both Sides - ANSI F14K		626
2	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Flush Pull	GSH921		630
1	ea.	Door Closer	4041-Cush (Security Closer)		689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets)		630
1	ea.	Thresholds	DS5000 x D.W.		627
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Security Astragal	DS179SP-LPASA		600
1	ea.	Security Door Contact	TA4108	DPS	BLK
1	ea.	Door Viewer	DS238		626
1	ea.	Security Astragal	DS179SP-LPASA M/F14K		

Heading # 45

1	Sgl	Dr # 143B	Exterior from 143 1/900 x 2150 x 45mm IHMD x PSF Type D1/F1		RHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS		630
1	ea.	Classroom Lockset	L9466P-06C L/Trim Both Sides - ANSI F14K		626
2	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Flush Pull	GSH921		630
1	ea.	Door Closer	4041-Cush (Security Closer)		689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets)		630
1	ea.	Thresholds	DS5000 x D.W.		627
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Security Astragal	DS179SP-LPASA		600
1	ea.	Security Door Contact	TA4108	DPS	BLK
1	ea.	Door Viewer	DS238		626
1	ea.	Security Astragal	DS179SP-LPASA M/F14K		

Heading # 46

1	Sgl	Dr # 144	143 from 144 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51		LHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS		630
1	ea.	Classroom Lockset	L9466P-06C L/Trim Both Sides - ANSI F14K		626
2	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Flush Pull	GSH921		630
1	ea.	Door Closer	4041-Cush (Security Closer)		689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F14K		630

Heading # 47

1	Sgl	Dr # 145	Exterior to 145 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		LHR
3	ea.	Hinges	LH1368BB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		652
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Thresholds	DS5000 x D.W.		627
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Security Astragal	DS179SP-LPASA		
1	ea.	Security Door Contact	TA4108 M/F15	DPS	BLK

Heading # 48

1	Sgl	Dr # 146	145 to 146 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - STC51 45 Min Rated		LH
3	ea.	Hinges	LH1379BB 114 x 101mm		652
1	ea.	Storeroom Lockset	L9080P-06C - ANSI F07		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Door Closer	4041-Cush		689
1	ea.	Kickplate	GSH80A-254 x D.W. M/F07		630

Heading # 49

1	Sgl	Dr # 147	143 from 147 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 0 Min Rated	RHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Storeroom Lockset	L9080P L/Trim Both Sides - ANSI F07K	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F07K	630

Heading # 50

1	Sgl	Dr # 148	143 from 148 1/900 x 2150 x 45mm HMD x PSF Type D5/F1	RHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Storeroom Lockset	L9080P L/Trim Both Sides - ANSI F07K	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F07K	630

Heading # 51

1	Sgl	Dr # 149A	Exterior from 149 1/900 x 2150 x 45mm IHMD x PSF Type D1/F1	RHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Classroom Lockset	L9466P-06C L/Trim Both Sides - ANSI F14K	626
2	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike	
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets)	630
1	ea.	Thresholds	DS5000 x D.W.	627
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.	627
1	ea.	Door Sweeps	DS138 x D.W.	627
1	ea.	Door Viewer	DS238	626
1	ea.	Security Astragal	DS179SP-LPASA M/F14K	

Heading # 52

1	OHD	Dr # 149B	Exterior from 149	
1	OHD	Dr # 149C	Exterior from 149 5/3600 x 3150 x 45mm Type D30	
			Complete by Door Supplier	

Heading # 53

1	Sgl	Dr # 149D	149 from 143 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 60 Min Rated	RHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Classroom Lockset	L9466P-06C L/Trim Both Sides - ANSI F14K	626
2	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets)	630
2	ea.	Door Viewers	DS238 M/F14K	626

Heading # 54

1	Sldg	Dr # 150	143 to 150	
1	Sldg	Dr # 152	143 to 152	
1	Sldg	Dr # 153	143 to 153	
1	Sldg	Dr # 155	143 to 155	
1	Sldg	Dr # 156	143 to 156	
1	Sldg	Dr # 158	143 to 158	
1	Sldg	Dr # 159	143 to 159	
			7/900 x 2150 x 45mm IHMD x PSF Type D4/	
			Complete by Detention Door Supplier	

Heading # 55

1	Sgl	Dr # 151	143 from 151	LHR
			1/800 x 2150 x 45mm HMD x PSF Type D6/F4	
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Deadlock	L9464P - ANSI F18	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets)	630
			M/F18	

Heading # 56

1	Sgl	Dr # 154	143 from 154	RHR
			1/800 x 2150 x 45mm HMD x PSF Type D6/F4	
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Deadlock	L9464P - ANSI F18	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets)	630
			M/F18	

Heading # 57

1	Sgl	Dr # 157	143 from 157 1/800 x 2150 x 45mm HMD x PSF Type D6/F4	LHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Deadlock	L9464P - ANSI F18	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F18	630

Heading # 58

1	Sgl	Dr # 160	143 from 160 1/800 x 2150 x 45mm HMD x PSF Type D6/F4	LHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Deadlock	L9464P - ANSI F18	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F18	630

Heading # 59

1	Sldg	Dr # 161	143 to 161	
1	Sldg	Dr # 162	143 to 162	
1	Sldg	Dr # 164	143 to 164	
1	Sldg	Dr # 165	143 to 165	
1	Sldg	Dr # 167	143 to 167	
1	Sldg	Dr # 168	143 to 168 6/900 x 2150 x 45mm IHMD x PSF Type D4/	

Complete by Detention Door Supplier

Heading # 60

1	Sgl	Dr # 163	143 from 163 1/800 x 2150 x 45mm HMD x PSF Type D6/F4	LHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Deadlock	L9464P - ANSI F18	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F18	630

Heading # 61

1	Sgl	Dr # 166	143 from 166 1/800 x 2150 x 45mm HMD x PSF Type D6/F4	LHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Deadlock	L9464P - ANSI F18	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F18	630

Heading # 62

1	Sgl	Dr # 169	143 from 169 1/800 x 2150 x 45mm HMD x PSF Type D6/F4	RHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Deadlock	L9464P - ANSI F18	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F18	630

Heading # 63

1	Sldg	Dr # 170	143 to 170 14/900 x 2150 x 45mm IHMD x PSF Type D4/	
			Complete by Detention Door Supplier	

Heading # 65

1	Sldg	Dr # 171	143 to 171 1/900 x 2150 x 45mm IHMD x PSF Type D5/	
1	ea.	Deadlock	L9464P - ANSI F18	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
			Complete by Detention Door Supplier	

Heading # 66

1	Sgl	Dr # 172	140 to 172 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 0 Min Rated	LHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Storeroom Lockset	L9080P L/Trim Both Sides - ANSI F07K	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets)	630

Heading # 67

1	Sgl	Dr # 173	140 to 173 1/900 x 2150 x 45mm HMD x PSF Type D1/F1 - 0 Min Rated	LH
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS	630
1	ea.	Storeroom Lockset	L9080P L/Trim Both Sides - ANSI F07K	626
1	ea.	Abloy Cylinder	Secure Abloy CY415T	626
1	ea.	Flush Pull	GSH921	630
1	ea.	Door Closer	4041-Cush (Security Closer)	689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F07K	630

Heading # 68

1	Sgl	Dr # 174	140 from 174 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		LHR
3	ea.	Hinges	GSH918-HT 114 x 101mm SYS		630
1	ea.	Storeroom Lockset	L9080P L/Trim Both Sides - ANSI F07K		626
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Flush Pull	GSH921		630
1	ea.	Door Closer	4041-Cush (Security Closer)		689
1	ea.	Kickplate	GSH80A-254 x D.W. (SS Rivets) M/F07K		630

Heading # 69

1	Sgl	Dr # SS1	Exterior from SS1 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		RHR
3	ea.	Hinges	LH1368BB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		652
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Thresholds	DS5000 x D.W.		627
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Security Astragal	DS179SP-LPASA		
1	ea.	Security Door Contact	TA4108 M/F15	DPS	BLK

Heading # 70

1	Sgl	Dr # SS2	Exterior from SS2 1/900 x 2150 x 45mm HMD x PSF Type D1/F1		RHR
3	ea.	Hinges	LH1368BB 114 x 101mm NRP		652
1	ea.	Storeroom Lockset	L9485P-06C L/Occ Indicator - ANSI # F15		652
1	ea.	Abloy Cylinder	Secure Abloy CY415T		626
1	ea.	Construction Cylinder	Mortise/Rim as Per Device - Keyed Alike		
1	ea.	Door Closer	4041-Reg		689
1	ea.	Kickplate	GSH80A-254 x D.W.		630
1	ea.	Thresholds	DS5000 x D.W.		627
1	sets	Weatherstrip	DS130 1/D.W. 2/D.H.		627
1	ea.	Door Sweeps	DS138 x D.W.		627
1	ea.	Security Astragal	DS179SP-LPASA		
1	ea.	Security Door Contact	TA4108 M/F15	DPS	BLK

END OF SECTION

Part 1 General

1.1 ADMINISTRATION REQUIREMENTS

.1 Coordination: Coordinate work of this Section with the installation of frames to ensure a continuous, uninterrupted sequence, and to prevent the undue exposure of unprotected frames to weather, and as follows:

.1 Do not install any glazing until all nearby welding is completed.

.2 Mark each light of glass as it is installed in a manner to make it visible and obvious to all persons.

.3 Do not use materials that may permanently mar, discolour or disfigure the glass.

1.2 RELATED REQUIREMENTS

.1 ASTM International

.1 ASTM C1503-08(2013), Standard Specification for Silvered Flat Glass Mirror.

.2 CSA Group

.1 CAN/CGSB-12.1-2017, Safety Glazing.

.2 CAN/CGSB-12.3-M91(R2017), Flat, Clear Float Glass.

.3 CAN/CGSB-12.4(R2017), Heat Absorbing Glass.

1.3 SUBMITTALS

.1 Submit required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit manufacturer's technical data for each glazing material required, including installation and maintenance instructions.

.3 Samples for Verification: Submit the following samples for each glass type specified for verification by Consultant of products supplied to the Project:

.1 Sealed Glass Units: Submit one fully double glazed 300 mm x 300 mm sample; indicate which surface low-e coatings have been applied to; attach glass performance requirements to back side of unit.

.2 Spandrel Glass Units: Submit one fully double glazed 300 mm x 300 mm sample using material selected from initial sample selection process; and for each additional spandrel type specified.

1.4 PROJECT CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Submit maintenance brochures on the care and cleaning of glass and glazing materials.

1.5 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Installer: Use installers having experience with projects of similar scope and complexity, and approved for installing products by glass manufacturer.

.2 Delegated Design Professional: Manufacturer's engineering recommendations:

.1 Perform glazing work in accordance with written recommendations from the glass manufacturer or glass fabricator.

.2 Certify glass compatibility with glazing materials; such as insulating glass sealants, structural sealants and silicones, gaskets, setting blocks, and similar components

.3 Verify glass design, heat treatment and thickness; analyze for thermal stress and maximum deflection.

.2 Certifications: Provide the following during the course of the Work:

.1 Compliance Certification: Provide certificates from manufacturer indicating tested performance requirements required by Authorities Having Jurisdiction and these specifications have been met.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: Deliver packaged materials in their original containers with manufacturer's labels and seals intact.

.3 Storage and Handling Requirements: Store vertically, blocked off the floor in a weatherproof enclosure in original containers with manufacturers labels and seals intact until read for installation, and as follows:

.1 Install glass as soon as possible after delivery to site.

.2 Handle glass carefully to its place of installation.

.3 Prevent damage to glass, adjacent materials and surfaces.

1.7 SITE CONDITIONS

.1 Ambient Conditions: Maintain temperature, humidity and solar exposure conditions of glass and glazing materials during shipping, storage and site installation as required by manufacturer to maintain warranty and performance of installed products, and as follows:

.1 Install glazing when ambient temperature is above 2°C of the manufacturer's minimum and rising.

.2 Maintain ventilated environment for 24 hours after installation.

.3 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.8 WARRANTY

.1 Provide manufacturer's warranty for the following types of glass listed, against defects in materials and workmanship for the period indicated, commencing from the date of Substantial Performance of Work:

.1 Seal Failure: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions.

.2 Evidence of Failure: Obstruction of vision by dust, moisture, or film on interior surfaces of glass.

.3 Allowable Specific Exclusions: Breakage resulting from thermal stress will be accepted as a limitation to the warranty in accordance with CAN/CGSB 12.20

.4 Warranty Period: Ten (10) Years.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis-of-Design products are named in this Section; additional manufacturers offering similar setting systems may be incorporated into the work provided they meet the performance requirements established by the named products.

.2 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

.1 Vision Glass:

.1 AGC Flat Glass North America (formerly AFG or AFGD)

.2 AHC Glass (formerly Visteon)

.3 Pilkington Glass of Canada

.4 Prelco Inc.

.5 Vitro Architectural Glass (formerly PPG Industries)

.6 Schott Glass AG

.7 Viracon Inc.

2.2 PERFORMANCE REQUIREMENTS

.1 Building Envelope Performance: Provide continuity of building enclosure vapour and air barrier using glass and glazing materials utilizing inner light of multiple lite insulated units for continuity of air and vapour seal.

.2 Exterior Glazing Security: Provide security glazing film to exterior glazing units on interior surface.

2.3 GLASS MATERIALS

.1 Float Glass: In accordance with CAN/CGSB-12.3, glazing quality and as follows:

.1 Clear Glass: no tint

.2 Insulated Glass: Tinted Glass outside light and inside light with low E coating, with security film on inside face: Manufactured in accordance with CAN/CGSB-12.4 and as follows:

.1 Insulating Glass Applications: Type 2.

.2 Class: B - Heat strengthened or Class C - Tempered as required to prevent thermal shock breakage.

.3 Tint: tinted light grey glass.

.4 Security film on interior surface.

.5 Provide samples to Consultant for review.

.3 Insulated Spandel Glass:

.1 Insulating Glass Applications: Type 2.

.2 Cass: B – Heat strengthed or Class C – Tempered as required to prevent thermal shock breakage.

.3 Clear glass with full scrim Opasci coating on faces 2 and 3.

.4 Colour: Consultant to choose from manufacturers standard range.

.4 Clear Safety Glass: Manufactured in accordance with CAN/CGSB-12.1, in accordance with EN14179-1, and as follows:

.1 Type: 2 - Tempered.

.2 Class: B - Float Glass.

.3 Category: II - 540 J impact resistance.

.5 Clear Laminated Anti-Vault Glass: Manufactured in accordance with CAN/CGSB-12.1, and as follows:

.1 Tempered glass, 6 mm.

.2 PVB Interlayer, 0.76 mm.

.3 Tempered glass, 6 mm.

.6 Detention Glazing:

.1 In accordance with Section 08 32 00 – Steel Detention Doors.

.7 Acoustic Windows:

.1 Acoustic Window Secure: In accordance with Section 08 44 13 – Glazed Aluminum Curtain Walls and Aluminum Windows.

.2 Acoustic Window: In accordance with Section 08 44 13 – Glazed Aluminum Curtain Walls and Aluminum Windows.

.8 Transparent, One Way, Mirrored Glass Window: Manufactured in accordance with CAN/CGSB-12.6-M91 and as follows:

.1 Type: 1 – Almost transparent metallic coating applied to clear glass, 6.76 mm laminated glass.

.2 Class: B – Laminated, to CAN/CGSB-12.1-M90, 0.76 mm minimum thickness of laminating film.

.9 Mirrors, Silvered: to ASTM C1503 and as follows:

.1 Type: 1B - Float glass for high humidity use.

.2 Tint: Clear

.3 Edges: Pencil polished edge. Seal edges to prevent chemical or atmospheric penetration of backing.

2.4 INSULATING GLASS

.1 Insulating Glass Units: Provide sealed insulating glass units in configurations indicated, and as specified herein.

.1 Manufacture sealed insulating glass units without edge channels or tape, that is, with bare glass edges.

.2 Use two stage seal method of manufacture, as follows:

.1 Primary Seal: polyisobutylene sealing compound between glass and metal spacer/separator.

.2 Secondary Seal: polyurethane, silicone or polysulphide base sealant, filling gap between the two lites of glass at the edge up to the spacer/separator and primary seal.

.3 Install stainless steel capillary breather tubes to equalize pressure differentials between insulating glass fabricating location and insulating glass installation location; crimp tube immediately prior to installation in accordance with glass fabricator's written instructions.

.4 Spacer/Separator: Glass Fabricator's standard stainless steel; coloured natural, spacer containing desiccant, sealed to provide continuous vapour barrier between interior of sealed unit and secondary seal.

.5 Sealants for Insulating Glass Units:

.1 Primary Seal: Polyisobutylene; colour black

.2 Secondary Seal: Silicone Sealant Structural Glazing as specified in Section 07 92 00; compatible with SSG adhered curtain wall system specified in Section 08 44 13;

.2 Sealed units to exterior hollow metal doors and sidelights and where required by the National Building Code 2010: same as sealed units specified for curtain wall in this Section, except with tempered glass to both lites.

.3 Insulating Glass Units

.1 Unit Composition:

.1 Exterior Lite: light Grey tinted heat strengthened or tempered glass.

.2 Air Space: 13 mm Air Filled

.3 Interior Lite: Clear annealed glass with interlayer.

.2 Unit Properties:

.1 Thickness: 6 mm or greater as required to meet structural performance criteria.

.2 Solar Heat Gain Coefficient (SHGC): 0.30

.3 Visible Light Transmission (Tvis): 50

.4 Winter U-Value English (Btu/(hr x sqft x ºF): 0.29

.5 Winter U-Value Metric (W/(M^2 x K): 1.64

.6 Basis-of-Design Materials: Vitro Solarban 60 on Optigray 6 mm + 13 mm air space + 3 mm Clear_030PVB_3 mm Clear.

2.5 ACCESSORY MATERIALS

.1 Glazing Tape: 100% polybutalene vehicle. Extruded in ribbon form with paper separator. Tape shall have an integral shim strip where required.

.2 Setting Blocks: Silicone, Shore A Hardness 90; Shims Shore A Hardness 50.

.3 Spacers: Silicone and other resilient blocks of 40 to 50 Shore A durometer hardness, adhesive-backed on one face only, tested for compatibility with specified primary and secondary glazing materials.

.4 Glazing Compound: For glazing to metal, in accordance with CAN/CGSB 19.2.

.5 Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

.6 Stainless Steel Speaker Disc:

.1 125 mm Diameter, including gaskets, exterior and inter plates with speak through holes, and tamperproof fasteners, Room 103.

.2 Weizel Security Speaking Disc Model Number: 45-115-01-SD1, room 141 and 142.

.7 Glazing film: Provided glazing film to interior surface exterior windows, main level and clerestory. Exterior glazing in room 121 and 123 to receive frosted finish, based on 3M's Mat Crystal2 – SH2MACRX2.

2.6 FABRICATION - GENERAL

.1 Fabricate mirrors to fit measurements of finished spaces, made at the site. Make no horizontal joints.

.2 Cut all glass to field measurement with proper clearances. Cut to produce clean, straight edges with no chips, cracks or flaws.

.3 Make any cut outs, openings to reviewed shop drawings. Grind exposed edges smooth round off corners.

2.7 FABRICATION - INSULATING GLASS

.1 Shop fabricate insulating glass units in accordance with CAN/CGSB.12.8 and IGMAC certification as a minimum.

.2 Sealed units shall have a minimum of 13 mm air space giving a total overall thickness of not less than 25 mm. Edge spacer shall not bow in or out more than 5 mm over full length of a side.

.3 Sealed units shall be assembled and air space sealed in a clean, dry environment, in a location with the same barometric air pressure as the job site.

.4 Sealed units shall be assembled and air space sealed in a clean, dry environment, to suit local barometric air pressure conditions to prevent distortion of sealed units.

.5 Unit types, make-up and colour shade as listed at end of this Section.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that openings for glazing are correctly sized and within tolerance.

.2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.2 PREPARATION

.1 Ensure all glazing rebates smooth and true, free of projections nails, screws, fastenings properly set to prevent contact with glass.

.2 Ensure all stops, splines, glazing accessories provided by other sub-contractors accurately cut to length and proper size and type for specific glazing.

.3 Clean contact surfaces with solvent and wipe dry.

.4 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.5 Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION - GENERAL

.1 Install in accordance with the manufacturer's written instructions and the contract documents, plumb, true, level and rigid.

.2 Do not glaze when ambient or surface temperatures are less than 4°C. Glazing rebates, stops and glass shall be dry, free from ice, frost slick, grease, oil, dust, rust, or other matter detrimental to adhesion of tape, glazing compounds and sealant.

.3 Installation of glass shall be by workmen skilled in this trade in strict accordance with manufacturer's directions.

.4 Position sealed units to provide minimum 12 mm glass bite, and minimum 6 mm perimeter clearance between glass and framing.

.5 Glass shall be free from contact with the frames and stops.

.6 Glaze interior doors with foam tape on both sides. Trim tape even with the sight line.

.7 Use sealant at exterior doors, sealing water and weather tight.

3.4 SEALED UNITS

.1 Install sealed units in accordance with manufacturer’s written instructions, taking care not to warp or twist glass to prevent stress or breaking of glass seals.

.2 Crimp capillary breather tube in accordance with fabricator’s written instructions, and as follows:

.1 Do not trim sealant from around base of tube.

.2 Do not pull or attempt to remove the tube.

.3 Crimp tube immediately prior to installing sealed unit by placing pliers perpendicular to tube 25 mm from end of tube.

.4 Do not permit tube to be exposed to or sit in water.

.5 Cover tube with stainless steel strip and set in sealant bead compatible with insulated glass sealants.

.3 Install new sealed units into existing skylight frames.

.1 Install accessories to complete installation of sealed units.

3.5 GLASS SCHEDULE

.1 Aluminum Curtain Walls:

.1 Insulating glass units: 6 mm grey tinted exterior light (6 mm grey tinted tempered glass for windows below 2133 mm); 6 mm clear float interior light, low E coating to #3 surface and security film on interior surface.

.2 Insulating spandrel unit: 6 mm clear tempered glass exterior light with Opasci coating #2 surface, 6 mm clear tempered glass interior light with Opasci coating #3 surface.

.2 Aluminum Windows Exterior:

.1 Insulating glass units: 6 mm grey tinted exterior light (6 mm grey tinted tempered glass for windows below 2133 mm); 6 mm clear float interior light, low E coating to #3 surface and security film on interior surface.

.2 Insulating spandrel unit: 6 mm clear tempered glass exterior light with Opasci coating #2 surface, 6 mm clear tempered glass interior light with Opasci coating #3 surface.

.3 Aluminum/Pressed Steel Windows Interior:

.1 Antivault glazing millwork between room 103 and 119, and room 141 and 142.

.2 Acoustic Window Secure: Room 142 and 144.

.3 Acoustic Window: Between room 103 and 105.

.4 Hollow Metal Doors, Borrowed Lights and Pressed Steel Glazed Frames:

.1 Exterior Doors and Frames: 6 mm grey tinted exterior light (6 mm grey tinted tempered glass for windows below 2133 mm); 6 mm clear float interior light, low E coating to #3 surface and security film on interior surface.

.2 Exterior Frames: 6 mm clear tempered glass exterior light with Opasci coating #2 surface, 6 mm clear tempered glass interior light with Opasci coating #3 surface.

.3 Interior Doors: Single pane 6 mm tempered safety glazing.

.4 Interior Borrowed Lights: Single pane glass.

.5 Detention Glazing:

.1 Detention Doors: Locations noted in door schedule. Sizes and finishes in accordance with Section 08 32 00 – Steel Detention Doors.

.6 One-way Mirrored Glass:

.1 Glazing between Door 103 and adjacent millwork desk 119.

.7 Mirrors:

.1 Sizes and locations as per drawings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 09 22 16 – Gypsum Board Assemblies

.2 Section 05 41 00 – Structural Metal Stud Framing

1.2 REFERENCES STANDARDS

.1 ASTM International

.1 ASTM C645-14e1, Standard Specification for Non-structural Steel Framing Members.

.2 ASTM C754-17, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.2 Environmental Choice Program (ECP)

.1 CCD-047-98(R2005), Architectural Surface Coatings.

.2 CCD-048-95(R2006), Surface Coatings - Recycled Water-Borne.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

.1 MPI #26, Primer, Galvanized Metal, Cementitious.

.5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including percentages or recycled content materials and products, showing their costs and

Part 1 General

1.1 RELTED REQUIERMENTS

.1 Section 07 84 00 – Fire Stopping

.2 Section 07 92 00 – Joint Sealants

.3 Section 08 11 00 – Metal Doors and Frames

.4 Section 08 14 16 – Flush Wood Doors

.5 Section 08 31 00 – Access Doors and Panels

.6 Section 08 44 14 – Glazed Aluminum Curtain Walls and Aluminum Windows

1.2 DEFINITIONS

.1 Levels of Finish: Standard levels of finish defined by NWCB Manual apply to products of this Section as follows:

.1 Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile.

.2 Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view.

.3 Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat over entire surface for corridors, long hallways, walls and ceilings longer than 7500 mm or walls higher than 3600 mm.

.2 Refer to ASTM C11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.3 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 23.

1.1.1 Action Submittals: Provide following submittals before starting any work of this Section:

.1 Product Data: Submit product data for each type of product indicated.

.2 Samples: Submit samples for trim accessories, full-size sample 300 mm long for each trim accessory indicated.

.2 Informational Submittals: Provide following submittals during the course of the Work:

.1 Submit ULC Assembly Listings and Materials cut sheets for fire rated assemblies as follows:

.1 Not later than 30 working days following Award of Contract, submit copies of ULC Assembly and Materials Listing for indicating ULC Number and how assembly meets the rating criteria for assemblies listed on drawings or meets requirements of Appendix D of Alberta Building Code for review by the Consultant.

.2 Use the same system and material as would be required for a tested assembly for the project; ULC Listings are tested with the specific

materials indicated; substitutions will not be permitted unless evidence of equivalency is confirmed.

.3 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site; include manufacturer's printed instructions for installation.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

.2 Storage and Handling Requirements: Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes; Stack gypsum panels flat and on sufficient spacers to prevent sagging, not in direct contact with floor surfaces.

1.5 SITE CONDITIONS

.1 Ambient Conditions: Store and install materials specified in this Section in accordance with requirements of NWCB Manual.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section, manufacturers offering products that may be incorporated into the Work upon preapproval from Consultant include; but are not limited to, the following:

.1 CertainTeed

.2 CGC Inc.

.3 Georgia-Pacific Canada, Inc.

.2 Additional Manufacturers: Additional manufacturers are listed for accessory items and are incorporated into the Work subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials.

2.2 PERFORMANCE REQUIREMENTS

.1 Fire Test Response Characteristics: Refer to Section 07 05 80; use materials identical to those listed for ULC assemblies submitted to Consultant.

.2 Acoustic Characteristics: Walls are to be assembled to tested rating assemblies to meet STC ratings as indicated.

2.3 MATERIALS

.1 Steel Suspended Ceiling and Soffit Framing: Provide components and materials in accordance with ASTM C754 for interior conditions as indicated on Drawings, and as follows:

.1 Tie Wire: ASTM A641 Class 1 zinc coating, soft temper, No. 18 gauge wire.

.2 Hangers:

.1 Wire Hangers: ASTM A641, Class 1 zinc coating, soft temper, No. 8 gauge.

.3 Carrying Channels: Cold rolled, commercial steel sheet with a base metal thickness of 1.2 mm x 13 mm minimum wide flange, with ASTM A653, Z180, hot dip galvanized zinc coating; 38 mm minimum depth.

.4 Furring Channels: Commercial steel sheet with ASTM A653, Z180, hot dip galvanized zinc coating, as follows:

.1 Hat Shaped, Rigid Furring Channels: ASTM C645, 0.46 mm thickness x 22 mm deep.

.2 Steel Partition Framing: Provide components and materials in accordance with ASTM C754 for conditions indicated on Drawings.

.3 Steel Sheet Components, Steel Studs and Runners: In accordance with ASTM C645 requirements for metal and with ASTM A653, Z180, hot dip galvanized zinc coating and as follows:

.1 Steel Studs: Nominal 0.46 mm base metal thickness, except use 0.75 mm heavy weight framing to support fire rated door frames; depth as indicated on drawings.

.2 Runners: Width, thickness and galvanizing to match steel studs, and as follows:

.1 Double Runner Deflection Track: Outside runner using 50 mm flanges; inner runner 33 mm; maintaining 25 mm minimum deflection space.

.2 Base Runner: Bottom track with 33 mm upstanding legs.

.3 Flat Strap and Backing Plate, strapping: Steel sheet for blocking and bracing in length and width indicated; 1.2 mm nominal base metal thickness x 406 mm wide.

.4 Horizontal Cross Bracing: 1.2 mm nominal base metal thickness; 13 mm minimum width flange x 38 mm minimum depth.

.5 Clip Angle: 38 mm x 38 mm x 1.8 mm nominal base metal thickness.

.6 Furring Channels: Commercial steel sheet with ASTM A653, Z180, hot dip galvanized zinc coating, as follows:

.1 Hat Shaped, Rigid Furring Channels: ASTM C645, 0.75 mm thickness x 22 mm deep.

.2 Resilient Furring Channels: 0.46 mm thickness x 13 mm deep members designed to reduce sound transmission having asymmetrical face attached to single flange by a slotted leg (web).

.4 Heavy Gauge Interior Partition Framing: Steel stud framing for walls having large format tile finish, and walls exceeding 4440 mm in height, and as follows:

.1 Cold Formed Sheet Steel: Commercial steel sheet Interior members not forming a part of the exterior building envelope shall have a minimum ASTM A653, Z180, hot dip galvanized zinc coating, thickness of framing members exclusive of galvanized coating.

.2 Studs: to CAN/CSA-S136 and shall be identified as to specification, type grade and mechanical properties; minimum 92 mm deep x 38mm wide x metal core

thickness 0.75 mm spaced at 406 mm on centre, hot dipped galvanized steel; roll formed with knurled flanges, services and bracing cut outs.

.3 Sill tracks: To CAN/CSA-S136, top track shall be a single track system with minimum metal core thickness 0.75 mm, hot dipped galvanized steel. Top track flanges of depth to suit vertical deflection; do not fix top of studs to track, minimum depth 38 mm and width to suit studs. Floor track to suit stud width, with 33 mm flanges.

.4 Channel stiffener: 19 mm cold rolled channel of 1.2 mm, electro-galvanized steel.

.5 Fasteners:

.1 Stud to stud: Steel, self drilling, self threading, case hardened. Material: stainless steel or steel with minimum 0.008mm cadmium or zinc coating. Head Profile: hex, pan, and low profile type. Length: adequate to penetrate not less than 3 fully exposed threads beyond joined materials.

.2 Track to concrete: Hilti drilled insert, sizes as specified. Do not use Powder Actuated Fasteners.

.3 Track to steel: Secure track to structural steel over 8 mm thickness with Hilti "DX fastening system" with "X-EDNI" nails as specified. Provide additional steel back up above interstitial steel deck for wall support.

.4 Drilled Inserts: Steel, cadmium plated or hot dip galvanized, sizes as indicated on drawings.

.6 Bolts and Nuts: Meeting requirements of ASTM A307, with large flat type steel washers, sized to suit fasteners, hot dip galvanized, 413.68 MPa Tensile Strength

.7 Welding Electrodes: Minimum tensile strength series of 480 MPa, suitable for material being welded.

.8 Touch up Paint: Zinc rich, to CAN/CGSB-1.181.

.5 Interior Gypsum Panels: Provide in maximum lengths and widths available that minimize joints in each area and correspond with support system as indicated on drawings, in thicknesses as indicated and as follows:

.1 Regular Type Gypsum Board: Meeting requirements of ASTM C1396M with long edges tapered, and as follows:

.1 Location: Vertical surfaces, unless otherwise indicated.

.2 Acceptable Materials:

.1 CertainTeed, Easi-Lite

.2 CGC Inc., Sheetrock

.3 Georgia-Pacific Canada, Inc., Toughrock Gypsum Wallboard

.2 Fire Resistant Type (Type X) Gypsum Board: Meeting requirements of ASTM C1396M with long edges tapered, and as follows:

.1 Location: Where required for fire resistance rated assembly.

.2 Acceptable Materials:

.1 CGC Inc., Fiberock Aqua-Tough Firecode.

.2 Georgia Pacific Canada, Inc., Toughrock Fireguard

.3 CertainTeed Inc., ProRoc Type X

.3 Impact Resistant Gypsum/Cellulose Fibre Board: Manufactured to produce superior resistance to surface indentation and through penetration than standard gypsum panels; gypsum panels with cellulose fibre reinforced facers and glass fibre reinforced core, tapered edges, minimum 11.2 kg/m^2, 13 mm thickness, Type X ULC fire rating, conforming to ASTM C1278, and CCMC 12370-R listing and tested to the following performance ratings:

.1 Location: where indicated on Drawings.

.2 Indentation Resistance: ASTM D5420 to provide 3.30 mm maximum indentation.

.3 Hard Body Impact Resistance: To produce failure using a 50 mm pipe cap to produce failure at 47.1 N.m of force.

.4 Soft Body Impact Resistance: ASTM E695 to produce structural failure at greater than 163 N.m using a 27.2 kg bag.

.5 Basis-of-Design Materials: CGC Fiberock Abuse Resistant Panels Type X, where required.

.6 Exterior Sheathing: Provide gypsum sheathing panels in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated, and as follows:

.1 Gypsum Based Wall Sheathing Board: ASTM C1177 proprietary brand gypsum based wall sheathing material formulated specifically for exterior use in water managed building envelope systems and as follows:

.1 Location: Exterior walls, roof deck and soffits.

.2 Acceptable Materials:

- CertainTeed GlasRoc Exterior Sheathing
- CGC Securock Glass Mat Sheathing
- Georgia Pacific Dens-Glass Gold

.7 Joint Treatment Materials: Provide joint compound and accessory materials in accordance with ASTM C475 and as follows:

.1 Joint Tape:

.1 Interior Gypsum Board: Paper.

.2 Interior Mould Resistant Gypsum Board: Fibreglass mesh tape.

.3 Exterior Gypsum Soffit Board: Fibreglass mesh tape.

.4 Tile Backing Panels: As recommended by panel manufacturer.

.2 Joint Compound for Interior Gypsum Board: Vinyl based, non-asbestos, low dusting type compatible with other compounds applied on previous or for successive coats, and as follows:

.1 Pre-filling: Setting type taping compound.

.2 Embedding and First Coat: Drying type compound.

.3 Fill Coat: Drying type compound.

.4 Finish Coat: Drying type, sandable topping compound.

.5 Skim Coat: Drying type, sandable topping compound.

.6 Acceptable Materials:

.1 CertainTeed Dust Away

.2 CGC Dust Control

.8 Joint Compound for Tile Backing Panels:

.1 Gypsum based tile backing board: Use setting type taping and setting type, sandable topping compounds.

.9 Joint Compound for Interior Mould Resistant Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

.1 Pre-filling: Setting type joint compound.

.2 Embedding and First Coat: Setting type joint compound.

.3 Fill Coat: Setting type, sandable topping compound.

.4 Skim Coat: Setting type joint compound, sandable topping compound.

2.4 ACCESSORIES

.1 Trim Accessories:

.1 Interior Trim: Galvanized coated steel sheet or rolled zinc meeting the requirements of ASTM C1047, in the following shapes:

.1 CB Corner Bead: Standard 0.40 mm thickness, corrosion resistant outside corner reinforcements, angle to suit installation.

.2 Reinforced Corner Bead: Heavy duty 0.46 mm thickness, corrosion resistant outside corner reinforcements for use at high exposure corners, angle to suit installation.

.3 LC Edge Bead: U-shaped trim 0.40 thickness to provide a clean finished edge; exposed long flange receives joint compound; use at exposed panel edges, and returns to adjacent materials.

.4 Expansion Joints: Back-to-back edge beads at joints spanning building expansion and movement joints.

.5 Control Joints: V-shaped trim having strippable joint protection specifically manufactured to provide thermal stress relief to large ceiling and wall areas; confirm locations with Consultant before installation.

.6 Strippable Edge Trim: Extruded PVC with pre-masked L-shaped tape on trim with tear away protective serrated strip for removal after compound and paint is applied, for use at areas where gypsum butts aluminum frames and where gypsum butts concrete or concrete block.

.7 Acceptable Materials:

.1 Dietrich Industries, Metal Trims and Finishing Products

.2 Other materials may be acceptable provided information is sent to and accepted by the Consultant before installing products required by this Section.

.2 Acoustic Materials: Coordinate placement of acoustic materials with wall assembly types. Use only fire rated materials in fire and smoke rated assemblies. Acoustic sealants

shall be applied prior application of fire and smoke seals specified in Section 07 84 00 and as follows:

.1 Acoustic Sealant for Exposed Joints: Non-sag, paintable, non-staining, latex sealant in accordance with ASTM C834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction:

.1 Basis-of-Design Materials: Pecora Corp., AC-20 FTR Acoustic and Insulation Sealant.

.2 Acoustic Sealant for Concealed Joints: Non-drying, non-hardening, non-skinning, non-staining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission:

.1 Acceptable Materials:

.1 Pecora Corp., BA-98.

.2 Tremco, Acoustical Sealant

.3 Acoustic Insulation for Fire and Smoke Rated Assemblies: Meeting the requirements of ULC S702 mineral fibre acoustic sound batts, Type 1 for all properties except thermal performance, width to friction fit steel studs; un-faced, thickness minimum 89 mm to fill a minimum of 90% of the cavity thickness, nominal density 40 kg/m^3 minimum; STC ratings as indicated on drawings; having maximum flame spread and smoke developed of 20/20 in accordance with CAN/ULC S102 and being non-combustible in accordance with CAN/ULC S114:

.1 Acceptable Materials:

.1 Owens-Corning Canada Inc., Sound Attenuation Fire Batts

.2 Roxul Inc., Roxul AFB Acoustical Fire Batt

.3 Auxiliary Materials: Provide auxiliary materials in accordance with referenced installation standards and manufacturer's written recommendations, and as follows:

.1 Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

.2 Steel Drill Screws: ASTM C1002, unless otherwise indicated, except use screws in accordance with ASTM C954 for fastening panels to steel members from 0.75 mm to 2.67 mm thickness, and as follows:

.1 Type S: Shallow pitch screw; used for single layer gypsum board application

.2 Type G: Steep pitch screw; used for double layer gypsum board application

.3 Isolation Strip at Exterior Walls: Adhesive backed, closed cell vinyl foam strips that allow fastener penetration without foam displacement, 3 mm thick, in width to suit steel stud size.

.4 Access Panels: Refer to Section 08 31 00, rated to suit wall or ceiling fire rating.

Part 3 Execution

3.1 EXAMINATION

.1 Examine areas and substrates, with Installer present, and including welded hollow metal frames, cast in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Suspended Ceilings:

.1 Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.

.2 Furnish inserts and other devises indicated to other trades for installation in advance of time needed for coordination and construction where concrete inserts are required.

.2 Spray Applied Cementitious Fire Rating Materials:

.1 Coordinate with sprayed fire resistive materials; install gypsum board assemblies to the greatest extent possible before application of spray applied fire rating materials.

.2 Before sprayed fire resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed on fire resistive materials.

.3 Provide continuous plates fastened to building structure not more than 610 mm O/C where offset anchor plates are required.

.4 After sprayed fire resistive materials are applied, remove them only to extent necessary for installation of gypsum board assemblies and without reducing the fire resistive material thickness below that required to obtain fire resistance rating indicated. Protect remaining fire resistive materials from damage.

.3 Foam Deck Inserts:

.1 Coordinate with fire resistive foam deck inserts, firestopping and smokeseal materials specified in Section 07 84 00 – Fire Stopping.

.2 Install specified materials in accordance with material manufacturer's written instructions.

.4 Access Panels and Doors:

.1 Coordinate access panels and wall types with materials specified in Section 08 31 00 – Access Doors and Panels.

.2 Coordinate with Mechanical and Electrical for locations and size requirements of access panels.

.3 Coordinate and confirm location of access panels before installation with Consultant.

.4 Install specified materials in accordance with material manufacturer's written instructions.

.5 Fire Rated Construction:

.1 Install materials forming a part of fire rated construction in accordance with manufacturer's instructions and as required to meet specific ULC listed construction requirements submitted by Subcontractor.

.2 Install fire rated gypsum wall panels vertically; horizontal installation does not meet testing standard unless horizontal blocking is installed behind horizontal joints.

3.3 INSTALLING STEEL FRAMING

.1 Installation Standards: ASTM C754, and ASTM C840 requirements that apply to framing installation.

.2 Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. In accordance with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with NWCB, Specification Standards Manual.

.3 Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement, and as follows:

.1 Isolate ceiling assemblies where they abut or are penetrated by building structure.

.2 Isolate partition framing and wall furring where it abuts structure, except at floor.

.3 Install double runner deflection track at head of assemblies that avoid axial loading of assembly and laterally support assembly.

.4 Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

.5 Installing Steel Suspended Ceiling and Soffit Framing: Suspend ceiling hangers from building structure as follows:

.1 Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.

.2 Install supplemental suspension members and hangers in form of trapezes or equivalent devices where width of ducts and other construction within ceiling plenum produces hanger spacing that interfere with the location of hangers required to support standard suspension system members.

.3 Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

.4 Secure wire hangers by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.

.5 Secure rod, flat or angle hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail:

.1 Do not attach hangers to steel deck tabs.

.2 Do not attach hangers to steel roof deck. Attach hangers to structural members. Provide additional carrier channels between structural elements where structure does not align with hangers.

.3 Do not connect or suspend steel framing from ducts, pipes, or conduit.

.6 Install steel framing components for suspended ceilings so members for panel attachment are level to within 3 mm in 3600 mm measured lengthwise on each member and transversely between parallel members.

.7 Wire-tie furring channels to supports, as required to in accordance with requirements for assemblies indicated. Clips will not be acceptable.

.8 Install suspended steel framing components in sizes and spacing indicated, but not less than that required by the referenced steel framing and installation standards:

.1 Hangers: 1220 mm O/C.

.2 Carrying Channels (Main Runners): 1220 mm O/C.

.3 Furring Channels (Furring Members): 406 mm O/C.

.6 Installing Steel Partition Framing: Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction:

.1 Install foam gasket isolation strip between studs where studs are installed directly against exterior walls.

.2 Install each steel framing and furring member so fastening surfaces vary not more than 3 mm from the plane formed by the faces of adjacent framing.

.3 Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board:

.1 Cut studs 13 mm short of full height to provide perimeter relief.

.2 For fire resistance rated and STC rated partitions that extend to the underside of floor slabs and roof decks or other continuous solid structure surfaces: Install framing around structural and other members extending below floor slabs and roof decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.

.3 Terminate partition framing at suspended ceilings where indicated.

.4 Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.

.5 Install horizontal cross bracing to steel studs at 1220 mm O/C vertically for the entire length of wall for unbraced walls exceeding 3660 mm in length.

.6 Frame door openings using 0.75 mm steel studs and in accordance with gypsum board manufacturer's applicable written recommendations:

.1 Screw vertical studs at jambs to jamb anchor clips on door frame; install runner track section (for cripple studs) at head and secure to jamb studs.

.2 Install two studs at each jamb, connected for entire length.

.3 Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

.7 Frame openings other than door openings the same as required for door openings. Install framing below sills of openings to match framing required above door heads.

3.4 ACCESS PANELS

.1 Install access panels in wall assemblies to maintain fire rating of assembly.

.2 Confirm location of access panels with the Consultant before installation.

.3 Minor adjustments to location within wall system may be required where panel interferes with architectural appearance.

3.5 APPLYING AND FINISHING PANELS

.1 Gypsum Board Application and Finishing Standards: ASTM C840.

.2 Panel Application Methods:

.1 Single Layer Application:

.1 On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing.

.2 On partitions, apply gypsum panels vertically (parallel to framing), unless horizontal application is indicated or otherwise required by fire resistance rated assembly, and to minimize end joints.

.3 Stagger abutting end joints not less than one framing member in alternate courses of board.

.4 At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire resistance rated assembly.

.5 Apply gypsum panels to supports using Type S screws fastened 10 mm from edges of board.

.6 Apply gypsum board to assemblies having resilient channels using Type S screws fastened 38 mm edges of boards.

.2 Double Layer Application:

.1 Apply first layer with enough screws to hold panel in place.

.2 Stagger and offset joints of second layer from first layer.

.3 Apply second layer over first layer and secure as specified for single layer application using screws long enough to penetrate both layers and penetrate 10 mm into metal framing.

.3 Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

.4 Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling; stagger abutting end joints of adjacent panels not less than one framing member spacing.

.5 Install gypsum panels with face side out; butt panels together for a light contact at edges and ends with not more than 1.5 mm of open space between panels; do not force into place.

.6 Locate edge and end joints over supports:

.1 Do not place tapered edges against cut edges or ends.

.2 Stagger vertical joints on opposite sides of partitions.

.3 Do not make joints other than control joints at corners of framed openings.

.4 Stop gypsum board away from underside of floor above and roof deck to allow for deflection of structure.

.5 Attach gypsum board to vertical studs, not to ceiling track, to allow for deflection.

.7 Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

.8 Attach gypsum panels to framing provided at openings and cut outs.

.9 Form control joints to account for thermal movements, to account for movement where direction of framing changes direction, and movements arising differing substrate materials using V-Shaped trims by framing back-to-back framing members and a break in gypsum panel at a maximum of 7.5 metres O/C, as follows:

.1 Install control joints in wall and ceiling construction in accordance with ASTM C840 so that gross area enclosed by joints does not exceed 80 m^2 between joints using limiting distances as follows:

Partition Type	**Maximum Single Dimension**
Interior Partitions	9 metres
Interior Ceilings with Perimeter Relief	15 metres
Interior Ceilings without Perimeter Relief	9 metres
Exterior Ceilings	9 metres
Exterior Walls	9 metres

.2 Lay out control joints to coincide as far as possible with door, window or screen frames, but not necessarily to occur at every individual frame; install control joints vertically and horizontally from corners of openings.

.3 Provide continuous dust barrier behind joints.

.4 Install joints straight and true.

.5 Form control joints to meet sound rated construction and fire ratings required for remainder of wall or ceiling construction.

.6 Obtain Consultant's acceptance of control joint layout before starting installation of materials specified in this Section.

.10 Form expansion joints to account for building movements using back-to-back framing members and edge trims, and a break in gypsum panel over structural movement joints and floor slab control joints as follows:

.1 Install expansion joints incorporating continuous air and vapour membranes and with sufficient gap to allow for projected building movements.

.2 Seal back-to-back edge bead control joints with clear silicone sealant as specified in Section 07 92 00.

.3 Provide continuous dust barrier behind joints.

.4 Install joints straight and true.

.5 Form expansion joints to meet sound rated construction and fire ratings required for remainder of wall or ceiling construction.

.11 Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally:

.1 Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 0.7 m^2 in area.

.2 Fit gypsum panels around ducts, pipes, and conduits.

.3 Cut gypsum panels to fit profile formed by coffers, joists, and other structural members where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks; allow 6 mm to 10 mm wide joints to install sealant.

.12 Isolate perimeter of non-load bearing gypsum board partitions at structural abutments, except floors. Provide 6 mm to 13 mm wide spaces at these locations, and trim edges with J-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustic sealant.

.13 Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations, and as follows:

.1 Space screws a maximum of 300 mm O/C for vertical applications.

.2 Space fasteners in panels that are tile substrates a maximum of 200 mm O/C.

.14 Install fire rated and labelled gypsum board at all locations indicated on Drawings; continue fire and smoke rated wall construction behind and around fire hose cabinet recesses and other recessed items larger than a double gang switch box to maintain wall fire rating.

.15 Install sheet metal backing where required for mounting of items. Spot glue sheet in place before applying surface layer of gypsum board.

.16 Finishing Gypsum Board Assemblies:

.1 Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

.2 Pre-fill open joints, rounded or bevelled edges, and damaged surface areas.

.3 Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

.4 Gypsum Board Finish Levels: Finish panels to levels indicated above.

.5 Mould resistant Gypsum Board: Do not tape or fill joints in mould resistant gypsum board used as a substrate for ceramic tile.

3.6 ACOUSTIC INSTALLATION

.1 Acoustic Sound Batts:

.1 Install acoustic sound batts within metal stud space and above suspended gypsum board ceilings as indicated for sound or fire rating.

.2 Acoustic sound batts to extend full height of partitions.

.3 Fill behind electrical outlet boxes, fire hose cabinets, washroom accessories and other openings with at least 150 mm lap around perimeter of opening; do not compress acoustic sound batts as this could cause the gypsum board finish to bulge or push outward.

.4 Electrical outlet boxes also to use plastic vapour barrier boxes inside the box and acoustic putty outside the box.

.5 Coordinate with Electrical and Mechanical Subcontractors and verify that no back-to-back openings are formed, whether or not so indicated on drawings.

.6 Installation to in accordance with manufacturer's current written recommendations.

3.7 ACOUSTIC SEALANT INSTALLATION

.1 Apply acoustic bead to stud track bottom and top.

.2 Apply non-hardening acoustic sealant to perimeter of each sheet of gypsum board and any wall connections and penetrations.

.3 Offset all receptacle boxes from one another, even in unrated separations.

.4 Stagger joints of second layer of gypsum board joints.

3.8 FIRE RATING SEALANT INSTALLATION

.1 Seal fire rated partitions strictly in accordance with fire sealant manufacturer’s instructions for specific fire rating requirements listed; coordinate with Section 07 84 00.

.2 Locate sealant to ensure it is covered at completion of partition when finishes applied.

.3 Seal around mechanical and electrical work and other work in wall to ensure proper fire rating.

3.9 INSTALLING TRIM ACCESSORIES

.1 For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

.2 Control Joints: Install control joints at locations indicated on Drawings, confirm locations of joints with Consultant before construction, and in accordance with ASTM C840 and in specific locations approved by Consultant for visual effect where joints are not otherwise indicated.

.3 Reveals: Cut vertical trims and casing beads at horizontal reveal locations, and install horizontal reveals continuous around corners and edges.

3.10 FIELD QUALITY CONTROL

.1 Above Ceiling Observation: Before installing gypsum board ceilings, Consultant will conduct an above ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected:

.1 Notify Consultant seven (7) working days in advance of date and time when Project, or part of Project, will be ready for above ceiling observation.

.2 Before notifying Consultant, complete the following in areas to receive gypsum board ceilings:

.1 Installation of 80% of lighting fixtures, powered for operation.

.2 Installation, insulation, and leak and pressure testing of water piping systems.

.3 Installation of air duct systems.

.4 Installation of air devices.

.5 Installation of mechanical system control air tubing.

.6 Installation of acoustic isolation system.

.7 Installation of ceiling support framing.

.2 Acoustic Inspections

.1 Inspection and testing of acoustic application will be carried out by a third party inspection agency certified to perform inspections to confirm Sound Transmission Class (STC) ratings of designated acoustic rooms.

.2 Contractor will pay for inspections at completion of acoustic rooms, prior to Substantial Completion. Inspection costs to include travel, living allowance, site inspections, testing and reports.

.3 If acoustic rooms perform lower than the noted STC ratings, Contractor to pay for all remediation to construction and retesting by the same inspection agency until STC levels are met.

.4 Rooms 105, 107, 109, 110, 141, 142, and 144 are to be testing to STC 50. Rooms 141 and 142 are considered one room.

END OF SECTION

percentages of post-consumer and pre-consumer content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates regional materials.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal framing from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 43 – Environmental Procedures.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Non-load bearing channel stud framing: to ASTM C645 roll formed from 0.61 mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board.

.1 Knock-out service holes at 460 mm centres.

.2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height.

.3 Shaft wall framing: to requirements of applicable ULC design..

.4 Metal channel stiffener: 19 mm size, 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.

.5 Acoustical sealant: in accordance with Section 07 92 00 - Joint Sealants.

.6 Sealants: VOC limit compliant with SCAQMD Rule 1168.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for non-structural metal framing application in accordance with manufacturer's written instructions.

- .1 Visually review substrate in presence of Consultant.
- .2 Inform Consultant of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written acceptance to proceed from Consultant.

3.2 ERECTION

.1 Align partition tracks at floor and steel deck and secure at 600 mm on centre maximum.

.2 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

.3 Place studs vertically at dimensions shown on drawings and not more than 50 mm from abutting walls, and at each side of openings and corners.

- .1 Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.4 Erect metal studding to tolerance of 1:1000.

.5 Attach studs to bottom track using screws.

.6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.7 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.8 Provide two studs extending from floor to steel deck at each side of openings wider than stud centres specified.

- .1 Secure studs together, 50 mm apart using column clips or other accepted means of fastening placed alongside frame anchor clips.

.9 Install heavy gauge single jamb studs at openings.

.10 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs.

- .1 Secure track to studs at each end, in accordance with manufacturer's instructions.
- .2 Install intermediate studs above and below openings in same manner and spacing as wall studs.

.11 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.12 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.

.13 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.14 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.

.1 Use 50 mm leg ceiling tracks.

.15 Install continuous insulating strips to isolate studs from uninsulated surfaces.

.16 Install two continuous beads of acoustical sealant under studs and tracks around perimeter of sound control partitions.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by non-structural metal framing application.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 35 00 – Concrete Finishing

.2 Section 07 92 00 – Joint Sealants

.3 Section 09 29 00 – Gypsum Wallboard

1.2 REFERENCE STANDARDS

.1 ANSI Standards

.1 ANSI A118.4, Latex Modified Portland Cement Mortar.

.2 ASTM International

.1 ASTM C144-11, Standard Specification for Aggregate for Masonry Mortar.

.2 ASTM C373-16e1, Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products.

.3 ASTM C734-15, Standard Test Method for Low-Temperature Flexibility of Latex Sealants After Artificial Weathering.

.4 ASTM C920-14a, Standard Specification for Elastomeric Joint Sealants.

.5 ASTM D412-16, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension.

.3 International Organization for Standardization

.1 ISO 13007-14, Ceramic Tiles – Grouts and Adhesives – Part 1: Terms, Definitions and Specifications for Adhesives.

.4 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

.5 Terrazzo Tile and Marble Association of Canada (TTMAC)

.1 Tile Specification Guide 09 30 00 2016/2017, Tile Installation Manual.

.2 Tile Maintenance Guide 2000.

1.3 ACTION AND INFORMATION SUBMITTALS

.1 Submit required information in accordance with Section 01 33 00 – Submittal Requirements.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit manufacturer's product data for each type of product specified. Data shall indicate compliance with specification and installation recommendations of manufacturer of products being used.

.2 Samples for Verification: Submit samples for verification including sample sets showing the full range of variations expected where products involve normal colour and texture variations:

.1 Submit two (2) sets 300 mm x 300 mm sized panel using specified material including coloured grout mounted on 19 mm thick plywood backer.

.2 Submit tile sample showing installation of perimeter accessories, control or movement joints, and trims where applicable.

.3 Informational Submittals: Provide the following submittals during the course of the work:

.1 Certificates: Submit written statements from manufacturers indicating compatibility with respect to other manufacturer's materials where more than one manufacturer's products form a part of a single tile assembly.

1.4 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit copies of TTMAC Maintenance Guide, and additional materials as follows:

.1 Provide specific warning of any maintenance practice or materials that may damage or disfigure the finished Work.

.2 Provide manufacturer's maintenance data sheets for floor sealers and other non-tile accessories.

.2 Spare Parts: Deliver maintenance materials to Owner as follows:

.1 Deliver tile maintenance materials in the following quantities:

.1 Ceramic Tile: 2% of total installation with a minimum of 8 pieces of each colour and type

.2 Porcelain Tile: 2% of total installation with a minimum of 1 box of each colour and type.

.3 Trim Units: 3% of total installation consisting of full size units of each type, composition, colour, and pattern

1.5 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Standard of the work of this Section: Provide materials and workmanship in accordance with recommendations of Terrazzo, Tile and Marble Association of Canada (TTMAC) and the requirements of the ANSI A108.1 Series of Standards.

.2 Supplier: Obtain materials from one (1) source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties.

.3 Materials: Tile that does not meet a Grade 1 Standard, or is marked as a factory second or discount will be rejected, immediately removed from the site and replaced with specified materials.

.4 Installers: Execute Work of this Section using qualified personnel skilled in ceramic tile installation, having a minimum of five (5) years proven experience and have completed tile installations similar in material, design, and extent to that indicated for this Project.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use in accordance with ANSI A108.1 for labelling sealed tile packages.

.2 Storage and Handling Requirements: Store materials to prevent damage or contamination to materials by water, freezing, foreign matter, and other causes; store cementitious materials in a dry area, and blocked off floor and ground surfaces.

1.7 SITE CONDITIONS

.1 Ambient Conditions: Apply tile after completion of work by other Sections is complete; to surfaces sufficiently dry, clean, firm, level, plumb and free from oil or wax or any other material deleterious to tile adhesion and as follows:

.1 Temperature: Maintain tile materials and substrate temperature between TTMAC recommended minimum and maximum temperature range; unless indicated otherwise by manufacturer, for 48 hours before and during installation until materials are fully set and cured; provide additional heat during winter months or at any other time when there is a risk that surface temperatures may drop below minimum recommended temperatures.

.2 Ventilation: Maintain adequate ventilation where Work of this Section generates toxic gases or where there is a risk of raising relative humidity to levels that could damage building finishes and assemblies.

Part 2 Products

2.1 MATERIALS

.1 Provide tile products manufactured in accordance with ANSI A108.1 as appropriate to the Basis-of-Design Materials.

.2 Factory blend tile that exhibits colour variations within the ranges selected and package so tile units taken from one package show the same range in colours as those taken from other packages.

2.2 TILE

.1 Wall Tile:

.1 Ceramic Wall Tile: Iris Ceramica, Maiolica series, 100 x 300 mm. Refer to drawings for colours. Distributor: Division9, A Gesco Company, www.division9.ca, p: 403-214-3119, e: jfraleigh@divisions9.ca

.2 Porcelain Wall Tile: Stone Tile, Touch series, 100 x 300 mm. Refer to drawings for colours.

.2 Floor Tile:

.1 Porcelain Floor Tile:

.1 Stone Tile, Kursaal Series. Refer to drawings for sizes and colours.

.2 Olympia Tile and Stone, Quebec series, 50 x 50 mm. Refer to drawings for colour.

2.3 TRIMS

.1 Transition Edge Strips: satin nickel anodized aluminum edge strips; height as required to suit tile installation; with integral perforated anchoring leg for setting the strip into the setting material for use at outside corners and top of tile:

.1 Basis-of-Design Materials: Profilitec:

.1 Filojolly RFJ-AS
.2 Kerajolly KJ-AS
.3 Appendo APP15-ASXB
.4 Listec LI15-AS

2.4 ACCESSORY MATERIALS

.1 Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers and as follows:

.1 Job Site Cleaner: Phosphoric acid/nitric acid based cleaning solution mixed in accordance with cleaner manufacturers recommendations and as recommended by tile manufacturer.

.2 Maintenance Cleaner: Non-toxic, electrolytic, biodegradable, non-ammonia containing, PH controlled cleaning solution mixed in accordance with manufacturer's recommendations.

2.5 MORTAR SETTING MATERIALS

.1 Manufacturers: Mortar and grout materials listed in this Section shall be of a uniform quality for each mortar, and grout component from a single manufacturer and each aggregate from one source or producer as follows:

.1 Custom Building Products Ltd.
.2 Flextile Ltd.
.3 Laticrete International Inc.
.4 MAPEI Inc.

.2 Interior Thin Set Wall System: Dry set mortar meeting or exceeding the requirements of ANSI A108.1 formulated for thin set applications of ceramic biscuit tile, factory sanded mortar consisting of Portland cement, sand and additives requiring only potable water to be added for installation:

.1 Acceptable mortar materials:

.1 Custom Building Products Premium Blend Thinset
.2 Flextile Ltd., #51 Floor and Wall Mix
.3 Laticrete International Inc. 317 Thinset Mortar
.4 MAPEI Inc. Kerabond

.3 Exterior Tile Assembly:

.1 Patching compound for any concrete recesses more than 3 mm deep over 3000 mm.

.2 60 mil self-adhering rubberized asphalt sheet waterproofing underlayment membrane used for concrete decks and provide crack suppression with primer compatible with membrane.

.3 Tile setting mortar: polymer modified, non-sagging dry-set cement mortar for large and heavy tile applications. Complying with ANSO A118.4 and ISO 13007.

.4 Grout: 100% silicone sealant for heavy duty traffic and expansion/movement joints complying with ASTM C734, ASTM C920, and ASTM D412.

2.6 GROUT

.1 Colour: as selected by the Consultant. Refer to drawings.

.2 Portland Cement Grout for Wall and Floor Joints ≤3 mm Interior Only: factory blended urethane sanded grout meeting requirements of ASHM C267 chemical:

.1 Acceptable Materials:

.1 Flextile Ltd., Colourmax Plus

2.7 MIXING MORTARS AND GROUT

.1 Mix mortars and grouts in accordance with referenced standards, and mortar and grout manufacturers' written instructions.

.2 Add materials, water, and additives in accurate proportions.

.3 Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

Part 3 Execution

3.1 EXAMINATION

.1 Examine substrates, areas, and conditions where tile will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

.2 Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and are within flatness tolerances required by TTMAC.

.3 Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of Work, and similar items located in or behind tile have been completed before installing tile.

.4 Verify that joints and cracks in tile substrates are coordinated with tile joint locations; adjust joints in consultation with Consultant where joints are not coordinated.

.5 Verify that tile subject to colour variations has been blended in the factory and packaged so tile units taken from one package show the same range of colours as those taken from other packages. If not factory blended, blend tiles at site before installing.

.6 Verify that back of tile is free from contamination before installation.

.7 Notify Contractor in writing of any conditions that are not acceptable; do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION NEW INSTALLATIONS

.1 Make backing surfaces level and true to a tolerance in plane of ±3 mm in 2440 mm for walls.

.2 Use trowelable levelling and patching compounds in accordance with tile setting material manufacturer's written instructions to fill cracks, holes, and depressions.

.3 Remove protrusions, bumps, and ridges by sanding or grinding.

3.3 INSTALLATION

.1 Install tiling in accordance with requirements of TTMAC Tile Installation Manual and parts of ANSI A108 Series of tile installation standards that apply to types of setting and grouting materials, and to methods required for complete ceramic tile installation.

.2 Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions:

.1 Terminate Work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

.2 Cut edges smooth, even and free from chipping.

.3 Do not split tile.

.3 Accurately form intersections and returns; perform cutting and drilling of tile without marring visible surfaces:

.1 Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints.

.2 Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile.

.4 Lay tile in pattern indicated on Drawings and as follows:

.1 Align joints when adjoining tiles on floor, base, walls, and trim are the same size.

.2 Lay out tile Work and centre tile sites in both directions in each space or on each wall area.

.3 Centre tile patterns between control and movement joints. Notify the Consultant for further instructions where tile patterns do not align with control or movement joints.

.4 Cut tile accurately and without damage.

.5 Smooth exposed cut edges with abrasive stone, where exposed.

.6 Chipped or split edges are not acceptable.

.7 Minimum tile width: 1/2 unit unless specifically indicated otherwise on Drawings.

.8 Adjust tile layout to minimize tile cutting.

.9 Provide uniform joint widths.

.10 Make joints between tile sheets the same width as joints within tile sheets so joints between sheets are not apparent in finished Work.

.11 Cut, drill, and fit tile as required accommodating Work of other trades.

.12 Slope floor tile towards floor drains in thick-bed mortar installations.

.13 Lay out tile wainscots to next full tile beyond dimensions indicated.

.5 Press setting material into the back of tile having raised or textured backs to provide a minimum of 95% coverage:

.1 Set tile in place while bond coat is wet and tacky before it has skinned over.

.2 Notch bond coat in horizontal straight lines and set on freshly set setting material while moving tile back and forth at 90° to the notches.

.3 Fully support corners and edges of tile with setting material.

.4 Set tile with, maximum lippage of 1 mm over a 3 mm wide joint.

.6 Prevent rapid drying of setting material:

.1 Do not set tile on dry bed.

.2 Sound tile after setting and replace any hollow sounding units to obtain full bond.

.7 Provide additional ventilation as required.

.8 Clean excess setting materials from surface of tiles before final set.

.9 Sound tiles after setting material have cured and replace hollow sounding tile before grouting.

.10 Joint Widths: Install tile with the following joint widths:

.1 Ceramic Mosaic Tile: 1.5 mm

.2 Wall Tile: 1.5 mm

.3 Make joints consistent width and alignment within tile area.

.4 Maintain 2/3 of grout joint depth free of setting material.

.11 Back Buttering: Obtain minimum 100% mortar coverage in accordance with applicable requirements for back buttering of tile in referenced TTMAC and ANSI A108 series of tile installation standards for the following applications:

.1 Tile installed with chemical resistant mortars and grouts.

.2 Tile having tiles 305 mm or larger in any direction.

.3 Tile having tiles with raised or textured backs.

.12 Install prefabricated edge strips and control at locations indicated or where exposed edge of floor tile meets different flooring materials and exposed substrates.

.13 Protect exposed edges of floor tile with properly sized transition strips, use sloped reducer strips where uneven transitions between 6 mm and 13 mm occur. At 13 mm transitions use the Schluter Reno-ramp with 89 mm long ramp, or similar product.

3.4 CONTROL AND MOVEMENT JOINTS

.1 Install prefabricated control and movement joints in tile Work in accordance with detail 301EJ from TTMAC Installation Manual to suit installation indicated.

.2 Locate expansion, control, contraction, and isolation joints, as indicated in following table, unless specifically indicated otherwise on the Drawings:

Environment	Minimum	Maximum	Joint Width
Interior	4880 mm	6100 mm	6 mm
Exterior	3300 mm	3600 mm	6 mm

.3 Do not saw-cut joints after installing tiles:

.1 Locate joints in tile surfaces directly above joints in concrete substrates.

.2 Provide floor control joints over structural control joints.

.3 Install prefabricated joint profiles in accordance with manufacturer's written instructions, set with top surface of joint profile slightly below top surface of tile.

.4 Prepare joints and apply sealants in accordance with requirements of Section 07 92 00 – Joint Sealants.

.5 Keep control and movement joints free from setting materials.

.4 Form an open joint for sealant in tile Work wherever a change in the backing wall material occurs, at all vertical interior corners, around penetrating pipes and fixtures, and where tile abuts other materials or fixtures.

3.5 GROUT

.1 Site Applied Temporary Protective Coating: Protect exposed surfaces of tile against adherence of mortar and grout by pre-coating them with a continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces where required by tile manufacturer to prevent adhesion or staining of exposed tile surfaces by grout:

.1 Petroleum paraffin wax, applied hot.

.2 Grout release.

.3 Petroleum paraffin wax or grout release.

.2 Install grout in accordance with manufacturer's written instructions, the requirements of the Terrazzo, Tile and Marble Association of Canada (TTMAC), and as follows:

.1 Allow proper setting time before application of grout.

.2 Force grout into joints to a smooth, dense finish.

.3 Remove excess grout in accordance with manufacturer's written instructions and polish tile with clean cloths.

.3 Install grout for ceramic tile (Sand-Portland cement, dry-set, commercial Portland cement, and latex-Portland cement grouts) in accordance with ANSI A108.10.

3.6 CLEANING AND PROTECTION

.1 On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter using Job Site Cleaner listed in 2.4.1.1 above:

.1 Remove grout residue from tile as soon as possible.

.2 Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than ten (10) days after installation.

.3 Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning.

.4 Flush surface with clean water before and after cleaning.

.5 Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

.2 Leave finished installation clean and free of cracked, chipped, broken, unbonded, or other tile deficiencies:

.1 Protect finished areas from traffic until setting materials have sufficiently cured in accordance with TTMAC requirements.

.2 Protect floor areas from traffic after grouting is completed in accordance with manufacturer's written instructions.

.1 Keep traffic off floors for a minimum of 24 hours after completion of grouting.

.2 Use stepping boards where access is required for light foot traffic only after 24 hours from completion of grouting.

.3 Do not immerse in water for a minimum of 21 days after completion of tile work.

.3 Provide protective covering until Substantial Performance of the Work.

.4 Protect wall tiles and bases from impact, vibration, heavy hammering on adjacent and opposite walls for a minimum of 14 days after installation.

3.7 INSTALLATION SCHEDULE

.1 Install tile on gypsum board walls to TTMAC details 304W.

.2 Install tile on concrete floors, thin set method, to TTMAC details 311F.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and application of acoustical units for direct application or for application and installation within a suspended ceiling.

.2 Sustainable requirements for construction and verification.

1.2 RELATED REQUIREMENTS

.1 Section 09 21 16 – Gypsum Board Assemblies

1.3 REFERENCES STANDARDS

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C423-17, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

.2 ASTM E1264-14, Standard Classification for Acoustical Ceiling Products.

.3 ASTM E1477-98a(2017), Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction and Amendment No. 1 1988.

.2 CAN/CGSB-92.1-M89, Sound Absorptive Prefabricated Acoustical Units.

.3 Canadian Standards Association (CSA International)

.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.4 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.2 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.6 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S102-2003, Surface Burning Characteristics of Building Materials and Assemblies.

.7 South Coast Air Quality Management District (SCAQMD), California State:

.1 SCAQMD Rule 1168, June 2006, Adhesives and Sealants Applications

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: Submit WHMIS MSDS in accordance with Section 02 81 01 - Hazardous Materials.

.3 Samples: Submit duplicate samples of each type acoustical units.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including percentages or recycled content materials and products, showing their costs and percentages of post-consumer and pre-consumer content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates regional materials.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Fire-resistance rated floor/ceiling and roof/ceiling assembly: certified by Canadian Certification Organization accredited by Standards Council of Canada.

.2 Mock-up:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Construct mock-up 10m^2 minimum of each type acoustical panel ceiling including one inside corner.

.3 Construct mock-up where directed.

.4 Allow 24 hours for inspection of mock-up by Consultant before proceeding with ceiling work.

.5 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of the finished work.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Protect on site stored or installed absorptive material from moisture damage.

.2 Store extra materials required for maintenance, where directed by Departmental Representative

.3 Waste Management and Disposal:

.1 Separate waste materials in accordance with Section 01 74 21 - Construction /Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate facilities.

.3 Collect and separate for disposal paper, plastic, and corrugated cardboard packaging material in accordance with Waste Management Plan.

.4 Place materials defined as hazardous or toxic in designated containers in accordance with Section 01 35 43 - Environmental Procedures.

.5 Handle and dispose of hazardous materials in accordance with Regional and Municipal, regulations.

.6 Ensure emptied containers are sealed and stored safely in accordance with Section 01 35 43 - Environmental Procedures.

.7 Fold up metal and/or plastic banding, flatten and place in designated area for recycling.

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Permit wet work to dry before beginning to install.

.2 Maintain uniform minimum temperature of 15 degrees C and humidity of 20% before and during installation.

.3 Store materials in work area 48 hours prior to installation.

1.8 EXTRA MATERIALS

.1 Provide extra materials of acoustic units in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide acoustical units amounting to 2% of gross ceiling area for each pattern and type required for project.

.3 Ensure extra materials are from same production run as installed materials.

.4 Clearly identify each type of acoustic unit, including colour and texture.

.5 Deliver to Owner, upon completion of the work of this section.

Part 2 Products

2.1 MATERIALS

.1 Acoustic units for suspended ceiling system: to ASTM E1264.

.1 Type AP-1. Armstrong, Ultima, 1941

.1 Class: A Fire Rating.

.2 Ecolabel: certified mineral fibre with minimum 76 % recycled content

.3 Textures: smooth, fine.

.4 Flame spread rating: 0.25 or less in accordance with CAN/ULC-S102.

.5 Smoke developed: 10-25 or less in accordance with CAN/ULC-S102.

.6 Noise Reduction Coefficient (NRC): 0.80.

.7 Ceiling Attenuation Class (CAC) rating: 35, in accordance with ASTM E1264

.8 Light Reflectance (LR) range: 0.87 to ASTM E1477.

.9 Edge type: tegular.

.10 Colour: white.

.11 Size: 610 x 610 x 15 mm thick.

.12 Surface coverings: Ecolabel certified paint low VOC paint.

.2 Adhesive: low VOC type recommended by acoustic unit manufacturer.

.3 Staples, nails and screws: to CSA B111 non-corrosive finish as recommended by acoustic unit manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Do not install acoustical panels and tiles until work above ceiling has been reviewed by Consultants.

3.2 INSTALLATION

.1 Install acoustical panels and tiles in ceiling suspension system.

3.3 APPLICATION

.1 Install acoustical units parallel to building lines with edge unit not less than 50% of unit width.

.2 Scribe acoustic units to fit adjacent work. Butt joints tight.

3.4 INTERFACE WITH OTHER WORK

.1 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, and gypsum bulkheads to be built into acoustical ceiling components.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 – Cast-In-Place Concrete.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM F1303-04, Standard Specification for Sheet Vinyl Floor Covering with Backing.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1113-16, Architectural Coatings.

.2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for resilient floor and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit duplicate 300 x 300 mm sample pieces of sheet material and 150 mm long for resilient accessories and heat welding beads.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of recycled content materials and products, showing their percentages of post-consumer, post-industrial content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates regional materials.

.5 Closeout Submittals:

.1 Provide maintenance data for resilient flooring for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Waste Management and Disposal:

.1 Separate waste materials or [recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 AMBIENT CONDITIONS

.1 Maintain air temperature and structural base temperature at flooring installation area above 20 degrees C for 48 hours before, during and 48 hours after installation.

1.6 MAINTENANCE

.1 Extra Materials:

.1 Provide extra materials of resilient sheet flooring and adhesives in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide 6 linear m x roll width of each colour, pattern and type flooring material required for project for maintenance use.

.3 Extra materials one piece and from same production run as installed materials.

.4 Identify each roll of sheet flooring and each container of adhesive.

.5 Deliver to owner, Consultant, upon completion of the work of this section.

.6 Store where directed by DCC Representative

Part 2 Products

2.1 MATERIALS

.1 Sheet vinyl with backing: to ASTM F1913.

.1 Wear layer: 1.27 mm.

.2 Width 1830 mm.

.3 Products: Armstrong Corlon, refer to drawings for colours.

.4 Thickness: 2 mm.

.2 Linoleum sheet flooring: to ASTM F2034.

.1 Type: Linoleum sheet with backing.

.2 Thickness: 2.5 mm.

.3 Product: Forbo, refer to drawings for colours and series.

.3 Unbacked Sheet Rubber flooring: Conforming to ASTM F1859 and the following:

.1 Class: I – Homogenous.

.2 Width: Nominal 1004 mm.

.3 Backing: None.

.4 Overall Thickness: nominal 3.5 mm.

.5 Product: Nora, Satura, refer to drawings for colours.

.4 Backed sheet rubber flooring:

.1 Width: 1.86 mm.

.2 Thickness: 6 mm.

.3 Product: Mondo, Ramflex, 707 Grey.

.5 Resilient base: continuous, top set, complete with premoulded end stops

.1 Type: rubber.

.2 Style: cove.

.3 Height: 102 mm.

.4 Lengths: cut lengths minimum 2400 mm.

.5 Colour: indicated on finished schedule drawings.

.6 Primers and adhesives: of types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.

.1 Rubber floor adhesives:

.1 Adhesive: maximum VOC limit compliant with SCAQMD Rule 1168.

.2 Cove base adhesives:

.1 Adhesive: maximum VOC limit compliant with SCAQMD Rule 1168.

.7 Sub-floor filler and leveller: white premix latex requiring water only to produce cementitious paste, 2 part latex-type filler requiring no water as recommended by flooring manufacturer for use with their product.

.8 Metal edge and transition strips:

.1 Aluminum extruded, smooth, mill finish with lip to extend under floor finish, shoulder flush with top adjacent floor finish.

.2 Edge and transitions strips to create smooth transition between dissimilar resilient sheet flooring materials.

.9 Sealer and wax: type recommended by resilient flooring material manufacturer for material type and location.

.1 Sealer: maximum VOC limit compliant with SCAQMD Rule 1113.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 SITE VERIFICATION OF CONDITIONS

.1 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

3.3 PREPARATION

.1 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

.2 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.3 Prime concrete slab to resilient flooring manufacturer's printed instructions.

3.4 APPLICATION: FLOORING

.1 Provide high ventilation rate, with maximum outside air, during installation, and for 48 hours after installation. If possible, vent directly to outside. Do not let contaminated air recirculate through district or whole building air distribution system. Maintain extra ventilation for at least one (1) month following installation.

.2 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.3 Lay flooring with seams parallel to building lines to produce a minimum number of seams. Border widths minimum 1/3 width of full material.

.4 Run sheets in direction of traffic. Double cut sheet joints and heat weld according to manufacturer's printed instructions.

.5 Heat weld seams of linoleum sheet flooring in accordance with manufacturer's printed instructions.

.6 As installation progresses, roll flooring with 45 kg minimum roller to ensure full adhesion.

.7 Cut flooring around fixed objects. Millwork may be placed on flooring depending on Contractor’s schedule.

.8 Install feature strips and floor markings where indicated. Fit joints tightly.

.9 Continue flooring over areas which will be under built-in furniture.

.10 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.

.11 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar, except at acoustic doors. Acoustic thresholds must be level, if flooring terminates to dissimilar thicknesses, continue the thickest material to edge of threshold.

.12 Install metal edge strips at unprotected or exposed edges where flooring terminates.

3.5 APPLICATION: BASE

.1 Lay out base to keep number of joints at minimum.

.2 Clean substrate and prime with one coat of adhesive.

.3 Apply adhesive to back of base.

.4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.

.5 Install straight and level to variation of 1:1000.

.6 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.

.7 Cope internal corners. Use premoulded corner units for right angle external corners. Use formed straight base material for external corners of other angles.

.8 Install toeless type base before installation of carpet on floors.

.9 Heat weld base in accordance with manufacturer's printed instructions.

3.6 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Remove excess adhesive from floor, base and wall surfaces without damage.

.3 Clean, seal and wax floor and base surface to flooring manufacturer's printed instructions.

3.8 PROTECTION

.1 Protect new floors from final inspection.

.2 Prohibit traffic on floor for 48 hours after installation.

.3 Use only water-based coating for linoleum.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes one resinous flooring system with epoxy body.

.1 Application Method: Multilayer Broadcast.

1.2 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-in-place Concrete

.2 Section 03 35 00 – Concrete Finishing

1.3 REFERENCE STANDARDS

.1 ASTM International:

.1 ASTM 307-03(2012), Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfaces.

.2 ASTM C413-01(2012), Standard Test Method for Absorption of chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

.3 ASTM C580-02(2012), Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

.4 ASTM C881/C881M-15, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

.5 ASTM D2240-15, Standard Test Method for Rubber Property-Durometer Hardness.

.6 ASTM D2794-93(2010), Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

.7 ASTM E648-17, Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

1.4 SUBMITTALS

.1 Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

.2 Samples for Verification: For each resinous flooring system required, 6 inches (150 mm) square, applied to a rigid backing by Installer for this Project.

.3 Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

.4 Maintenance Data: For resinous flooring to include in maintenance manuals.

1.5 QUALITY ASSURANCE

.1 Installer Qualifications: Engage an experienced installer (Applicator) who is experienced in applying resinous quartz flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in

applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.

.1 Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

.2 Contractor shall have completed at least three (3) projects of similar size and complexity.

.2 Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer, with not less than ten (10) years of successful experience in manufacturing and installing principal materials described in this section. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

.3 Manufactured Field Technical Service Representatives: Resinous flooring manufacture shall retain the services of Field Technical Service Representatives who are trained specifically on installing the system to be used on the project.

.4 Pre- installation Conference:

.1 General Contractor shall arrange a meeting not less than ten (10) days prior to starting work.

.2 Attendance:

.1 General Contractor

.2 Consultant

.3 Owner's Representative.

.4 Sub-contractor Installer.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.1 Deliver and store materials in manner to prevent damage.

.2 Ensure materials remain in original wrapping and containers until used.

.2 All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

.3 Waste Management and Disposal:

.1 Dispose of waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.7 PROJECT CONDITIONS

.1 Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

.1 Maintain material and substrate temperature between 65 and 85 degrees F (18 and 30 degrees C) during resinous flooring application and for not less than 24 hours after application.

.2 Lighting: Provide temporary lighting if permanent lighting is not in place. Simulate permanent lighting conditions during resinous flooring application.

.3 Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

.4 Concrete substrate shall be properly cured for a minimum of thirty (30) days. A vapour barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

.5 Protection of finished flooring system from damage by subsequent trades shall be the responsibility of the Contractor.

1.8 WARRANTY

.1 Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of one (1) full year from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of one (1) full year from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

Part 2 Products

2.1 RESINOUS FLOORING

.1 Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include,

.1 Must comply with multiple layer broadcast epoxy base with integral quartz aggregate, coloured throughout. Liquid rich, slurry type systems will not be accepted, and will result in a disqualification from bid.

.2 Products:

.1 The Basis of Design is Stonshield SLT®. Substitution information must be provided for Consultant review prior to using another product. Accepted substitutions can be reviewed during construction.

.3 System Characteristics:

.1 Colour and Pattern: Choose from Manufacturer’s standard colour range.

.2 Wearing Surface: Standard or Medium.

.3 Integral Cove Base: 100 mm.

.4 Overall System Thickness: Nominal 3 mm.

.4 System Components: Manufacturer's standard components that are compatible with each other and as follows:

.1 Primer:

.1 Material Basis: Stonhard Standard Primer

.2 Resin: Epoxy

.3 Formulation Description: Two (2) component, 100 percent solids.

.4 Application Method: Squeegee and roller.

.5 Number of Coats: One (1).

.2 Undercoat:

.1 Material design basis: Stonshield Undercoat

.2 Resin: Epoxy

.3 Formulation Description: Two (2) component, 100 percent solids.

.4 Application Method: Rubber Squeegee or Spring Steel Squeegee.

.1 Thickness of Coats: nominal 2 mm.

.2 Number of Coats: One (1).

.5 Aggregates: Colour Quartz Aggregate

.6 Pattern: Tweed

.3 Sealer:

.1 Material Basis: Stonkote CE4®.

.2 Resin: Epoxy

.3 Formulation Description: Two (2) component, 100% solids, UV Stable.

.4 Type: Clear.

.5 Finish: Gloss.

.6 Number of Coats: One (1).

.7 Texture level: Standard or medium.

.5 System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

.1 Tensile Strength: 1,600 psi per ASTM C307.

.2 Flexural Strength: 4,000 psi per ASTM C580.

.3 Water Absorption: < 0.1% per ASTM C413.

.4 Impact Resistance: > 160 in. lbs. per ASTM D2794.

.5 Flammability: Class 1 per ASTM E648.

.6 Hardness: 85 to 90, Shore D per ASTM D 2240.

2.2 ACCESSORIES MATERIALS

.1 Patching and Fill Material: Resinous product of or accepted by resinous flooring manufacturer and recommended by manufacturer for application indicated.

.2 Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

Part 3 Execution

3.1 PREPARATION

.1 General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral pH substrate for resinous flooring application.

.2 Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

.1 Mechanically prepare substrates as follows:

.1 Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.

.2 Comply with ASTM C811 requirements, unless manufacturer's written instructions are more stringent.

.2 Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.

.3 Verify that concrete substrates are dry.

.4 Verify that concrete substrates have neutral pH and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

.3 Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

.4 Use patching and fill material to fill holes and depressions in substrates according to manufacturer’s written instructions.

.5 Treat control joints and other non-moving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer’s written recommendations.

3.2 APPLICATION

.1 General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

.1 Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.

.2 Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.

.3 At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.

.1 Apply joint sealant to comply with manufacturer's written recommendations.

.2 Apply primer where required by resinous system, over prepared substrate at manufacturer's recommended spreading rate. Immediately broadcast quartz silica aggregate into the wet coating using manufacturer's specially designed spray caster.

.3 Integral Cove Base: Stonshield cove mortar, apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, of cove base. Round internal and external corners.

.1 Integral Cove Base: 100 mm high.

.4 Apply by broadcast coat in accordance with Manufacturer’s written instructions in thickness indicated for flooring system. Immediately broadcast quartz silica aggregate into the wet coating using manufacturer's specially designed spray caster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

.5 Apply topcoats in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.3 TERMINATIONS

.1 Chase edges to “lock” the flooring system into the concrete substrate along lines of termination.

.2 Penetration Treatment: Lap and seal resinous system onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

.3 Trenches: Continue flooring system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.

.4 Treat floor drains by chasing the flooring system to lock in place at point of termination.

3.4 JOINTS AND CRACKS

.1 Treat control joints to bridge potential cracks and to maintain monolithic protection.

.2 Treat cold joints and construction joints to bridge potential cracks and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.

.3 Discontinue floor coating system at vertical and horizontal contraction and expansion joints by installing backer rod and compatible sealant after coating

installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.5 FIELD QUALITY CONTROL

.1 Material Sampling: Owner may at any time and any numbers of times during resinous flooring application require material samples for testing for compliance with requirements.

3.6 CLEANING, PROTECTING, AND CURING

.1 Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 18 hours.

.2 Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

.3 Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Definitions: Resinous epoxy floor coating system includes a 100% solids, Low VOC, two component, moisture-tolerant, pigmented, general service, epoxy primer and a 100% solids, Low VOC, two component, moisture tolerant, pigmented, general service epoxy topcoat.

1.2 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-in-place Concrete

.2 Section 03 35 00 – Concrete Finishing

.3 Section 07 03 75 - Joint Sealers

1.3 REFERENCES STANDARDS

.1 ASTM International:

.1 ASTM C881/C881M-15, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

.2 ASTM D2240-15, Standard Test Method for Rubber Property-Durometer Hardness.

.3 ASTM D2369-10(2015), Standard Test Method for Volatile Content of Coatings

.4 ASTM D4060-14, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.

.5 ASTM D7234-12, Standard Test Method for Bond Strength of Epoxy Resin Systems used with Concrete Slant Shear

.6 ASTM F1869-16a, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

.7 ASTM F2170-16b, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 Underwriter’s Laboratory Canada:

.1 CAN/ULC-S102.2-10, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, cleaning procedures.

.3 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for high build glazed coatings. Indicate VOC content.

.4 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit duplicate 75 x 75mm samples of each colour and finish coating applied to smooth hardboard.

.5 Closeout Submittals:

.1 Provide maintenance data for coatings for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 QUALITY ASSURANCE

.1 No request for substitution shall be considered that would change the generic type of floor system specified (i.e. 100% solids, two-component, epoxy coating). Materials of other manufactures may be substituted only on acceptance of Consultant. Request for substitution will only be considered only if submitted ten (10) days prior to bid date. Request will be subject to specification requirements described in this section.

.2 Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.

.1 Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

.2 Contractor shall have completed at least three (3) projects of similar size and complexity.

.3 Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, and topcoats, through one source from a single manufacturer, with not less than ten (10) years of successful experience in manufacturing and installing principal materials described in this section. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

.4 Manufacturer Field Technical Service Representatives: Resinous flooring manufacturer shall retain the services of Field Technical Service Representatives who are trained specifically on installing the system to be used on the project.

.1 Field Technical Services Representatives shall be employed by the system manufacture to assist, as required, in the quality assurance and quality control process of the installation and shall be available to perform field problem solving issues with the installer.

.5 Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

.1 Apply full-thickness mockups on 10 m^2 floor area selected by Consultant.

.2 Allow 24 hours for inspection of mock-up by Consultant and Owner before proceeding with coating work.

.3 When accepted, mock-up will demonstrate minimum standard for this work. Accepted mockups may become part of the completed Work if undisturbed at time of Substantial Performance of the Work.

.6 Pre-installation Conference:

.1 General contractor shall arrange a meeting not less than thirty (30) days prior to starting work. Attendance:

.1 General Contractor

.2 Consultant

.3 Owner's Representative.

.4 Manufacturer/Installer's Representative.

.7 ISO 9001: All materials, including primers, resins, curing agents, finish coats, aggregates and sealants are manufactured and tested under an ISO 9001 registered quality system.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.1 Deliver and store materials in manner to prevent damage.

.2 Ensure materials remain in original wrapping and containers until used.

.2 Waste Management and Disposal:

.1 Dispose of waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.7 PROJECT CONDITIONS

.1 Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

.1 Maintain material and substrate temperature between 65 and 85 degrees F (18 and 30 degrees C) during resinous flooring application and for not less than 24 hours after application.

.2 Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

.3 Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

.4 Concrete substrate shall be properly cured for a minimum of thirty (30) days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

.5 Protection of finished flooring system from damage by subsequent trades shall be the responsibility of the Contractor.

1.8 WARRANTY

.1 Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of (1) full year from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of one (1) full year from date of installation.

Part 2 Products

2.1 MATERIALS

.1 Available Products: Subject to compliance with requirements, products that may be incorporated into the work include,

.2 Acceptable Manufacturers,

.1 Stonhard, Basis of Design

.3 Products: Subject to compliance with requirements:

.1 Stonhard; Stonkote GS4 c/w slip resistant texture. Basis of Design

.4 System Characteristics:

.1 Color: As selected by Consultant from manufacturer's standard colours.

.2 Wearing Surface: Texture # 2

.3 Integral Cove Base: TBD mm

.4 Overall System Thickness: nominal 12-16mil

.5 System Components: Manufacturer's standard components that are compatible with each other and as follows:

.1 Primer:

.1 Material Basis: Stonhard Standard Primer / Stonkote GS4®

.1 Resin: Epoxy

.2 Formulation Description: Two (2) component, 100 percent solids.

.3 Application Method: Squeegee and roller.

.4 Number of Coats: One (1).

.2 Covebase:

.1 Material design basis: Stonclad GS

.2 Resin: Epoxy

.3 Formulation: Three (3) component, 100 percent solids epoxy mortar consisting of an epoxy resin, amine curing agent and selected, graded aggregates blended with inorganic pigments.

.1 Thickness of coats: Nominal 3mm

.2 Number of coasts: One (1).

.4 Application Method: Metal Trowel

.1 Thickness Coats: Nominal 6mm

.2 Number of Coats: one (1).

.5 Aggregates: Pigmented blended aggregate

.3 Wear Course:

.1 Stonhard Texture # 2 Aggregate

.4 Top Coat:

.1 Material Basis: Stonkote GS4®.

.2 Resin: Epoxy

.3 Formulation Description: Two (2) component, 100% solids.

.4 Application Method: Squeegee and roller.

.5 Finish: Gloss.

.6 Number of Coats: one (1).

.5 Approvals: Components listed above are the basis of design intent; all bids will be compared to this standard including resin chemistry, color, surface, thickness, and installation procedures, including number of coats. Contractor shall be required to comply with all the requirements of the Specifications and all of the components required by the Specifications, whether or not such products are specifically listed above.

.6 System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

.1 Abrasion Resistance: 0.02 gm max. weight loss per ASTM D4060, CS-17

.2 Bond Strength: ASTM D7234, > 400psi (100% concrete failure)

.3 Hardness: 80 to 85, Shore D per ASTM D2240.

.4 VOC Content: 0 g/L per ASTM D2369

.5 Flammability: to CAN/ULC-S102.2; Flame Spread 0,Smoke Developed 34

.7 ACCESSORY MATERIALS

.8 Patching and Fill Material: Resinous product of or accepted by resinous flooring manufacturer and recommended by manufacturer for application indicated.

.1 Basis of Design: Stonhard “Stonset PM5”

.9 Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

.1 Basis of Design: Stonhard “Stonflex MP7”

2.2 MIXES

.1 Mix coatings according to manufacturer's instructions.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PREPARATION

.1 General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral pH substrate for resinous flooring application.

.2 Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

.1 Comply with ASTM C811/C881M requirements, unless manufacturer's written instructions are more stringent.

.3 Bring damage to the attention of the Consultant. Upon instruction repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.

.4 Verify that concrete substrates are dry.

.1 Perform in situ probe test, ASTM F2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 85 percent.

.2 Perform anhydrous calcium chloride test, ASTM F1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 5 lb of water/1000 sq. ft. of slab in 24 hours.

.3 Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.

.5 Verify that concrete substrates have neutral pH and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

.6 Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

.7 Use patching and fill material to fill minor holes and depressions in substrates according to manufacturer's written instructions.

.8 Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

3.3 APPLICATION

.1 General: Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic surface of thickness indicated,

uninterrupted except at expansion joints or other types of joints (if any), indicated or required.

.2 Primer: Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates. Primer shall be applied in one coat at 6-8 mils thickness immediately after mixing using high quality medium nap rollers. Coordinate timing of primer application with application of flooring system to ensure optimum inter-coat adhesion.

.3 Integral Cove Base: Apply cove base mix to vertical surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, of cove base. Round internal and external corners at a 25mm radius.

.4 Apply by broadcast coat in accordance with Manufacturer's written instructions in thickness indicated for flooring system. Immediately broadcast quartz silica aggregate into the wet coating using manufacturer's specially designed spray caster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

.5 Topcoat: Mix material according to manufacturer's recommended procedures. Topcoat material shall be applied in two coats at 6-8 mils per coat immediately after mixing using high quality medium nap rollers. Strict adherence to manufacturer's coverage rates shall be maintained.

3.4 FIELD QUALITY CONTROL

.1 Material Sampling: Owner may at any time and any numbers of times during resinous flooring application require material samples for testing for compliance with requirements.

.1 Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.

.2 Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.

.3 If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

.2 Final installation will be subject to review and by both the Consultant and Owner. Deficiencies are to be documented for remedial action and sign off. Complete any requested remedial work as required to achieve acceptance.

3.5 CLEANING, PROTECTING AND CURING

.1 Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 18 hours.

.2 Contractor shall protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application.

.3 Cleaning: Contractor shall remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 09 65 16 – Resilient Sheet Flooring

1.2 REFERENCES STANDARDS

.1 American Association of Textile Chemists and Colorists (AATCC)

.1 AATCC Test Method 16-2004, Colorfastness to Light.

.2 ASTM International:

.1 ASTM D2859-16, Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-4.2 No. 27.5-2008, Textile Test Methods - Colourfastness to Rubbing (Crocking).

.2 CAN/CGSB-4.2 No.27.6M-2008, Textile Test Methods - Flame Resistance - Methemine Tablet Test for Textile Floor Coverings.

.3 CAN/CGSB-4.2 No. 76-94/ISO 2551: 1981, Textile Test Methods - Machine-Made Textile Floor Coverings - Determination of Dimensional Changes Due to the Effects of Varied Water and Heat Conditions.

.4 CAN/CGSB-4.2 No.77.1-94/ISO 4919:2000, Textile Test Methods - Carpets - Determination of Tuft Withdrawal Force.

.5 CRI Carpet Installation Standard 2009.

.6 CRI Green Label Indoor Air Quality Testing Program.

.7 CRI Green Label Plus Indoor Air Quality Testing Program.

.4 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S102.2-10, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for each carpet tile, adhesive, carpet protection, subfloor patching compound and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.

.3 Shop Drawings:

.1 Information on shop drawings to indicate:

.1 Nap: direction, open edges, special patterns.

.2 Edgings: show location of edge moldings and edge bindings.

.4 Samples:

.1 Submit for review and acceptance of each unit.

.2 Submit duplicate samples of each type of carpet tile specified and duplicate tiles for each colour selected.

.5 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.6 Test and Evaluation Reports:

.1 Certified test reports showing compliance with specified performance characteristics and physical properties.

.7 Manufacturer's Instructions: submit manufacturer's installation instructions.

.8 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of content of materials for project.

.3 Regional Materials: submit evidence that project incorporates regional materials and products, showing their distance from project to furthest site of extraction or manufacture.

.4 Low-Emitting Materials:

.1 Submit listing of adhesives used in building, showing compliance with VOC and chemical component limits or restriction requirements.

.2 Submit listing of carpet, carpet backer and adhesive used in building, showing compliance with CRI Green Label Plus Indoor Air Quality Test Program.

.9 Qualification Statements:

.1 Compliance: to CAN/ULC-S102, CAN/ULC-S102.2.

.2 Testing: passes testing requirements of:

.1 Green Label Plus Indoor Air Quality Testing Program.

.3 Tuft bind: meets requirements of CAN/CGSB-4.129 when tested to CAN/CGSB-4.2 No.77.1.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for installed products for incorporation into manual.

.3 Warranty Documentation: submit warranty documents specified.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra stock materials: deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.

.1 Quantity: provide minimum 5 tiles of:

.1 Carpet tile: each colour, type and pattern.

.2 Delivery, storage and protection : comply with Owner's requirements for delivery and storage of extra materials. Include standards, limitations and criteria that establish an overall level of quality for products and work for this Section. Co-ordinate with Section 01 45 00 - Quality Control.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Prequalification: compliance with Health Canada regulations under "Hazardous Products Act", Part II of Schedule 1, to CAN/CGSB-4.2 No. 27.6.

.2 Qualifications:

.1 Manufacturer: capable of providing field service representation during construction and approving application method.

.2 Flooring Contractor:

.1 Experienced in performing work of this Section who has specialized in installation of work similar to that required for this project.

.2 Must not sub-contract labour without written acceptance of Consultant.

.3 Responsible for proper product installation, including floor testing and preparation as specified and in accordance with carpet manufacturer's written instructions.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect carpet tile & adhesive in original containers or wrapping with manufacturer's seals and labels intact.

.3 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness.

.4 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.5 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 43 – Environmental Procedures.

.5 Packaging Waste Management: remove for reuse by manufacturer of packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.8 SITE CONDITIONS

.1 Ambient Conditions:

.1 Moisture: ensure substrate is within moisture limits and alkalinity limits recommended by manufacturer. Prepare moisture testing and provide report to Contractor.

.2 Temperature: maintain ambient temperature of not less than 18 degrees C from 48 hours before installation to at least 48 hours after completion of work.

.3 Relative humidity: maintain between 10% and 65% for 48 hours before, during and 48 hours after installation.

.4 Install carpet after space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete.

1.9 WARRANTY

.1 Manufacturer's warranty: submit, for Consultant's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and does not limit other rights Owner may have under Contract Documents.

.2 Warranty period: Lifetime Commercial Limited Warranty, and one (1) year warranty commencing on date of substantial performance of work.

.1 Warranty covers labour, repair or replacement of defective components for one (1) year after date of substantial performance.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURER AND PRODUCT

.1 Acceptable Manufacturer
Masland Contract
716 Bill Myles Dr.
Saraland, AL 36571
Tel: 1-888-633-4770

.2 Refer to drawings for carpet tile finish.

2.2 MATERIALS

.1 Manufacturers:

.1 Ensure manufacturer has minimum 5 years experience in manufacturing components similar to or exceeding requirements of project.

.2 Description:

.1 Sustainability Characteristics:

.2 Adhesives: VOC limit compliant with SCAQMD Rule 1168 GS-36.

.1 VOC limit: compliant with SCAQMD Rule 1113

.3 Carpet and Accessories:

.1 Green Label Plus certified.

2.3 PERFORMANCE

.1 Flammability: certified by ASTM D2859.

.2 Flame Spread: maximum flame spread rating 300, maximum smoke developed classification 500, when tested to CAN/ULC-S102.2.

.3 Smoke Development: 450 or less per ASTM E662.

.4 Dry Breaking Strength: to ASTM D2661, minimum acceptable tear strength in both length and width:

.1 11.3 kg for carpets installed by glue down installation.

.5 Wear: maximum 10% of pile face fiber by weight for 10 years.

.6 Edge Ravel: none for 10 years.

.7 Static Resistance: permanent static control to AATCC 134, 3000 V maximum at 20% RH and 22 degrees C.

.8 Static Generation: less than 3.5 kV per AATCC 134 for 10 years.

.9 Tuft Bind: Tuft Lock: to ASTM D1335, CAN/CGSB-4.129, minimum acceptable 1.6 kilograms for cut pile product 3.6 for loop pile product.

.10 De-lamination of Secondary Backing: Lamination Strength of Secondary Backing: to ASTM D3936, minimum acceptable peel strength of 1.6 kg/25 mm.

.11 Stain resistance: to AATCC 175, 8.

.12 Soil Resistance: Fluorine Durability Level to AATCC 189, 350 ppm fluorine minimum.

.13 Indoor Air Quality Certification: certified to CRI Green Label Plus IAQ requirements.

2.4 FABRICATION

.1 Tile: product- Masland Contract, Dimishing Grid, colour- refer to finish drawings, size 24in x 24in.

.2 Face construction:

.1 Tip sheared loop pattern.

.3 Pile Surface Appearance:

.1 Multi-level cut and loop pile: textured.

.4 Pile fibre: to CAN/CGSB-4.129.

.1 Dynex Sd Nylon (permanent stain resistance).

.5 Dyeing Method: solution dyed.

.6 Tufted Carpet Backing: to CAN/CGSB-4.129.

.1 Primary backing:

.1 Synthetic non-woven

.7 Gauge: 5/64.

.8 Face Weight: 746g/m2 (22 oz./sq.yd.)

.9 Finished Pile Height: 7.14 mm (0.281")

.10 Anti-microbial Resistance: to AATCC 174, 2 mm minimum halo of inhibition for gram positive bacteria.

.1 1 mm minimum halo of inhibition for gram negative bacteria.

.2 Ensure no fungal growth.

2.5 ACCESSORIES

.1 Resilient Base: Section 09 65 00.

.2 Adhesive:

.1 Multi-purpose Adhesive Type: recommended by carpet tile manufacturer for direct glue down installation.

.2 Pressure Sensitive Type: recommended by carpet tile manufacturer for direct glue down installation of speciality backed carpet tiles.

.3 Mill-applied Adhesive Type: fully cured. Combination of pre-applied adhesive and tile to meet carpet only VOC emissions criteria of Carpet and Rug Institute Green Label Plus Indoor Air Quality Certification Program.

.4 On site application VOC limit: compliant with SCAQMD Rule 1168.

.3 Transition Mouldings:

.1 Carpet to linoleum reducer strip:

.1 Type: non-metallic, heavy-duty thermoplastic vinyl "T" shaped cap insert and minimum 50mm wide extruded aluminum anchorage flange, profiled to accept cap.

Part 3 Execution

3.1 INSTALLERS

.1 Use experienced and qualified technicians to carry out assembly and installation of tile carpet.

3.2 EXAMINATION

.1 Examine conditions, substrates and work to receive work of this Section, co-ordinate with Section 01 71 00 - Examination and Preparation.

.2 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for carpet tile installation in accordance with manufacturer's written instructions.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.3 PREPARATION

.1 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations and co-ordinate with Section 01 71 00 - Examination and Preparation.

.1 Prepare floor surfaces in accordance with CRI Carpet Installation Standard.

.2 Tile Carpeting Preparation:

.1 Pre-condition carpeting: following manufacturer's written instructions.

3.4 INSTALLATION

.1 Install carpet tiles in accordance with manufacturer's written instructions, and CRI 104 Carpet Installation Standard and co-ordinate with Section 01 73 00 - Execution.

.2 Co-ordinate tile carpeting work with work of other trades, for proper time and sequence to avoid construction delays.

.3 Install carpet tile after finishing work is completed but before demountable office partitions and telephone and electrical pedestal outlets are installed.

.4 Install carpet tile to monolithic pattern.

.5 Snugly join carpet tiles in completed installation.

.1 Measure distance covered by 11 carpet tiles (10 joints) and ensure distance is in compliance with manufacturer specifications.

.2 Do not trap yarn between carpet tiles.

.6 Ensure finished installation presents smooth wearing surface free from conspicuous seams, burring and other faults.

.7 Use material from same dye lot.

.1 Ensure colour, pattern and texture match within visual areas.

.2 Maintain constant pile direction.

.8 Fit around architectural, mechanical, electrical and telephone outlets, and furniture fitments, around perimeter of rooms into recesses, and around projections.

.9 Extend carpet tiles into toe spaces, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

.10 Install carpet tiles smooth and free from bubbles, puckers, and other defects.

.11 Protect exposed carpet tile edges at transition to other flooring materials with suitable transition strips.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.1 Vacuum carpets clean immediately after completion of installation.

.2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal 01 35 43 – Environmental Procedures.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Prohibit traffic on carpet for period of 24 hours minimum after installation and until adhesive is cured.

.3 Install carpet protection to satisfaction of Consultant.

.4 Repair damage to adjacent materials caused by tile carpeting installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 09 21 16 - Gypsum Board

1.2 REFERENCES STANDARDS

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C423-17, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.3 Canadian Standards Association (CSA International)

.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1113-04, Architectural Coatings.

.2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

.6 Underwriter Laboratories of Canada (ULC)

.1 CAN/ULC-S702-97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit manufacturer’s technical data for each acoustic material required, including installation and maintenance instructions.

.3 Samples for Verification: Submit the following samples for each acoustic treatment type specified for verification by Consultant of products supplied to the Project:

1.4 QUALITY ASSURANCE

.1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.

.2 Construct one representative mock-up of each type acoustical wall treatment system.

.3 Construct mock-up of one full panel minimum to indicate method of assembly, installation and fixing.

.4 Construct mock-up where directed.

.5 Allow 24 hours for inspection of mock-up by Consultant before proceeding with work.

.6 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of the finished work if no deficiencies are noted by the Consultant..

.7 Materials and products in accordance with Section 01 35 43 - Environmental Procedures.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Commence installation after building enclosed and dust-generating activities are completed.

.2 Permit wet work to dry prior to commencement of installation.

.3 Maintain uniform minimum temperature of 15 degrees C and relative humidity of 20-40% prior to, during and after installation.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Acoustical construction products must:

.1 Not require being labelled as poisonous, corrosive, flammable or explosive under Consumer Chemical and Container Regulations of the Hazardous Products Act.

.2 Be accompanied by detailed instructions for proper handling and maintenance so as to minimize health concerns.

.2 Acoustic units – Fabric Faced, Impact Resistant 6 PCF Fibreglass

.1 Acoustic core material: to CAN/CGSB-92.1.

.1 Size: refer to drawings

.2 Fabric finish: as indicated.

.3 Flame spread class of 25 or less passing CAN/ULC – S102.

.4 NRC designation of 1.10.

.5 Metal support clips: roll formed galvanized steel to acoustic unit supplier's standard, allowing non-destructive de-mounting.

.3 Cementitious wood fibre acoustic units: to CAN/CGSB-92.1.

.1 Standard units: 38 mm thick and as dimensioned on drawings, belevel-butt edged painted finish, standard white NRC designation of 0.85.

.2 Flame spread rating of 25 or less passing CAN/ULC S102.

.3 Urea-formaldehyde free.

.4 Pre-approved manufacturer: Tectum

.4 Adhesive: type recommended by acoustic unit manufacturer.

.5 Staples, nails and screws: to CSA B111, non-corrosive finish, type recommended by acoustic unit manufacturer.

.6 Select paints that provide reduced environmental impacts as described in section 09 91 23 - Interior Painting. Ensure that selected paint materials will not compromise the acoustical properties of wall treatments.

2.2 FABRICATION

.1 Type 1 (ACP1 and ACP2): Fabric faced demountable acoustic units:

.1 Fabric bonded to the face, edges and back of core, square of corners tailored, square edge profile.

.2 Type 2 (ACP3): Cementitious wood fibre acoustic units:

.1 Aspen wood fibres bonded with inorganic hydraulic cement binder.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Ensure substrate surface is straight to tolerance of plus or minus 3 mm over 3000 mm.

.2 Install acoustic units to clean, dry and firm substrate using screws.

.3 Install acoustic units plumb and aligned. Arrange units as indicated. Cut units to be at least 50 % of unit width.

.4 Scribe acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.

.5 Install fibrous acoustical media and spacers over entire area behind perforated acoustic units.

3.3 FIELD QUALITY CONTROL

.1 Inspections:

.1 Inspection and testing of acoustic application will be carried out by a third party inspection agency certified to perform inspections to confirm Sound Transmission Class (STC) ratings of designated acoustic rooms.

.2 Contractor will pay for inspections at completion of acoustic rooms, prior to Substantial Completion. Inspection costs to include travel, living allowance, site inspections, testing and reports.

.3 If acoustic rooms perform lower than the noted STC ratings, Contractor to pay for all remediation to construction and retesting by the same inspection agency until STC levels are met.

.4 Rooms 105, 107, 109, 110, 141, 142, and 144 are to be testing to STC 50. Rooms 141 and 142 are considered one room.

.2

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Keep acoustic installation and all components clean. Remove blemishes immediately.

3.5 PROTECTION

.1 Use polyethylene cardboard to protect finished acoustical wall treatment from damage.

.2 Remove prior to substantial completion.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENT

.1 Section 05 05 19 – Common Work Results for Metalwork Finishing

.2 Section 09 97 19 – Painting Exterior Metal Surfaces

1.2 REFERENCES STANDARDS

.1 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33

.2 Environmental Protection Agency (EPA)

.1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current issue.

.2 Standard GPS-1-12, MPI Green Performance Standard.

.3 Standard GPS-2-12, MPI Green Performance Standard.

.5 National Fire Code of Canada.

.6 Society for Protective Coatings (SSPC)

.1 Systems and Specifications, SSPC Painting Manual 2005.

.7 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113-A2016, Architectural Coatings.

.8 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Contractor: to have a minimum of five (5) years proven satisfactory experience. When requested, provide list of last three (3) comparable jobs including, job name and location, specifying authority, and project manager.

.2 Qualified journeypersons as defined by local jurisdiction to be engaged in painting work

.3 Apprentices: may be employed provided they work under direct supervision of qualified journeyperson in accordance with trade regulations.

.4 Conform to latest MPI requirements for exterior painting work including preparation and priming.

.5 Materials: in accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.

.6 Paint materials such as linseed oil, shellac, and turpentine to be highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and to be compatible with other coating materials as required.

.7 Retain purchase orders, invoices and documents to prove conformance with noted MPI requirements when requested by Consultant.

.8 Standard of Acceptance:

.1 Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.4 PERFORMANCE REQUIREMENTS

.1 Environmental Performance Requirements:

.1 Provide paint products meeting MPI "Environmentally Friendly" E1 E2 E3 ratings based on VOC (EPA Method 24) content levels.

.2 Green Performance in accordance with MPI Standard GPS-1.

1.5 SCHEDULING

.1 Submit work schedule for various stages of painting to Consultant for review. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Consultant for changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants in and about building.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

.3 Upon completion, submit records of products used. List products in relation to finish system and include the following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour number[s].

.4 MPI Environmentally Friendly classification system rating.

.5 Manufacturer's Material Safety Data Sheets (MSDS).

.4 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit duplicate 200 x 300mm sample panels of each paint special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards submitted.

.2 When approved, samples shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

.3 Submit full range of available colours where colour availability is restricted.

.5 Sustainability Submittals:

.1 Co-ordinate submittals requirements in accordance with Section 01 35 43 – Environmental Procedures.

1.7 QUALITY CONTROL

.1 Provide mock-up in accordance with Section 01 45 00 - Quality Control.

.2 When requested by Consultant or Paint Inspection Agency, prepare and paint designated surface, area, room or item to requirements specified herein, with specified paint or coating showing selected colours, number of coats, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When accepted, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

1.8 MAINTENANCE

.1 Extra Materials:

.1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit one, four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

1.9 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Section 01 35 43 – Environmental Procedures.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements, supplemented as follows:

.1 Deliver and store materials in original containers, sealed, with labels intact.

.2 Labels: to indicate:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Provide and maintain dry, temperature controlled, secure storage.

.5 Observe manufacturer's recommendations for storage and handling.

.6 Store materials and supplies away from heat generating devices.

.7 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.

.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.9 Keep areas used for storage, cleaning and preparation, clean and orderly. After completion of operations, return areas to clean condition.

.10 Remove paint materials from storage only in quantities required for same day use.

.11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.12 Fire Safety Requirements:

.1 Provide one 9kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

.2 Waste Management and Disposal:

.1 Separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

.3 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.4 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.5 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground the following procedures shall be strictly adhered to:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.6 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.7 Set aside and protect surplus and uncontaminated finish materials. Deliver to or arrange collection by individuals, for verifiable re-use or re-manufacturing.

.8 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

1.11 AMBIENT CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Do not perform painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.

.2 Where required, provide continuous ventilation for seven (7) days after completion of application of paint.

.3 Co-ordinate use of existing ventilation system with Owner and ensure its operation during and after application of paint as required.

.4 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.5 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities to be provided by General Contractor.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by specifying body, Paint Inspection Agency and, applied product manufacturer, perform no painting work when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate temperature is over 32 degrees C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.

.4 Relative humidity is above 85 % or when dew point is less than 3 degrees C variance between air/surface temperature.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.2 Perform no painting work when maximum moisture content of substrate exceeds:

.1 12% for concrete and masonry (concrete block).

.2 15% for wood.

.3 12% for plaster and gypsum board.

.3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.

.5 Do not apply paint when:

.1 Temperature is expected to drop below 10 degrees C before paint has thoroughly cured.

.2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.

.3 Surface to be painted is wet, damp or frosted.

.6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.

.7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.

.8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

.9 Paint occupied facilities in accordance with approved schedule only. Schedule operations such that painted surfaces will have dried and cured sufficiently before occupants are affected.

Part 2 Products

2.1 MATERIALS

.1 Paint materials listed in latest edition of MPI Approved Products List (APL) are acceptable for use on this project.

.2 Paint materials for paint systems: to be products of single manufacturer.

.3 Only qualified products with E2 E3 "Environmentally Friendly" ratings are acceptable for use on this project.

.4 Use only MPI listed L rated materials.

.5 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, to be as follows:

.1 Be water-based water soluble water clean-up.

.2 Be non-flammable biodegradable.

.3 Be manufactured without compounds which contribute to ozone depletion in upper atmosphere.

.4 Be manufactured without compounds which contribute to smog in the lower atmosphere.

.5 Do not contain methylene chloride chlorinated hydrocarbons toxic metal pigments.

.6 Water-borne surface coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

.7 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

.8 Water-borne surface coatings and recycled water-borne surface coatings must have flash point of 61.0 degrees C or greater.

.9 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:

.1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.10 Water-borne paints and stains, and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.

.11 The following must be performed on each batch of consolidated post-consumer material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.

.1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.

.2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.

.3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

2.2 COLOURS

.1 Where specific products are available in restricted range of colours, selection will be based on limited range.

.2 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Consultant's written permission.

.2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.

.3 Add thinner to paint manufacturer's recommendations. Do not use kerosene or organic solvents to thin water-based paints.

.4 Thin paint for spraying according in accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Consultant.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss: defined as sheen rating of applied paint, in accordance with following values:

Gloss Level Category/	Units @ 60 Degrees/	Units @ 85 Degrees/
G1 – matte finish	0 to 5	max. 10
G2 – velvet finish	0 to 10	10 to 35
G3 – eggshell finish	10 to 25	10 to 35
G4 – satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	85	

.2 Gloss level ratings of painted surfaces as specified.

2.5 EXTERIOR PAINTING SYSTEMS

.1 Asphalt Surfaces: zone/traffic marking for drive and parking areas, etc.

.1 EXT 2.1A - Latex zone/traffic marking finish.

.2 EXT 2.1B - Alkyd zone/traffic marking finish.

.2 Structural Steel and Metal Fabrications:

.1 EXT 5.1G - Pigmented polyurethane finish (over epoxy zinc rich primer and high build epoxy).

.2 EXT 5.1P - Pigmented polyurethane finish (over epoxy zinc rich primer).

.3 Steel - High Heat: heat exchangers, breeching, pipes, flues, stacks, etc., with temperature range as noted

.1 EXT 5.2D - High heat resistant coating, maximum [593] degrees C

.4 Galvanized Metal: not chromate passivated

.1 EXT 5.3D - Pigmented polyurethane finish for use in high contact/high traffic areas.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 EXAMINATION

.1 Exterior repainting work: inspected by MPI Accredited Paint Inspection Agency (inspector) acceptable to specifying authority and local Painting Contractor's Association. Painting contractor to notify Paint Inspection Agency minimum of one (1) week prior to commencement of work and provide copy of project repainting specification and Finish Schedule.

.2 Exterior surfaces requiring repainting: inspected by both painting contractor and Paint Inspection Agency who will notify Consultant and Contractor in writing of defects or problems, prior to commencing repainting work, or after surface preparation if unseen substrate damage is discovered.

.3 Where assessed degree of surface degradation of DSD-1 to DSD-3 before preparation of surfaces for repainting is revealed to be DSD-4 after preparation, repair or replacement of such unforeseen defects discovered are to be corrected, as mutually agreed, before repainting is started.

.4 Where "special" repainting or recoating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating manufacturer to provide as part of work, certification of surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Owner.

3.3 PREPARATION

.1 Perform preparation and operations for exterior painting in accordance with MPI Maintenance Painting Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

.3 Clean and prepare exterior surfaces to be repainted in accordance with MPI Maintenance Repainting Manual requirements. Refer to the MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and surface debris by vacuuming, wiping with dry, clean cloths or compressed air.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly. Allow sufficient drying time and test surfaces using electronic moisture meter before commencing work.

.5 Use water-based cleaners in place of organic solvents where surfaces will be repainted using water based paints.

.6 Many water-based paints cannot be removed with water once dried. Minimize use of kerosene or such organic solvents to clean up water-based paints.

.4 Clean metal surfaces to be repainted by removing rust, dirt, oil, grease and foreign substances in accordance with MPI requirements. Remove such contaminates from surfaces, pockets and corners to be repainted by brushing with clean brushes, blowing with clean dry compressed air, or brushing/vacuum cleaning as required.

.5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before priming and between applications of remaining coats. Touch-up, spot prime, and apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.6 Do not apply paint until prepared surfaces have been accepted by Consultant.

.7 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

3.4 PROTECTION

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Consultant.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Remove light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Store items and re-install after painting is completed.

.5 Move and cover exterior furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.6 As painting operations progress, place "WET PAINT" signs in pedestrian and vehicle traffic areas.

3.5 APPLICATION

.1 Apply paint by brush roller, air sprayer, or airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Consultant.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray Application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.

.4 Brush out immediately runs and sags.

.5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access and when specifically authorized by Consultant.

.5 Apply coats of paint as continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Co-ordinate painting of exterior mechanical piping with Section 23 05 53.01 - Mechanical Identification.

.2 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, duct work and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.

.3 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.4 Do not paint over nameplates.

.5 Paint fire protection piping red.

.6 Paint steel electrical light standards. Do not paint outdoor transformers and substation equipment.

3.7 FIELD QUALITY CONTROL

.1 Inspection:

.1 Field inspection of exterior painting operations to be carried out be independent inspection firm as designated by Consultant.

.2 Advise inspection agency when each surface and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.3 Co-operate with inspection firm and provide access to areas of work.

.2 Manufacturer's Field Services:

.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.8 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.1 Remove paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

3.9 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Material and installation of site applied paint finishes to new interior surfaces, including site painting of shop primed surfaces.

.2 Sustainable requirements for construction and verification

.2 Related Requirements

.1 Section 09 96 00 – High Build Coating

.2 Section 09 91 23 – Exterior Painting

1.2 REFERENCES STANDARDS

.1 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33

.2 Environmental Protection Agency (EPA)

.1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 1995, (for Surface Coatings).

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual, current issue.

.2 Standard GPS-1-12, MPI Green Performance Standard.

.3 Standard GPS-2-12, MPI Green Performance Standard.

.5 National Fire Code of Canada - 1995

.6 Society for Protective Coatings (SSPC)

.1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

.7 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113-A2016, Architectural Coatings.

.8 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Contractor: minimum of five (5) years proven satisfactory experience. Provide list of last three (3) comparable jobs including, job name and location, specifying authority, and project manager.

.2 Journeymen: qualified journeymen who have "Tradesman Qualification Certificate of Proficiency" engaged in painting work.

.3 Apprentices: working under direct supervision of qualified trades person in accordance with trade regulations.

.2 Mock-Ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

.1 Provide 3000 mm x 3000 mm mock-up. Prepare and paint designated surface, area, room or item (in each colour scheme) to specified requirements, with specified paint or coating showing selected colours, gloss/sheen, textures.

.2 Mock-up will be used:

.1 To judge workmanship, substrate preparation, operation of equipment and material application and workmanship to MPI Architectural Painting Specification Manual standards.

.3 Locate where directed.

.4 Allow 24 hours for inspection of mock-up before proceeding with work.

.5 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Accepted mock-up may remain as part of finished work.

.3 Construction requirements: in accordance with Section 01 35 43 – Environmental Procedures.

1.4 SCHEDULING

.1 Submit work schedule for various stages of painting to Consultant for review. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Consultant for changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit product data and instructions for each paint and coating product to be used.

.2 Submit product data for the use and application of paint thinner.

.3 Submit electronic copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application and curing.

.3 Samples:

.1 Submit full range colour sample chips to indicate where colour availability is restricted.

.2 Submit duplicate 200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:

.3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.4 Test reports: submit certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.1 Lead, cadmium and chromium: presence of and amounts.

.2 Mercury: presence of and amounts.

.3 Organochlorines and PCBs: presence of and amounts.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions:

.1 Submit manufacturer's application instructions.

.7 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour numbers.

.4 MPI Environmentally Friendly classification system rating.

1.6 MAINTENANCE

.1 Extra Materials:

.1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.

.2 Quantity: provide one - four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Delivery, storage and protection: comply with Consultant requirements for delivery and storage of extra materials.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Pack, ship, handle and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.

.2 Acceptance at Site:

.1 Identify products and materials with labels indicating:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Storage and Protection:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store materials and supplies away from heat generating devices.

.3 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.

.5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.

.7 Remove paint materials from storage only in quantities required for same day use.

.8 Fire Safety Requirements:

.1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

.9 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for recycling and place in designated containers waste in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with Regional and Municipal, regulations.

.7 Ensure emptied containers are sealed and stored safely.

.8 Unused paint and coating materials must be disposed of at official hazardous material collections site.

.9 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for

disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

.10 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.11 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.12 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.13 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.14 Set aside and protect surplus and uncontaminated finish materials: Deliver to or arrange collection by employees, for verifiable re-use or re-manufacturing.

1.8 SITE CONDITIONS

.1 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless pre-approved written approval by Specifying body and product manufacturer, perform no painting when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is under 85% or when the dew point is more than 3 degrees C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.

.2 Perform painting work when maximum moisture content of the substrate is below:

.1 Allow new concrete and masonry to cure minimum of 28 days.

.2 15% for wood.

.3 12% for gypsum board.

.3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.2 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.3 Additional interior application requirements:

.1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Consultant such that painted surfaces will have dried and cured sufficiently before occupants are affected.

Part 2 Products

2.1 MATERIALS

.1 Materials and resources in accordance with Section 01 35 43 – Environmental Procedures.

.2 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.3 Provide paint materials for paint systems from single manufacturer.

.4 Only qualified products with E2 E3 "Environmentally Friendly" rating are acceptable for use on this project.

.5 Conform to latest MPI requirements for interior painting work including preparation and priming.

.6 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

.7 Provide paint products meeting MPI "Environmentally Friendly" E2 E3 ratings based on VOC (EPA Method 24) content levels.

.8 Use MPI listed materials having minimum E2 E3 rating where indoor air quality (odour) requirements exist.

.9 Paints, coatings, solvents, cleaners, lubricants, and other fluids:

.1 Water-based.

.2 biodegradable.

.3 Manufactured without compounds which contribute to ozone depletion in the upper atmosphere.

.4 Manufactured without compounds which contribute to smog in the lower atmosphere.

.5 Do not contain methylene chloride, chlorinated hydrocarbons, or toxic metal pigments.

.10 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

.11 Flash point: 61.0 degrees C or greater for water-borne surface coatings.

.12 Ensure manufacture and process of water-borne surface coatings does not release:

.1 Matter in undiluted production plant effluent generating 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to natural watercourse or sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to natural watercourse or a sewage treatment facility lacking secondary treatment.

.13 Water-borne paints and stains, and water borne varnishes to meet minimum "Environmentally Friendly" E2 rating.

2.2 COLOURS

.1 Colours: as indicated.

.2 Where specific products are available in restricted range of colours, selection based on limited range unless noted otherwise.

.3 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. Obtain written acceptance from Consultant for tinting of painting materials.

.2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.

.3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

.4 Thin paint for spraying in accordance with paint manufacturer's instructions.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 3 - Eggshell Finish	10 to 25	10 to 35
Gloss Level 5 - Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 - Traditional Gloss	70 to 85	
Gloss Level 7 - High Gloss Finish	More than 85	

.2 Gloss level ratings of painted surfaces as specified.

2.5 INTERIOR PAINTING SYSTEMS

.1 Concrete horizontal surfaces: floors and concrete ceilings:

.1 INT 3.1A – Latex G5.

.2 INT 3.1P – Epoxy High Build G6.

.2 Concrete masonry units:

.1 INT 4.2D – High performance architectural latex G3 finish.

.2 INT 4.2R – Epoxy High Build G6.

.3 Structural steel and metal fabrications: columns, beams, joists:

.1 INT 5.1R High Performance Arcitectural latex G5.

.4 Steel - high heat: (boilers, furnaces, heat exchangers, breeching, pipes, flues, stacks, etc., with temperature range as noted):

.1 INT 5.2A - Heat resistant enamel finish, maximum 205 degrees C.

.5 Galvanized metal: doors, frames, railings, misc. steel, pipes, overhead decking, and ducts.

.1 INT 5.3M - High performance architectural latex G5 finish.

.6 Wood Paneling and Casework: partitions, panels, shelving, millwork:

.1 INT 6.4M – W.B. Varnish, Clear acrylic G5.

.7 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material" and textured finishes:

.1 INT 9.2B - High performance architectural latex G3 finish.

.8 Acoustic panels and tiles:

.1 INT 9.3E High performance architectural latex G1 finish.

.9 Canvas and cotton coverings.

.1 INT 10.10 – Institutional low odour/VOC G5 finish.

2.6 SOURCE QUALITY CONTROL

.1 Perform following tests on each batch of consolidated post-consumer material before surface coating is reformulated and canned. Testing by laboratory or facility which has been accredited by Standards Council of Canada.

.1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.

.2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.

.3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

.1 High Build Coating to be inspected by MPI Accredited Paint Inspection Agency (inspector) acceptable to specifying authority and local Painting Contractor's Association. Painting contractor to notify Paint Inspection Agency minimum of one (1) week prior to commencement of work and provide copy of project repainting specification and Finish Schedule.Surfaces requiring repainting: inspected by both painting contractor and Paint Inspection Agency who will notify Consultant and Contractor in writing of defects or problems, prior to commencing repainting work, or after surface preparation if unseen substrate damage is discovered.

.2 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Consultant damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.3 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.4 Maximum moisture content as follows:

.1 Gypsum board: 12%.

.2 Concrete: 12%.

.3 Concrete Block: 12%.

.4 Wood: 15%.

3.4 PREPARATION

.1 Protection:

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Consultant.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.2 Surface Preparation:

.1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.

.2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.3 Place "WET PAINT" signs in occupied areas as painting operations progress.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by blowing with clean dry compressed air.

.6 Touch up of shop primers with primer as specified.

.7 Do not apply paint until prepared surfaces have been accepted by Consultant.

3.5 APPLICATION

.1 Method of application to conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in uniform layer using brush and/or roller type suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.

.4 Brush out immediately all runs and sags.

.5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.

.5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects and provide better adhesion of coats.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Coordinate painting of mechanical piping with Section 23 05 53.01 – Mechanical Identification

.2 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.

.3 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.4 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.5 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.6 Do not paint over nameplates.

.7 Keep sprinkler heads free of paint.

.8 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.9 Paint fire protection piping red.

.10 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.11 Paint natural gas piping yellow.

.12 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.13 Do not paint interior transformers and substation equipment.

3.7 SITE TOLERANCES

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.8 FIELD QUALITY CONTROL

.1 Interior painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and local Painting Contractor's Association. Painting contractor shall notify Paint Inspection Agency a minimum of one (1) week prior to commencement of work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.

.2 Interior surfaces requiring painting shall be inspected by Paint Inspection Agency who shall notify Consultant and General Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.

.3 Where "special" painting, coating or decorating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating manufacturer shall provide as part of this work, certification of surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Owner.

.4 Standard of Acceptance:

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

.5 Field inspection of painting operations to be carried out be independent inspection firm as designated by Consultant or Owner.

.6 Advise Consultant when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been reviewed.

.7 Cooperate with inspection firm and provide access to areas of work.

.8 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Consultant.

3.9 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

END OF SECTION

1. General

1.1 RELATED REQUIREMENTS

.1 Section 04 22 00 – Concrete Unit Masonry
.2 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM D638-14, Standard Test Method for Tensile Properties of Plastics.

.2 ASTM D1044-13, Standard Test Method for Resistance of Transmission Plastics to Surface Abrasion.

.3 ASTM E84-16, Standard Test Method for Surface Burning Characteristics of Building Materials.

.4 ASTM E96/E96M-16, Standard Test Method for Water Vapor Transmission of Materials.

Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.186-1996, High Performance Glazed Coating System, Interior.

.2 Underwriters' Laboratory of Canada

.1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

.1 Submit product data in accordance with Division 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit proof that product does not exceed flame spread 25 and smoke developed 50 in conformance with CAN/ULC-S102 and carries ULC or cUL rating.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Division 01. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for high build glazed coatings. Indicate VOC content.

.4 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures.

.5 Provide duplicate 300 x 300 mm samples of each colour and finish, coating applied to plywood.

1.4 FIELD MOCK-UPS

.1 Construct mock-ups in accordance with Division 01.

.2 Apply coating of each finish to 10 m^2 area of surface to be treated.

.3 Allow 24 hours for inspection of mock-up by Engineer before proceeding with coating work.

.4 Mock-ups are to be repeated as required by consultant to establish and act as the level of acceptance for finished work.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Ventilation.

.1 Provide ventilation continuously during and after coating application. Run system 24 hours per day during application; provide continuous ventilation for 7 days after completion of application.

.2 Ventilate enclosed spaces in accordance safety procedures to protect worker health and safety.

2. Products

2.1 MATERIALS

.1 Interior high build glazed coating materials: to CAN/CGSB-1.186, inorganic, non-thermosetting epoxy resin, pigmented with anti-microbial additive, DuroPlast 100 as manufactured by Duochem (1-604-521-0572) or accepted substitutions:

.1 Colours: Up to three colours to be selected by Consultant from manufacturer's standard range.

.2 Fire Hazard Classification:

.1 Maximum Flame Spread 25

.2 Fuel Contributed 25

.3 Smoke Density 25

.3 Adhesion: 225 N Dry

.4 Impact Resistance: 11 J

.5 % solids by weight: 90

.7 Scrubbability: 10% gloss loss over 5,000 cycles

.8 Specular Gloss: 80 units at 60°

.9 Permeability: to ASTM E96/E96M, 0.3 perms max.

.10 Abrasion Resistance: to ASTM D1044 (using Taber Abrasion Test CS-17), 0.099 gm weight loss.

.11 Elongation: to ASTM D638, minimum 70%.

.12 Tensile Strength: to ASTM D638, 3.5 MPa minimum.

.13 Chemical Resistance: resistant to sulphuric acid."

.2 All material must have been tested in conformance with CAN/ULC-S102 and have ULC certification. UL and ATSM E84 testing alone will not be accepted.

.3 Block Filler: cementitious type, to fill all voids visible with magnifying glass.

2.2 MIXES

.1 Mix coatings according to manufacturer's instructions.

3. Execution

3.1 FIELD QUALITY CONTROL

.1 Inspections:

.1 Inspections and testing of High Build Coating (HBC) to be carried out by a third party inspection agency, Master Painter's Institute (MPI) Accredited Paint Inspection Agency, (inspector) acceptable to specifying authority and local Painting Contractor's Association.

.2 Contractor will pay for three (3) HBC inspections before first application to review moisture levels, after primer application to review specification requirements, and after second HBC application. Inspection costs to include travel, living allowance, site inspections, testing and reports.

.3 Contractor to schedule Paint Inspection Agency minimum of one (1) week prior to commencement of work. The scheduled work is not to commence before receiving the report and ensuring all criteria are met.

.2 Surfaces requiring re-application: inspected by both painting contractor and Paint Inspection Agency who will notify Consultant and Contractor in writing of defects or problems, prior to commencing repainting work, or after surface preparation if unseen substrate damage is discovered.

.2 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Consultant damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.1 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.2 Maximum moisture content as follows:

.1 Concrete: 12%.

.2 Concrete Block: 12%.

.4 Owner review will determine level of acceptance from a mockup installation which may be used as part of the final application.

3.2 PREPARATION

.1 Prepare surfaces in accordance with CAN/CGSB-1.186 and coating material manufacturer's instructions.

.2 Mask surrounding surfaces to provide neat, clean juncture lines.

.3 Protect adjacent surfaces and equipment from damage by overspray.

.4 Doors and frames to be cleaned and prepared to provide 0.5 mil anchor profile using SP2 or SP3 method. An epoxy primer may be used if approved and warranted by the high build coating manufacturer.

3.3 WALL APPLICATION

.1 Apply coating to produce smooth surface, uniform in semi-gloss sheen, colour and finish, free from marks, dirt, particles, runs, crawls, curling, pinholes, air pockets and other defects and to achieve smoothness index in accordance with CAN/CGSB-1.186.

.2 Apply filler coats to porous surfaces by brush or spray in minimum two coats to achieve

minimum dry film thickness of 12 mils (250 microns). No pinholing to be evident.

.3 Apply two glaze coats to minimum total dry film thickness of 12 (250 microns) mils.

.4 Verify thickness using appropriate gauges to the satisfaction of the Consultant.

.5 Doors and frames to be spray finished after all work is complete."

3.4 CLEANING

.1 Clean surfaces to coating manufacturer's printed instructions and following procedures identified in Division 01 and Section 09 91 00.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 05 19 – Common Work Results of Metalwork Finishing

.2 Section 09 91 13 – Exterior Painting

1.2 REFERENCES STANDARDS

.1 ASTM Internatiomal

.1 ASTM A780/A780M-09(2015), Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

.2 ASTM D6386-16a, Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.

.3 ASTM D7803-12, Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating.

.2 The Master Painters Institute (MPI)

.1 Exterior Structural Steel and Metal Fabrications, current edition.

.1 EXT 5.1D, Alkyd.

.2 EXT 5.1G, Polyurethane, Pigmented (over epoxy zinc rich primer and high build epoxy).

.3 Environmental Choice Program (ECP)

.1 CCD-047-98(R2005), Architectural Surface Coatings.

.2 CCD-048-98(R2006), Surface Coatings - Recycled Water-borne.

.4 Federal Standard (FS)

.1 FED-STD-595B-17, Colours Used in Government Procurement.

.5 The Society for Protective Coatings (SSPC)

.1 SSPC-SP 1-82(R2004), Solvent Cleaning.

.2 SSPC-SP 2-82(R2004), Hand Tool Cleaning.

.3 SSPC-SP 3-82(R2004), Power Tool Cleaning.

.4 SSPC-SP 7/NACE No. 4-07, Brush Off Blast Cleaning.

.5 SSPC-Vis-1-89, Visual Standard for Abrasive Blast Cleaned Steel (Standard Reference Photographs) Editorial Changes September 1, 2000 (Steel Structures Painting Manual, Chapter 2 - Surface Preparation Specs.).

.6 SSPC-PA 2-04, Measurement of Dry Coat Thickness with Magnetic Gauges.

.7 SSPC Good Painting Practices, Volume 1, 4th Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for painting exterior metal surfaces and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit electronic copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.

.3 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.5 Test Reports:

.1 Submit test reports showing compliance with specified performance characteristics and physical properties and in accordance with Section 01 45 00 - Quality Control.

.6 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.4 QUALITY ASSURANCE

.1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Develop Construction Waste Management Plan related to Work of this Section.

Part 2 Products

2.1 MATERIALS

.1 Paint:

.1 Primer: MPI EXT 5.1C, primer, marine for steel.

.1 Primer for second coat: tinted sufficiently off finish colour of first coat to show where second coat is applied.

.2 Tinting material: compatible with primer and not detrimental to its service life.

.2 Enamel: MPI EXT 5.1G, enamel, alkyd, marine, exterior; first coat black, colour No. 501-201; second coat black, colour No. 512-201. Colours to match FS-595B. If majority of paint application is to be by brushing, use paint to MPI EXT 5.1D.

.1 Table.

Colour	Coat	Colour Number
Grey	First	501-205
	Second	501-203
Grey	First	501-203
	Second	501-201
Green	First	503-209
	Second	503-208
Green	First	503-221
	Second	503-201
Brown	First	504-102 semi-gloss
	Second	504-101 semi-gloss
Blue	First	502-202 semi-gloss
	Second	502-101 semi-gloss
Black	First	501-201
	Second	512-201

.3 Sand for sandblasting: to SSPC (Steel Structures Painting Council).

Part 3 Execution

3.1 PREPARATION

.1 Remove existing loose and rusted paint from exterior metal surfaces.

.2 New metal surfaces:

.1 Clean surfaces of new metal to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and foreign substances in accordance with the following:

.1 Commercial blast cleaning: to SSPC-SP 6.

.2 Solvent cleaning: to SSPC-SP 1.

.3 Hand tool cleaning: to SSPC-SP 2.

.4 Power tool cleaning: to SSPC-SP 3.

.5 Brush-off blast cleaning: to SSPC-SP 7.

.3 Metal surfaces to be repainted:

.1 Clean surfaces by removing loose, cracked, brittle or non-adherent paint, rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with following.

.1 Commercial blast cleaning: to SSPC-SP 6.

.2 Brush-off blast cleaning: to SSPC-SP 7.

.3 Solvent cleaning: to SSPC-SP 1.

.4 Hand tool cleaning: to SSPC-SP 2.

.5 Power tool cleaning: to SSPC-SP 3.

.2 Commercial blast clean rusted and bare metal surfaces where existing paint system has failed.

.3 Brush-off blast clean remaining metal surfaces to be painted.

.4 Scrape edges of old paint back to sound material where remaining paint is thick and sound, feather exposed edges.

.4 Compressed air to be free of water and oil before reaching nozzle.

.5 Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes, by blowing with clean dry compressed air, or by vacuum cleaning.

.6 Apply paint after prepared surfaces have been accepted by Consultant.

.7 Prior to starting paint application provide degree of cleanliness of surfaces to SSPC-Vis1.

.1 Apply primer, paint, or pretreatment after surface has been cleaned and before deterioration of surface occurs.

.2 Clean surfaces again if rusting occurs after completion of surface preparation.

.8 Mixing paint:

.1 Do not dilute or thin paint for brush application.

.2 Mix ingredients in container before and during use and ensure breaking up of lumps, complete dispersion of settled pigment, and uniform composition.

.3 Do not mix or keep paint in suspension by means of air bubbling through paint.

.4 Thin paint for spraying according to manufacturer's written instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Consultant.

.9 Number of paint coats:

.1 New metal surfaces.

.1 Shop: 2 primer coats to minimum dry film thickness of 35 microns per coat.

.2 Field: 2 alkyd enamel coats to minimum dry film thickness of 25 microns per coat.

3.2 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Apply paint by spraying, brushing, or combination of both. Use sheepskins or daubers when no other method is practical in places of difficult access.

.3 Use dipping or roller coating method of application when specifically authorized by Consultant in writing.

.4 Where surface to be painted is not under cover, do not apply paint when:

.1 Air temperature is below 5 degrees C or when temperature is expected to drop to 0 degrees C before paint has dried.

.2 Temperature of surface is over 30 degrees C unless paint is specifically formulated for application at high temperatures.

.3 Fog or mist occur at site; it is raining or snowing; there is danger of rain or snow; relative humidity is above 85%.

.4 Surface to be painted is wet, damp or frosted.

.5 Previous coat is not dry.

.5 Supply cover when paint must be applied in damp or cold weather. Supply, shelter, or heat surface and surrounding air to comply with temperature and humidity conditions specified. Protect until paint is dry or until weather conditions are suitable.

.6 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

.7 Apply each coat of paint as continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.8 Brush application:

.1 Work paint into cracks, crevices and corners and paint surfaces not accessible to brushes by spray, daubers or sheepskins.

.2 Brush out runs and sags.

.3 Remove runs, sags and brush marks from finished work and repaint.

.9 Spray application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Provide traps or separators to remove oil and water from compressed air and drain periodically during operations.

.3 Keep paint ingredients properly mixed in spray pots or containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.4 Apply paint in uniform layer, with overlapping at edges of spray pattern.

.5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray. In areas not accessible to spray gun, use brushes, daubers or sheepskins.

.6 Remove runs, sags and brush marks from finished work and repaint.

.10 Shop painting:

.1 Do shop painting after fabrication and before damage to surface occurs from weather or other exposure.

.2 Spray paint contact surfaces of field assembled, bolted, friction type joints with primer coat only. Do not brush primer after spraying.

.3 Do not paint metal surfaces which are to be embedded in concrete.

.4 Paint metal surfaces to be in contact with wood with either full paint coats specified or three (3) shop coats of specified primer.

.5 Do not paint metal within 50 mm of edge to be welded. Give unprotected steel one coat of boiled linseed oil or other accepted primer after shop fabrication is completed.

.6 Remove weld spatter before painting.

.7 Protect machine finished or similar surfaces that are not to be painted but that do require protection, with coating of rust inhibitive petroleum, molybdenum disulphide, or other coating.

.8 Copy previous erection marks and weight marks on areas that have been shop painted.

.11 Field painting:

.1 Paint steel structures as soon as practical after erection.

.2 Touch up metal which has been shop coated with same type of paint and to same thickness as shop coat. This touch-up to include cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas.

.3 Field paint surfaces (other than joint contact surfaces) which are accessible before erection but which are not to be accessible after erection.

.4 Apply final coat of paint after concrete work is completed. If concreting or other operations damage paint, clean and repaint damaged area. Remove concrete spatter and droppings before paint is applied.

.5 Where painting does not meet with requirements of specifications, remove defective paint, thoroughly clean affected surfaces and repaint in accordance with these specifications.

.12 Handling painted metal:

.1 Handle painted metal after paint has dried, or when necessary for handling for painting or stacking for drying.

.2 Scrape off and touch up paint which is damaged in handling, with same number of coats and kinds of paint as were previously applied to metal.

3.3 FIELD QUALITY CONTROL

.1 Site Tests, Inspections:

.1 Upon completion of the painting procedures test for dry film reading and evaluate the results as per SSPC-PA 2.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

3.5 PROTECTION

.1 Protect painted surfaces from damage during construction.

.2 Protection of surfaces:

.1 Protect surfaces not to receive paint.

.2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats of paint. Remove contaminants from surface and apply paint immediately.

.3 Protect cleaned and freshly painted surfaces from dust to acceptance of Consultant.

.3 Repair damage to adjacent materials caused by painting exterior metal surface application installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 09 96 00 – High Build Coating

1.2 REFERENCE STANDARDS

.1 Aluminum Association (AA)

.1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.

.2 ASTM International

.1 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A653/A653M-15, Standard Specification for Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

.3 ASTM B32-16, Standard Specification for Solder Metal.

.4 ASTM B456-11e1, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.3 CSA Group

.1 CSA W47.2-11(R2015), Certification of Companies for Fusion Welding of Aluminum.

.2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.3 CSA W59.2-M1991(R2013), Welded Aluminum Construction.

.4 Canadian Sheet Steel Building Institute (CSSBI)

.1 CSSBI SSF 6-2012, Sheet Steel Facts #6, Metallic Coated Sheet Steel for Structural Building Products.

.5 Green Seal (GS)

.1 GS-11-2011e2, Standard for Paints and Coatings.

.2 GS-36-2013e2.1, Adhesives for Commercial Use.

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.7 South Coast Air Quality Management District (SCAQMD)

.1 SCAQMD Rule 1113-2016, Architectural Coatings.

.2 SCAQMD Rule 1168-2005, Adhesive and Sealant Applications.

.8 Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

.1 MPI #76, Quick Dry Alkyd Metal Primer.

.2 MPI #96, Quick Dry Enamel Gloss.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for signage and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.

.2 Submit catalogue sheets with templates to scale.

.3 Indicate materials, thicknesses, sizes, finishes, colours, construction details, removable and interchangeable components, mounting methods, schedule of signs.

.4 Submit drawn-to-scale details for individually fabricated lettering indicating word and letter spacing.

.4 Samples:

.1 Submit representative sample of each type sign, sign image and mounting method including, but not limited to: graphics, cast letters, and wall plates fixed mounting installation method.

.5 Sustainable Design Submittals:

.1 Sustainability: in accordance with Section 01 35 43 – Environmental Procedures.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of pre-consumer and post-consumer content, and total cost of materials for project.

.4 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants, and paints and coatings used in building, showing compliance with VOC and chemical component limits or restriction requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

1.5 QUALITY ASSURANCE

.1 Welding Certification in accordance with CSA W47.2.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and 01 61 00- Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Aluminum flat cut: to designation AA 6063-T5.

.2 Prefinished sheet aluminum: plain utility sheet with manufacturer applied vinyl finish.

.3 Stainless steel: brushed finish.

.4 Acrylic sheet: polymethylmethacrylate (PMMA) cast sheet suitable for intended use in sign fabrication, colours to be from manufacturer’s standard range.

.5 Engraving sheet: lamicoid 3.2 mm thick plastic sheet, black with white text.

.6 Electrical components: CSA approved as indicated.

.7 Self-stick foam tape: 352.4 kg/m3density polyurethane open-cell foam tape for sign purposes, with synthetic self-stick adhesive on both sides.

.1 Width: to suit sign sizes.

.8 Adhesives, paints, sealants and solvents for acrylic sheet: type recommended by sheet manufacturer for applicable condition.

.1 Maximum VOC limit compliant to GS-36 Standard and SCAQMD Rule 1168.

.9 Acrylic top-coat: clear, non-yellowing, exterior grade, satin finish, acrylic polyester resin protective coating, compatible with acrylic surface of type recommended by sheet manufacturer.

.1 Maximum VOC limit compliant to GS-11 Standard and SCAQMD Rule 1113.

2.2 SIGN GRAPHICS

.1 Sign graphics: well defined, arranged for balanced appearance, and properly word and letter spaced.

.2 Cut and spray process: mask surfaces, accurately cut-out image, spray apply uniform coating to obtain opaque finish.

.3 Engraving: apply sign letters and numerals using pantograph mechanical engraving machine to obtain incised paint-filled letters.

.4 Self-stick vinyl film: individual letters and numerals and symbols die cut from 0.1mm thick white, black, and red integral colour, matte finish, exterior grade PVC film, with self-stick adhesive backing.

2.3 FLAT CUT LETTERS

.1 Cut letters and numerals from aluminum sheet.

.2 Helvetica typeface, upper case: sizes and thicknesses as indicated.

.1 Make corners square cut.

.3 Finish, after fabrication aluminum with clear anodizing.

2.4 WALL PLATES

.1 Metal wall plates:

.1 Fabricate from sheet aluminum sign plates, minimum 3.2 thick, with anodized finish.

.1 Sizes as indicated.

.2 Sign graphics: apply by self-stick vinyl letters and graphics.

.2 Fixed mounting:

.1 Prepare wall plates for fixing by self-stick foam tape unless noted otherwise.

.2 Include back-up plates for fixing to uneven surfaces where required.

2.5 DOOR PLATES

.1 Fabricate sign faces of extruded acrylic sheet, Consultant to select colour from manufacturer’s standard range.

.1 Size: as indicated.

.2 Sign graphics: apply by cut and spray.

.3 Fixed mounting: use self-stick foam tape.

.4 Pictographs: cut-out figures without backgrounds.

2.6 NUMBER PLATES

.1 Fabricate number plates for doors of engraving sheet for lamacoids.

.1 Size: as shown on drawings.

.2 Engrave 30 mm high, single line numerals incised to expose contrasting coloured core.

2.7 HIGH BUILD COATING

.1 Provide high build coating in accordance with Section 09 96 00 – High Build Coating.

.2 Prepare stencils for lettering and numerals as provided in accepted shop drawings.

2.8 FABRICATION

.1 Fabricate signs in accordance with details, specifications and shop drawings.

.2 Build units square, true, accurate to size, free from visual or performance defects.

.3 Fit and securely join sections to obtain tight, closed joints.

.4 Allow for thermal movement without distortion of components.

.5 Exposed fasteners as noted permitted where indicated with tamperproof fasteners.

.6 Polish exposed edges of metal to smooth, slightly convex profile.

.7 Do steel welding to CSA W59.

.1 Finish exposed welds flush and smooth.

.8 Apply bituminous paint to aluminum in contact with dissimilar metals, concrete or masonry.

.9 Manufacturer's nameplates on sign surface permitted in non-visible locations in completed work.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for signage installation in accordance with manufacturer's written instructions.

.1 Visually review substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Manufacturer's Instructions: compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

.2 Erect and secure signs plumb and level at elevations indicated Consultant.

.3 Comply with sign manufacturer's installation instructions and accepted shop drawings.

.4 Mechanical attachment:

.1 To wood: use tamperproof screws.

.2 Mechanical fasteners on exterior: non-staining, non-ferrous type.

.3 Fabricate special fasteners as required for installation conditions.

.4 Mechanical fasteners and methods of attachment subject to Consultant's acceptance.

.5 Adhesive attachment:

.1 Use self-stick adhesive foam tape to manufacturer's instructions to fix sign and prevent "rocking".

.2 Keep tape maximum 1.6 mm from edges.

.3 Use adhesive recommended by manufacturer for flat cut anodized aluminum numerals above door frames.

.6 High build coating:

.1 Apply high build coating lettering and numerals after high build coating is accepted without deficiencies in rooms and doors as noted by Owner and Consultant.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.1 Leave signs clean.

.2 Remove debris from interior of sign boxes.

.3 Touch up damaged finishes.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-In-Place Concrete

1.2 PRICE AND PAYMENT PROCEDURES

.1 Measurement and Payment:

.1 Measurement for supply and installation of signboards and, sign supports will be based on each complete sign installation.

1.3 REFERENCES STANDARDS

.1 American Association of State Highway and Transportation Officials (AASHTO)

.1 Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, (5th Edition).

.2 ASTM International

.1 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A276/A276M-17 Standard Specification for Stainless Steel Bars and Shapes.

.3 ASTM B209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.4 ASTM B 210M-12, Standard Specification for Aluminum-Alloy Drawn Seamless Tubes (Metric).

.5 ASTM B 211M-12e1, Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire (Metric).

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 62-GP-11M, Standard for Marking Material, Retroreflective, Enclosed Lens, Adhesive Backing.

.4 CSA International

.1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA O80 Series-15, Wood Preservation.

.3 CSA O121-17, Douglas Fir Plywood.

.4 CSA W47.2-11 (R2015), Certification of Companies for Fusion Welding of Aluminum.

.5 CAN/CSA-Z809-08, Sustainable Forest Management.

.5 Green Seal Environmental Standards (GS)

.1 GS-11-11, Paints and Coatings.

.6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113-A2016, Architectural Coatings.

.7 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for traffic signage, including product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that construction wastes were recycled or salvaged.

.2 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with EPA 832/R-92-005.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 43 – Environmental Procedures.

.5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 DESIGN CRITERIA

.1 Structural deflections and vibration in accordance with American Association of State Highway and Transportation Officials (AASHTO), "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals".

2.2 MATERIALS

.1 Flexible Sign supports:

- .1 Base plates for concrete mounted signs: 230 mm square (7ga.) standard steel base plate.
- .2 Carbon steel torsion spring with zinc coated bolts.
- .3 Corrosion resistant barrier with powder coat finish.
- .4 Posts: to CSA G40.21, 1.8 m long, 40 mm diameter post. Hot dipped galvanized: to ASTM A 123/A 123M.
- .5 Fasteners: bolts, nuts, washers and other hardware for roadside signs to be galvanized steel.

.2 Sign supports:

- .1 Base plates for natural ground mounted signs: to ASTM B209M.
- .2 Steel posts: to CSA G40.21, 3.2 m long, flanged "U" shaped in cross section, measuring 65 mm wide x 30 mm deep. Metal thickness: 4.5 mm. Hot dipped galvanized: to ASTM A123/A123M.Signboards:

.3 Aluminum sheet: to ASTM B 209M, precut to required dimensions.

- .1 Thickness for signboards up to 750 mm wide: 1.6 mm minimum.

.4 Connecting straps and brackets: to ASTM B 209M.

.5 Aluminum materials: to ASTM B 209M.

- .1 Reflective sheeting and tape: to CAN/CGSB 62-GP-11M. Adhesive, class RA2 reflectivity. Request sign colour information for production of shop drawings.
- .2 Clear varnish protective coat: MPI-EXT 6.4H.

2.3 FABRICATION

.1 Signboards:

- .1 Aluminum blanks:
  - .1 Degrease, etch and bonderize with chemical conversion coating.
  - .2 Clean surfaces with xylene thinner. Dry.
  - .3 For aluminum signboards that are to be painted before installation, spray and bake face of signboards with two coats of enamel in accordance with MPI-EXT 5.4A.

.2 Reflective background sheeting and lettering:

- .1 Cut and apply in accordance with manufacturer's instructions.

.2 Apply adhesive coated material with heat lamp vacuum applicator or by squeeze roll application method. Apply pressure sensitive material with roller or squeegee.

.3 Edge wrap sheeting on each extrusion prior to bolting extrusions. Match pieces of sheeting from different rolls for each signboard to ensure uniform appearance and brilliance by day and night.

.4 Reflective signboard faces may be prepared using silk screen transparent ink.

.5 Non-reflective lettering and symbols: cut from vinyl film as specified in CGSB 62-GP-9M.

.6 Clean signboards completely and apply transparent tape over top edge and extending 25 mm minimum down back and front of signboard.

.7 Protect finished signboard faces with one coat of clear varnish.

.3 Sign identification:

.1 Apply sign number and date of installation with 25 mm high stencil painted black letters on lower left back face of each signboard.

Part 3 Execution

3.1 INSTALLATION

.1 Sign support:

.1 Erect supports as indicated. Permissible tolerance: 30 mm maximum departure from vertical for direct buried supports. Where separate concrete footings have been placed, erect posts with base plates resting on levelling nuts and restrained with nuts and washers. Permissible tolerance: 12 mm maximum departure from vertical.

.2 Coat underside of base plate with corrosion protective paint before installation. Connect shoe base to shaft with inside and outside fillet welds.

.3 Close open aluminum tubes and posts with aluminum cap. Cut oblong holes in shoe bases to drain condensation. Install aluminum bolt cover on each base plate restraining nut.

.4 Erect posts plumb and square to details as indicated.

.5 Single channel steel posts:

.1 Drive to required depth without damage to posts.

.2 If rock or concrete is encountered, drill hole to required depth and set post in sand.

.3 In finished concrete surfaces, backfill with concrete or grout. Protect from adverse conditions until cured.

3.2 CORRECTING DEFECTS

.1 Correct defects, identified by Consultant, in sign message, consistency of reflectivity, colour or illumination. Correct angle of signboard for optimum performance during night conditions to acceptance of Consultant.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by traffic signage installation and salvage operations.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 10 28 10 – Washroom Accessories

1.2 REFERENCE STANDARDS

.1 ASTM International

- .1 ASTM A653/A653M-15w1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM A924/A924M-17, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-1.36-97, General Purpose Interior Alkyd Varnish.
- .2 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- .3 CAN/CGSB-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
- .4 CAN/CGSB-1.104-91, Semigloss Alkyd Air Drying and Baking Enamel.

.3 Green Seal Environmental Standards (GS)

- .1 GS-11-11, Standard for Paints and Coatings.
- .2 GS-36-13e2.1, Standard for Adhesives for Commercial Use.

.4 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

- .1 SCAQMD Rule 1113-A2011, Architectural Coatings.
- .2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for toilet and urinal partitions and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit electronic copies of WHMIS MSDS in accordance with Section 01 35 43- Environmental Procedures. Indicate VOC's:
  - .1 For caulking materials during application and curing.
  - .2 For adhesives.
  - .3 For laminates.

.3 Shop Drawings:

- .1 Submit installation drawings.

.2 Indicate fabrication details, plans, elevations, hardware, finishes, and installation details.

.4 Samples:

.1 Submit duplicate 300 x 300 mm samples of panel showing finishes, edge and corner construction and core construction.

.2 Submit duplicate representative samples of each hardware item, including brackets, fastenings and trim.

.5 Sustainable Design Submittals:

.1 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-industrial content.

.2 Regional Materials: submit evidence that project incorporates regional materials and products.

.3 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants, paints and coatings used in building, comply with VOC and chemical component limits or restriction requirements.

.4 Wood Certification: submit manufacturer's Chain-of-Custody Certificate number for CAN/CSA-Z809 or FSC or SFI certified wood.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, off ground, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect toilet and urinal compartments from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

.5 Packaging Waste Management: remove for reuse and return of packaging materials, padding, and pallets, as specified in[Construction Waste Management Plan in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Toilet and urinal compartments.

.2 Sheet steel: to ASTM A653/A653M with Commercial Quality ASTM A924/A924M.

.3 Minimum steel core thickness:

.1 Doors and panels: 0.80 mm.

.2 Pilaster: 1.0 mm.

.3 Reinforcement: 3.0 mm.

.4 Head rails: clear anodized, extruded aluminum, anti-grip design tubular steel, cast end preformed socket brackets.

.5 Stainless steel sheet metal: to ASTM A167, Type 304.

.6 Pilaster shoe: 0.80 mm thick stainless steel, 100 mm high.

.7 Attachment: galvanized tamperproof type screws and bolts.

2.2 COMPONENTS

.1 Hinges:

.1 Heavy duty, non-lubricating, nylon bushings.

.2 Material/finish: stainless steel casting.

.3 Swing: inward and outward, refer to plans.

.4 Return movement: gravity, non-rising.

.5 Adjustable to hold door open at any angle up to 90 degrees.

.6 Emergency access feature.

.2 Latch set: combination latch, door-stop, keeper and bumper, with emergency access feature, chrome plated non-ferrous.

.3 Wall and connecting brackets: stainless steel extrusion or casting.

.4 Coat hook: combination hook and rubber door bumper, chrome-plated non-ferrous.

.5 Door Pull: 150 mm door pull, chrome-plated

2.3 FABRICATION

.1 Doors and panels: 25 mm thick, two steel sheets faces bonded to honeycomb core 700 mm wide x 2200 mm high panel.

.2 Pilasters: 25 mm thick, constructed same as door, to suit space between walls 2200 mm high.

2.4 FINISHES

.1 Clean, degrease and neutralize steel components with phosphate or chromate treatment.

.2 Spray apply primer to CAN/CGSB-1.81, 1 coat.

.1 Primer: VOC limit 250 g/L maximum to SCAQMD Rule 1113 and GS-11.

.3 Spray apply finish enamel to CAN/CGSB-1.104, type 2, semi-gloss, 2 coats, minimum 0.025 mm thick.

.1 Enamel Finish: VOC limit 50 g/L maximum to SCAQMD Rule 1113 and GS-11.

.4 Finish: doors and pilaster/panels same colour.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for shower and dressing compartment installation in accordance with manufacturer's written instructions.

.1 Visually review substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 PREPARATION

.1 Ensure supplementary anchorage, is in place.

3.4 ERECTION

.1 Do work in accordance with manufacturer's written instructions.

.2 Partition erection.

.1 Install partitions secure, plumb and square.

.2 Leave 12 mm space between wall and panel or end pilaster.

.3 Anchor mounting brackets to masonry-concrete surfaces using screws and shields, to blocking/backing must be provided hollow walls to steel supports with bolts in threaded holes.

.4 Attach panel and pilaster to mounting brackets with self-drilling sheet metal screws.

.5 Provide for adjustment of floor braced pilasters variations with screw jack through steel saddles made integral with pilaster.

.1 Make adjustment and attachment of pilasters through 16 mm steel channel fastened to floor.

.1 Conceal floor fixings with stainless steel shoes.

.6 Equip doors with hinges, latch set, and each stall with coat hook with combination bumper mounted on door, mounting heights 1,400 mm above finished floor.

.1 Adjust and align hardware for easy, proper function. Set door open position at full open.

.7 Equip out swinging doors with door pulls on inside of door, mounting heights 1,200 mm above finished floor.

.3 Floor supported partition erection:

.1 Secure pilasters to floor with pilaster supports anchored with 50 mm minimum penetration in structural floor.

.2 Level, plumb and tighten installation with levelling device.

.3 Secure pilaster shoes in position.

.4 Set tops of doors level with tops of pilasters when doors are in closed position.

3.5 ADJUSTING

.1 Adjust doors and locks for optimum, smooth operating condition.

.2 Lubricate hardware and other moving parts.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.1 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

.2 Clean aluminum with damp rag and approved non-abrasive cleaner.

.3 Clean and polish hardware and stainless components.

.3 Waste Management: separate waste materials for in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by shower and dressing compartment installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 08 99 - Rough Carpentry for Minor Works.

1.2 REFERENCES STANDARDS

.1 ASTM International

.1 ASTM A240/A240M-16a, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.2 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM A924/A924M-17, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.4 ASTM B456-17, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.

.3 CSA International

.1 CAN/CSA-B651-12 (R2017), Accessible Design for the Built Environment.

.2 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped by Contractor.

.2 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

.4 Sustainable Standards Certification:

.1 Low-Emitting Materials:

.1 Submit listing of laminate adhesives used in building, verifying that they contain no urea-formaldehyde.

.2 Submit VOC of laminate adhesives used in building, verifying that they contain no urea-formaldehyde.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect washroom accessories from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Sheet steel: to ASTM A653/A653M with ZF001 designation zinc coating.

.2 Stainless steel sheet metal: to ASTM A240/A240M, with brushed finish.

.3 Stainless steel tubing: as per components listed below.

.4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

.5 Substitutions may be provided for review by Consultants of all components listed in this Section. Components by the same manufacturer as possible.

2.2 COMPONENTS

.1 Toilet tissue dispenser: Frost mulit-roll with reserve roll, approximately 330 mm high x 178 mm wide x 203 mm deep. Keyed tumbler lock and will dispense second roll once first roll is empty. 304 stainless steel, No. 4 finish.

.2 Semi-recessed waste receptacle: Frost 330 semi-recessed wall unit, approximately 438 mm wide x 762 mm high x 203 mm deep. Recessed wall of 0.7 mm stainless steel. Removable stainless steel waste receptacle.

.3 Lockable Semi-recessed waste receptacle: Frost 340B semi-recessed wall unit, approximately 349 mm wide x 1320 mm high x 155 mm deep. Interior of 0.7 mm galvanized steel, exterior of 0.7 mm stainless steel. Removable galvanized steel waste receptacle, lockable access door with continuous full height stainless steel hinge.

.4 Soap dispenser: 125 mm wide x 125 mm high x 255mm deep, manual foam soap dispenser. Based on Frost 702.

.5 Sanitary Napkin Disposal: Stainless steel, type 304 finish. Based on Frost 622.

.6 Hand dryer: 200 mm wide x 370 mm high x 150 mm deep compact, high speed eco-friendly. Based on Frost 1198.

.7 Shower Rod Curtain Accessories Size: 1780 mm x 1830 mm, 8 gauge thick, 100% non-toxic PEVA bathtub curtain, cold crack and mildew resistant, based on Frost 1144-503; chrome shower rod 1828 mm x 30 mm diameter, based on Frost 1145-72SS; hold back hook and chain, based on Frost 1144-500; stainless steel curtain hooks, based on Frost 1144-501L.

.8 Flip Down Shower Seat: Phenolic Top, all stainless tubular steel supports, Bobrick B-5191.

.9 Grab Bar, Horizontally or Vertically Mounted Grab Bar: 610 mm long, 30 mm diameter x 12 mm wall tubing of type 304 stainless steel having #4 finish, screw attachment, concealed flange, flanges welded to tubular bar, provided with steel back plates and all accessories, peened finish at area of hand grip. Based on Frost 1001.

.10 Grab Bar, Horizontally Mounted Grab Bar: 30 mm diameter x 12 mm wall tubing of type 304 stainless steel having #4 finish, screw attachment, concealed flange, flanges welded to tubular bar, provided with steel back plates and all accessories, peened finish at area of hand grip. Based on Frost 1001.

.11 Angled Grab Bar: 610 horizontal and 610 angled portion @ 60° to horizontal, 30 mm diameter x 12 mm wall tubing of type 304 stainless steel having #4 finish, screw attachment, concealed flange, flanges welded to tubular bar, provided with steel back plates and all accessories, peened finish at area of hand grip. Based on Frost 1002D.

.12 B-76717 Classic Series Single Robe Hook: satin stainless steel finish. Flange is 50 mm x 50mm, projects 40 mm from wall. Provide 2 per shower stall and where also indicated on the drawings.

.13 Framed Mirror: 610 mm x 915 mm standard vandal resistant mirror with one piece stainless steel channel frame with shock resistant primary back. Provide flush wall mount and fixed tilt with full galvanized back panel. Based on Frost 941.

.14 Towel bar: 90 mm x 460 mm x 75 mm stainless steel, screw concealed mounting system. Based on Frost 1140-S.

.15 Paper towel dispenser: White epoxy powder finish with lock, universal towel dispenser for single fold or roll towels. Based on Frost 101-1.

.16 Recessed Shelf: 495mm x 255 mm x 100 mm Stainless Steel, satin finish. Based on Bradley Model 760.

2.3 FABRICATION

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CAN/CSA-G164.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.

.9 Provide steel anchor plates and components for installation on studding and building framing.

2.4 FINISHES

.1 Chrome and nickel plating: to ASTM B456, polished finish.

.2 Baked enamel: condition metal by applying one coat of metal conditioner to CGSB 31-GP-107Ma, apply one coat Type 2 primer and bake, apply two coats Type 2 enamel to CAN/CGSB-1.88 and bake to hard, durable finish. Sand between final coats. Colour selected from standard range by Consultant.

.3 Manufacturer's or brand names on face of units not acceptable.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrates and surfaces to receive toilet and bathroom accessories previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to toilet and bathroom accessories installation.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Install and secure accessories rigidly in place as follows:

.1 Stud walls: install plywood backing to stud prior to gypsum board finish.

.2 Hollow masonry units: use toggle bolts drilled into wall cavity.

.3 Solid masonry: use bolt with lead expansion sleeve set into drilled hole.

.2 Use tamper proof screws/bolts for fasteners.

.3 Fill units with necessary supplies shortly before final acceptance of building.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by toilet and bathroom accessories installation.

3.5 SCHEDULE

.1 Locate accessories as shown on drawings.

END OF SECTION

Part 1. General

1.1 RELATED SECTIONS

.1 Section 03 30 00 – Cast-In-Place Concrete
.2 Section 05 50 00 – Metal Fabrications
.3 Division 26 - Electrical

1.2 REFERENCE STANDARDS

.1 ASTM C645-14e1, Standard Specification for Nonstructural Steel Framing Members.

.2 CSA W47.2-M1987(R2009), Certification of Companies for Fusion Welding of Aluminum.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Division 01.

.2 Shop Drawings and Product Data: include signage proof, plan, elevations, and sections of sign, connection devices between components and recommended installation procedures. Included also all information and dimensions. Drawings of mechanical and electrical boxed, concealed routing and services.

.3 Confirm all graphics, fonts and logos conform with Owner standards prior to submitting shop drawings.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for illuminated signs for incorporation into manual.

1.5 QUALITY ASSURANCE

.1 Welding Certification in accordance with CSA W47.2.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Prevent damage to signs and components during delivery, storage, and handling. Provide any protective material required, include cardboard and plastic covering.

.2 Schedule delivery as required to provide appropriate secure storage to prevent damage or vandalism.

Part 2. Products

2.1 ILLUMINATED SIGN BOX

.1 Provide Owner approved double-faced freestanding sigg as manufactured by Pattison Sign Group (1-800-661-2493, Tel: 613-247-7762 Fax: 613-247-7763) c/w posts and baseplates. Provide 120V, 1 Phase power. No substitutions permitted. Graphics will be provided by Owner after contract award.

.2 Sign to be one independent sign box mounted on common HSS Steel fabricated posts.

2.2 EXTERIOR SIGN GRAPHICS

.1 Sign graphics to be well defined, arranged for balanced appearance, and properly word and letter spaced. Silk Screen process: apply multi-colour photographic produced silk screen printed images to face side of transparent sign faces.

.2 Sign face to be translucent, U/V resistant, Lexan intended for use in sign fabrication. Provide foam seal gaskets to fix Lexan securely in place without potential for rattling or wind deflection.

2.3 PAINT FINISHES

.1 Sign paint finish to be prefinished sheet aluminum (baked enamel), dark blue colour to match Owner standards.

.2 Posts to be painted with epoxy paint finish, dark blue colour to match Owner standards.

2.4 FABRICATION - GENERAL

.1 Fabricate signs in accordance with Owner approved details, specifications and shop drawings. Fabricate Sign box and posts and related components as one coordinated unit to be delivered to site and mounted to piles.

.2 Build units square, true, accurate to size and free from visual or performance defects.

.3 Accurately fit and securely join sections to obtain tight, closed joints. Allow for thermal movement without potential for distortion of components. Grind all welds smooth.

.4 Exposed fasteners are to be avoided, and where necessary be located in inconspicuous locations accepted by consultant. Fasteners to be of same colour as adjacent materials.

.5 Apply bituminous paint to aluminum in contact with dissimilar materials.

.6 Manufacturers nameplates to be affixed only in inconspicuous locations and are not permitted on sign face, top or sides of signs.

.7 Include for all accessories required for a complete installation. All exposed fasteners to be tamperproof. Provide three (3) tamperproof fastener tools to be turned over to owner for access and servicing of sign.

Part 3. Execution

3.1 SITE MEASUREMENTS

.1 Take site measurements of existing building to confirm dimensions, level and alignment of installed piling, prior to starting work. Verify prior to installation and adjust sign dimensions to match installed piles.

3.2 INSTALLATION, GENERALLY

.1 Install partitions and all component parts, in accordance with manufacturer's instructions and as specified. Provide all electrical hook-ups for sign luminaire fixtures.

.2 Install signs, plumb, square and level. Accurately fit and fasten all components to one another. Adjust and shim as required to ensure a plumb, level installation.

3.3 TOUCH-UP AND CLEANING

.1 Touch-up finished surfaces with matching colour paint following finished installation.

.2 Clean all surfaces to be free of adhesives, soil and other contaminants. Trim all fillers neat and flush without damaging signs.

.3 Replace and components damaged as a result of mishandling during transportation or installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 08 99 – Rough Carpentry for Minor Works

1.2 REFERENCES STANDARDS

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A1008/A1008M-16, Standard Specification for Steel, Cold-Rolled, Carbon, Structural, High-Strength Low-Allow, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

.2 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Allow-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM A924/A924M-17, Standard Specification for General Requirements for Steel Sheet, Metallic coated by the Hot-dip Process.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-44.40-2001, Steel Clothing Locker.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for metal lockers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings: type and class of locker, thicknesses of metal, fabricating and assembly methods, tops, rods, hooks, shelves, bases, trim, numbering, filler panels, end/back panels, doors, handles, locking method, ventilation method finishes.

.4 Sustainable Standards Certification:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer, post-industrial content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates regional materials.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal lockers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management:

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Provide all miscellaneous accessories and fasteners as required to rigidly secure all lockers specified into position. Ensure backing requirements are co-ordinated and that all fastening methods are concealed or are aesthetically of high quality in terms of finish, alignment and method.

.2 Provide all miscellaneous trim as required to provide a finished installation where a recessed or semi-recessed installation is requested. Finish trims shall match the colour of the locker unless otherwise noted. Provide finished end panels and spacing fillers for all locker types with matching colour and concealed fastening methods to suit floor plan layouts.

.3 Provide sloped tops to locker types L1, L2, L3, L4, and L5. Colour to match locker frame.

.4 Construct wood base to raise lockers from the ground, the height of the scheduled floor base.

.5 **Type L1** – Personal Item Lockers: Lockers: to CAN/CGSB-44.40, 305 w x 481 dp x 1830 h one (1) tier. Banks of lockers as indicated on drawings.

.1 Body: 0.70 mm thick cold rolled steel, continuously lock formed back and sides.
.2 Frame: 1.6 mm thick formed steel channel, welded one piece construction, notched frame for rigid shelf support, 1.8 mm thick 5 knuckle hinges.
.3 Doors: 1.6 m thick cold rolled steel outer panel, 1.0 mm thick cold rolled steel inner panel for welded sandwich panel construction with sound abating honeycomb core, black polypropylene handle box flush with door face, prepared

for number plates, rubber bumper silencers, ventilation louvres top and bottom.

.4 Finish: Baked enamel. One (1) door colour, one (1) frame/body colour will be selected by Consultant from manufacturers standard range.

.5 Accessories: Three (3) wall coat hooks, metal shelf, number plates and padlock hasps.

.6 Padlocks to be Schlage 1001 with with 'c' keyway. Provide one (1) padlock per locker.

.6 **Type L2** – Police Lockers: to CAN/CGSB-44.40, Type 1-Single full-height locker, Class 2 - A bank of two or more lockers, freestanding. See attached drawing for locker configuration.

.1 Size: 610 mm wide x 610 mm deep x 1829 mm high,

.2 Assembly: welded, 1.30 mm frames and hinge reinforcement.

.3 Top: sloped, 0.80 mm.

.4 Doors: two leaves, one-piece double-wall envelope construction, steel thickness - outer skin 0.80 mm, inner skin 0.70 mm., hinges 1.60 mm.

.5 Sides and backs: 0.70 mm.

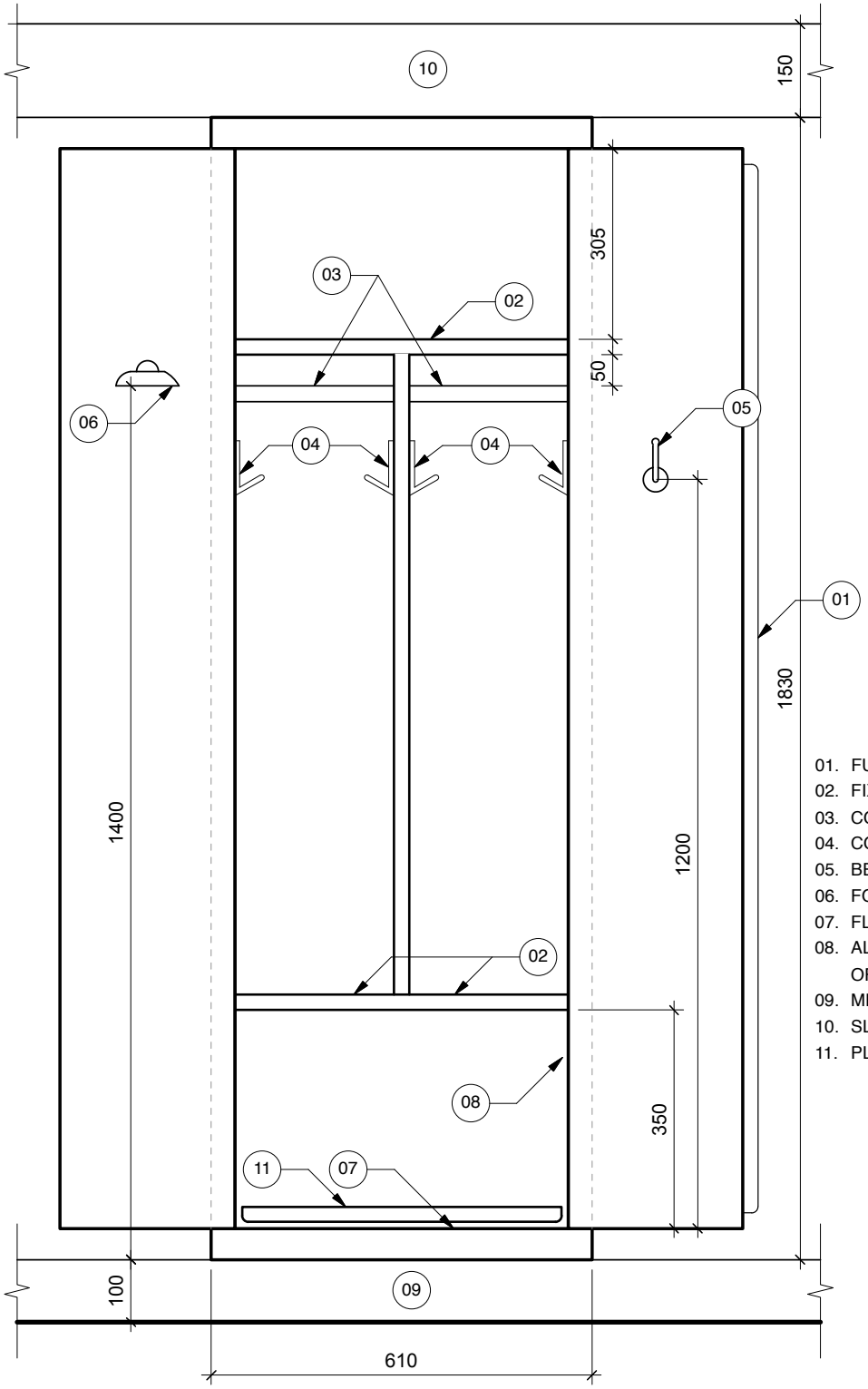
.6 Door handle: recessed handle steel with bright chromium nickel-plated finish, with 2.60 mm. hasp for padlock

.7 Accessories: 19 mm diam. steel hanger rods with chromium finish, 100 mm steel base, steel end panels, steel trim including corner angles, jamb trim, fillers, number plates, coat hooks, belt hook, note clip, number plates including any miscellaneous shown on attached drawing.

.8 Boot drip tray: removable 528 mm wide x 558 mm deep x 38 mm high black PVC.

.9 Finish: Baked Enamel, up to three (3) door colours, one (1) frame/body colour will be selected by Consultant from manufacturers standard range.

.10 Padlocks to be American Lock, by MasterLock, combination lock with key override. Provide one (1) padlock per locker.



01. FULL LENGTH, OVERLAPPING ASTRAGAL
02. FIXED SHELF
03. COAT HANGER ROD
04. COAT HOOKS - 3 PER SIDE
05. BELT HOOK
06. FORMS CLIP
07. FLOOR OF LOCKER FLUSH TO LIP
08. ALLOW CLEARANCE FOR FULL EXTENSION OF DRAWER WITH LOCKER DOOR @ 90°
09. METAL BASE
10. SLOPED TOP
11. PLASTIC BOOT TRAY

.7 **Type L3** –Lockers: to CAN/CGSB-44.40; Manufacturere: Groupe Lincora; product number GRC-1-1618721; size 406 w x 460 d x 1830 h (16”w x 18”d x 72”h) single (1) compartment. Banks of lockers as indicated on drawings.

.1 Body: 0.60 mm (24 ga.) sides and back, 0.70 mm (22 ga.) top and perforated bottom thick cold rolled steel, full length reversed door stop.
.2 Frame: 1.5 mm (16 ga.) thick formed steel channel, double layered in front, welded one piece construction, notched frame for rigid shelf support, 1.9 mm (14 ga.) thick 5 knuckle hinges.
.3 Doors: Perforated 0.9 mm thick cold rolled steel outer panel, 0.6 mm thick cold rolled steel inner panel for welded sandwich panel, additional tack welds top and bottom of door, black polypropylene handle box flush with door face, prepared for number plates, rubber bumper silencers.
.4 Finish: Baked enamel. One (1) door colour, one (1) frame/body colour will be selected by Consultant from manufacturers standard range.
.5 Accessories: Provided three (3) flat hooks, sloped top trim, number plates, 0.70 mm (22 ga.) colled rolled steel shelf.
.6 Locks: Handle with key lock, block, with nylon latch with 2.65 mm (12 ga.) hasp.

.8 **Type L4** – Lockers: to CAN/CGSB-44.40-92, Manufacturere: Groupe Lincora; product number GRC-2-1618721; size 406 w x 460 d x 1830 h (16”w x 18”d x 72”h) two (2) compartment. Banks of lockers as indicated on drawings.

.1 Body: 0.60 mm (24 ga.) sides and back, 0.70 mm (22 ga.) top and perforated bottom thick cold rolled steel, full length reversed door stop.
.2 Frame: 1.5 mm (16 ga.) thick formed steel channel, double layered in front, welded one piece construction, notched frame for rigid shelf support, 1.9 mm (14 ga.) thick 5 knuckle hinges.
.3 Doors: Perforated 0.9 mm thick cold rolled steel outer panel, 0.6 mm thick cold rolled steel inner panel for welded sandwich panel, additional tack welds top and bottom of door, black polypropylene handle box flush with door face, prepared for number plates, rubber bumper silencers.
.4 Finish: Baked enamel. One (1) door colour, one (1) frame/body colour will be selected by Consultant from manufacturers standard range.
.5 Accessories: Provided three (3) flat hooks, sloped top trim, number plates, 0.70 mm (22 ga.) colled rolled steel shelf.
.6 Locks: Handle with key lock, block, with nylon latch with 2.65 mm (12 ga.) hasp.

.9 **Type L5** – Lockers: to CAN/CGSB-44.40-92, Manufacturere: Groupe Lincora; product number GRC-2-2418721; size 610 w x 460 d x 1830 h (24”w x 18”d x 72”h) two (2) compartment. Banks of lockers as indicated on drawings.

.1 Body: 0.60 mm (24 ga.) sides and back, 0.70 mm (22 ga.) top and perforated bottom thick cold rolled steel, full length reversed door stop.
.2 Frame: 1.5 mm (16 ga.) thick formed steel channel, double layered in front,

welded one piece construction, notched frame for rigid shelf support, 1.9 mm (14 ga.) thick 5 knuckle hinges.

.3 Doors: Perforated 0.9 mm thick cold rolled steel outer panel, 0.6 mm thick cold rolled steel inner panel for welded sandwich panel, additional tack welds top and bottom of door, black polypropylene handle box flush with door face, prepared for number plates, rubber bumper silencers.

.4 Finish: Baked enamel. One (1) door colour, one (1) frame/body colour will be selected by Consultant from manufacturers standard range.

.5 Accessories: Provided three (3) flat hooks, sloped top trim, number plates, 0.70 mm (22 ga.) colled rolled steel shelf.

.6 Locks: Handle with key lock, block, with nylon latch with 2.65 mm (12 ga.) hasp.

.10 **Type L6** – Lockers: to CAN/CGSB-44.40-92, Manufacturere: Groupe Lincora; product number GRC-6-1618721; size 406 w x 460 d x 1830 h (24”w x 18”d x 72”h) six (6) compartment. Banks of lockers as indicated on drawings.

.1 Body: 0.60 mm (24 ga.) sides and back, 0.70 mm (22 ga.) top and perforated bottom thick cold rolled steel, full length reversed door stop.

.2 Frame: 1.5 mm (16 ga.) thick formed steel channel, double layered in front, welded one piece construction, notched frame for rigid shelf support, 1.9 mm (14 ga.) thick 5 knuckle hinges.

.3 Doors: Perforated 0.9 mm thick cold rolled steel outer panel, 0.6 mm thick cold rolled steel inner panel for welded sandwich panel, additional tack welds top and bottom of door, black polypropylene handle box flush with door face, prepared for number plates, rubber bumper silencers.

.4 Finish: Baked enamel. One (1) door colour, one (1) frame/body colour will be selected by Consultant from manufacturers standard range.

.5 Accessories: Provided three (3) flat hooks, sloped top trim, number plates, 0.70 mm (22 ga.) colled rolled steel shelf.

.6 Locks: Handle with key lock, block, with nylon latch with 2.65 mm (12 ga.) hasp.

.11 **Type L7 -** Lockers: Model EDHGS-10 635 mm wide x 816 mm high x 165 mm deep (25” x 32” x 6”) surface mounted installation, recessed ten (10) door unit c/w locks, as manufactured by Spacesaver. (1-800-255-8170)

.12 **Type L8** – Lockers: Model EDHGF-04 635 mm wide x 358 mm high x 165 mm deep (25” x 14” x 6”) flush installation, recessed four (4) door unit c/w locks, as manufactured by Spacesaver. (1-800-255-8170)

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates and surfaces to receive metal lockers in accordance with manufacturer's instructions prior to metal locker installation.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Assemble and install lockers in accordance with manufacturer's written instructions.

.2 Securely fasten lockers to grounds and nailing strips.

.3 Install wall trim around recessed locker banks.

.4 Install filler panels (false fronts) where indicated and where obstructions occur.

.5 Install finished end, back panels to exposed ends, backs of locker banks.

.6 Install locker numbers locks. No duplicate numbers in the same space. Numbering will be provided by the Consultant on shop drawings.

3.3 ADJUSTING

.1 Adjust metal lockers for correct function and operation in accordance with manufacturer's written instructions.

.2 Lubricate moving parts to operate smoothly and fit accurately.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal locker installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 - Section Cast In Place Concrete

1.2 REFERENCES STANDARDS

.1 ISO 14001 Certified for Environmental-friendly Production Methods.

.2 ISO 9001 Certified for Product Quality.

.3 SP – The Swedish National Testing and Research Institute.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for flag poles and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

.2 Indicate dimensions, finishes, base jointing, anchoring and support systems, cleats, halyard boxes, trucks, finials and base collar for flagpoles.

.3 Submit an electronic copy of drawings of flagpoles and bases, showing general layout, jointing and complete anchoring and supporting systems.

.4 Manufacturer's Instructions: submit manufacturer's installation instructions for each type of flagpole.

.1 Construction Waste Management: remove packaging as described in Section 01 74 19 - Waste Management and Disposal.

.2 Recycled Content: provide a product containing recycled materials if possible.

.3 Regional Materials: provide a product containing regional materials if possible.

1.4 QUALITY ASSURANCE

.1 Provide each flagpole as complete unit produced by single manufacturer, including fittings, accessories, bases and anchorage devices.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.1 Spiral wrap each flagpole with heavy kraft paper, wood strip and steel band, or polyethylene wrap and pack in tubing for shipment.

.2 Deliver flagpole in two (2) pieces.

.1 When more than one (1) piece is required, provide precision joints with self aligning internal splicing sleeve arrangement.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in a dry location, in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect flagpoles from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse and return of pallets, crates, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Fibreglass: polyester and fibreglass woven cloth, resistant to acids, petroleum and salt water; flame retardant; colour white.

.2 Isolation coating: alkali-resistant bituminous paint or epoxy resin solution.

2.2 DESIGN CRITERIA

.1 Flagpole, bases and anchorage devices to resist minimum wind velocity of 288 km/h unflagged and minimum 100 km/h flagged.

.2 Description:

.1 Exposed Height: 7.6 m (25’-0”).

.2 Butt Diameter: 114 mm (4 ½”).

.3 Top Diameter: 66 mm (2.6”).

.4 Options and Accessories: Internal halyard, internal locking door, finial, flash collar, galvanized tilting hinge base.

.5 Flag Size: 1,143 x 2,286 mm (45” x 90”) maximum.

2.3 FABRICATION

.1 Fabricate 7,620 mm long flagpole as complete unit including tilt base anchorage and fittings.

2.4 ACCESSORIES

.1 Finial: brass, acorn shape.

.2 Truck assembly: non-fouling, revolving double truck assembly, finish to match flagpole.

.3 Halyard: internal, two continuous halyards per flagpole; polypropylene, braided, white. Retaining loop and weights for internal halyard, stainless steel.

.4 Swivel snaps: two per halyard; galvanized steel with neoprene or vinyl covers.

.5 Cleat box: one per cleat; finish to match flagpole. Furnish hasp for padlock, hinged cover, and tamperproof screws. Include lockable cleat box.

2.5 FIELD FABRICATION

.1 Fabricate ground-set foundation assembly counterbalanced tilt installation of flagpole. Include locking lug on tilt pole.

.2 Fabricate mountings of galvanized steel where encased in concrete.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for flagpole installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Shop apply isolation coating to metal surfaces of flagpole and base that will be encased in concrete.

.2 Install flagpoles, base assemblies and fittings to shop drawings and manufacturer's instructions.

.3 Check and adjust installed fittings for smooth operation of halyards.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by flagpole installation.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submit shop drawings for each specified item, clearly showing assembly and finishes.

.2 Include installation details, method and location of all fastenings, anchorage, hardware, and all required accessories.

Part 2 Products

2.1 STEEL BIKE RACK

.1 "Downtown Rack", 50 mm square continuous tube, standard gauge, powder coat finish, as manufactured by Dero Bike Rack Company (Ph: 1-888-337-6729, Fax: 1-612-331-2731), www.dero.com.

.2 Quantity: Two (2) required.

2.2 INSTITUTIONAL STOOL

.1 304 mm diameter x 38 mm deep, 1.6 mm thick Type 304 stainless steel seat with #3 finish. Reinforce with 200 mm x 200 mm x 4.8 mm thick steel plate, stitch welded to underside of seat and pedestal. Edges of seat bottom to be rounded and smooth. No square edges.

.2 51 mm Schedule 40 (60mm outside diameter) pipe support column welded to 200 mm x 200 mm x 6 mm thick base plate with 4 – 12 mm dia. holes. Overall height from floor to top of seat 450 mm.

.3 Weld all joints and grind smooth. Square steel edges

.4 Prime painted support column and base plate.

.5 Quantity: One (1) required.

2.3 CONCRETE SPLASH PAD

.1 Concrete splash pad, 610 mm x 310 mm, precast product. Weight 25 kg.

.2 Quantity: One (1) per downspout.

2.4 CONCRETE SIDEWALK BLOCK

.1 Concrete sidewalk block, 610 mm x 760 mm x 45 mm thick, precast product. Weight 46.5 kg.

.2 Colour: Grey

2.5 SHIPS LADDER

.1 Structural steel flush tread hatch access model ships ladder, 68º steep incline, 4,800 mm high x 2085 mm horizontal run. 610 mm wide x 152 mm deep tread.

.2 Finish: Galvanized.

2.6 PLASTIC PIPE SLEEVES FOR BOLLARDS

.1 Sure Guard (Canadian Affiliate of Post Guard) polyethylene plastic pipe sleeves for steel pipe bollards. Manufactured by Encore Commercial Products Inc.

.1 Five (5) year UV stabilizer warranty.

.2 Thickness: 3 mm.

.3 Reflective Tape: 2 strips of 3M Series reflective tape recessed, 150 mm apart.

.4 Tensile Strength: 4,000 psi.

.5 Colours: Yellow post with red tape.

2.7 CUSTOM CONCRETE BENCH

.1 Urban Concrete GFRC Panels – a lightweight, durable concrete composed of Portland cement, fine aggregate sand, water, acrylic co-polymer, glass fiber reinforcement and additives used for thin wall casting applications.

.1 Physical Properties:

.1 Flexural Strength – 3,000 psi (21 MPa) to 4,600 psi (32 MPa)

.2 Tensile Strength – 1,000 psi (7 MPa) to 1,600 psi (11 MPa)

.3 Compressive Strength – 7,200 psi (50 MPa) to 11,400 (79 MPa)

.4 Impact Strength – 10,000 to 20,500 MPa

.5 Elasticity – 1.5 to 3.0 x 106 psi (10,500 to 20,500 MPa)

.6 Density – 105 to 130 lbs/cu.ft. (1.70 to 2.10 Mg/m3)

Part 3 Execution

3.1 PREPARATION

.1 Ensure that framing is installed and prepared before installation of equipment.

.2 Finished assemblies shall be complete in every respect, square, true to size and details, and free from distortion, twist or other defects, which could affect their strength, operation, or appearance. Factory applied finishes shall be uniform, smooth and without blemish.

3.2 INSTALLATION

.1 All items shall be installed plumb, square, properly spaced, rigidly coupled and adequately anchored maintaining uniformed clearances and accurate alignment.

.2 Where possible, anchors, braces, coupling brackets, etc. shall be fully concealed. Where drilling, cutting or abutting finished surface is required, the cut portion shall be covered with suitable shoes, collars, escutcheon plates or other finished accessories, as required.

.3 Protect adjacent finishes from damage when placing materials.

3.3 SCHEDULE

.1 Place bike racks in locations indicated, or as directed by Consultant, secured to sidewalk with surface mounted anchors with epoxy adhesive to anchors and base of mount in contact with concrete.

.2 Secure Institutional Stool to concrete floor using roundhead security screws with epoxy adhesive, 150mm minimum embed length, provided with unit, to locations indicated on drawings.

.3 Place concrete splash pads under down spouts on grade. Grade to slope away from the building.

.4 Secure ships ladder to concrete slab and roof hatch roof structure as engineered by manufacturer.

.5 Verify steel pipe cores are set true, aligned in concrete. Centre 2 foam strips over bollard. Slide pipe sleeve over the bollard and foam.

.6 Place custom concrete bench in room 103 flush to walls, base to be installed to but to bench.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Related Sections:

.1 Section 07 21 13 – Board Insulation
.2 Section 07 26 00 – Vapour Retarders
.3 Section 07 62 00 – Flashing and Trim
.4 ANNEX E ABORIGINAL PARTICIPATION COMPONENT (For artistic design)

1.2 REFERENCE STANDARDS

.1 American Architectural Manufacturers Association (AAMA):

.1 AAMA 2605 Voluntary Specification Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM B 209 Aluminum and Aluminum Alloy Sheet and Plate.

1.3 SYSTEM DESCRIPTION

.1 Modular perforated aluminum screen wall system with Ombrae™ Optical Tile Imaging technology.

.2 Mounting system, clips, and fasteners.

.3 Factory applied coating system.

1.4 DESIGN REQUIREMENTS

.1 Wall Panel Deflection: L/40.

.2 Thermal Movement: Design system to accommodate vertical thermal movement of components without causing buckling, and undue stress on fasteners when subject to seasonal temperature cycling.

.3 Tolerance of Substructure: Design system to accommodate up to 6 mm in 3000 mm variation out of plane in building structural framing or substrate.

1.5 PERFORMANCE REQUIREMENTS

.1 Structural Performance: No permanent deformation at 150 percent of design pressure exceeding L/60 for frame and L/40 for material.

1.6 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 Submittal Procedures.

.2 Shop Drawings: Show thickness and dimensions of panels, panel profile, Ombrae Optical Tile layout, fastening and anchoring methods, details, and locations of joints.

.3 Product Data: Manufacturer's panel profiles, dimensions, characteristics and structural properties.

.4 Design and Performance Data: Fabricator's system including standard drawings, details, and design.

.5 Panel Samples: Minimum 300 mm x 300 mm in specified thickness.

.6 Fabricator Instructions:

.1 Include installation instructions, technical bulletins, and other product data.
.2 Include instructions for substrate requirements, special handling criteria, installation sequence, perimeter conditions, cleaning procedures, and conditions requiring special attention.

1.7 QUALITY ASSURANCE

.1 Single Source Responsibility:

.1 Provide design and fabrication of wall panel system under responsibility of fabricator including perforated screen wall panel with Ombrae Optical Tiles, attachments, clips, girts, fasteners, and other accessories.

1.8 QUALIFICATIONS

.1 Fabricator:

.1 Company specializing in designing, engineering, and fabricating work of this Section.
.2 Approved by QMAAS Studios (Ombrae) as qualified to perform work of this Section.

.2 Installer:

.1 Company specializing in installing work of this Section.
.2 Trained and authorized by perforated screen wall panel system fabricator as qualified to perform work of this Section.

1.9 MOCKUP

.1 Provide under provisions of Section 01 45 00 - Quality Control.

.2 Construct mock-up, including outside corner condition showing complete system assembly.

.3 Construct size and type and locate as directed by Architect.

.4 Incorporate accepted mock-up into Work.

1.10 PRE-INSTALLATION CONFERENCE

.1 Arrange in accordance with Section 01 31 19 – Project Meetings.

.2 Attendance: Contractor, installer, Owner, Consultant, manufacturer's representative, and those requested to attend.

.3 Meeting Time: Minimum two (2) weeks prior to beginning work of this Section and work of related Sections affecting work of this Section.

.4 Location: Project Site.

1.11 DELIVERY, STORAGE, AND HANDLING

.1 Conform to provisions of Section 01 61 00 – Common Product Requirements and manufacturer's instructions.

.2 Deliver in manufacturer's protective packaging with identifying labels intact.

.3 Store in well ventilated space under cover, off ground, protected from direct sunlight, weather, moisture, soiling, and marring of surface.

.1 Protect panels from temperatures exceeding 120 degrees F (48.89 degrees C).
.2 Slope stored panels for positive drainage of water and condensation.

.4 Handle to prevent twisting, bending, and abrasion. Prevent contact with materials which may cause discoloration or staining.

1.12 PROJECT CONDITIONS

.1 Field Measurements: Verify actual conditions prior to fabrication and show on Shop Drawings.

1.13 COORDINATION

.1 Conform to Section 01 32 16.07 – Construction Progress Schedule for coordination with work of other Sections.

.2 Field dimensions, Shop Drawings, and fabrication with critical path of construction. Progress schedule as necessary to meet lead time and avoid delays.

1.14 WARRANTY

.1 Finish Coating System: Standard five (5) year materials Warranty against fading, crazing, and chalking of coating system.

.2 Panel Manufacturer: Standard two (2) year materials Warranty against defective materials.

.3 Panel System Fabricator: two (2) year fabrication Warranty for conformance to design and performance and requirements.

.4 Installer: two (2) year workmanship Warranty for water tightness as required.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of Design:

.1 Ombrae Technology KPS Perforated Screen Wall
Website: www.Ombrae.com

.2 Certified Erector/Distributor:

.1 Thermal Systems KWC Ltd., Tel (403) 250-5507
Website: www.thermalsystems.ca
E-mail: sales@thermalsystems.ca

.3 Consultant approved alternates will be accepted.

2.2 ALUMINUM SCREEN WALL PANEL

MATERIALS

.1 Aluminum Sheet: 3003 H14 aluminum alloy per ASTM-B209

.2 Thickness: 2mm.

.3 Optical Tile Size: 10 mm.

.4 Panel Size: 914 mm x 2900 mm.

2.3 ACCESSORIES

.1 Panel Anchorage System: two layers of continuous metal framing, perpendicular to each other, and as follows:

.1 First Layer: attached to building structure: extruded aluminum or hot dip galvanized steel, Z275 coating, secured to building structure.

.2 Second Layer: extruded aluminum or, if not directly supporting panels, hot dip galvanized steel, Z275 coating.

.3 Panel Support Framing/Cavity Spacer: extruded aluminum.

.4 Attachments, Clips, and Girts: As instructed by manufacturer.

.5 Anchorage System (Take items 2.1.5 in its entirety)

.6 Pop Rivets: Stainless steel or aluminum as determined by fabricator to prevent galvanic action.

.7 Screw Fasteners: Type S, self-tapping framing screws, DT2000 corrosion resistant as instructed by manufacturer to suit application.

.8 Shims: As instructed by manufacturer.

.9 Isolation Accessories: Isolation tape, pads, or coatings as necessary to prevent galvanic action between dissimilar metals.

2.4 FABRICATION

.1 Shop fabricate wall panels in sizes and joint configurations according to shop drawings.

.2 Form panel lines, breaks, and angles free from warp and buckle, and with no displacement of aluminum sheet.

.3 Custom perforate sheet with Ombrae Optical Tiles according to shop drawings.

.4 Form sections true to shape, accurate in size, square, and free from distortion or defects.

2.5 FINISHES

.1 Clear Anodizing: Type II, Class 1 or 2 in accordance to ASTM B117 336 hours salt spray test.

.2 Image to be created by local artist of Municipal District of Opportunity No. 17.

Part 3 Execution

3.1 EXAMINATION

.1 Verify conditions ready to receive work of this Section before beginning installation.

.2 Verify substrate framing members suitable for installation ready to receive wall panel system.

3.2 PREPARATION

.1 Shim metal framed framing members and supports as necessary to provide level and plumb substrate for fastening panels.

3.3 INSTALLATION

.1 Install in accordance with manufacturer's instructions and provisions of Contract Documents.

.2 Install wall panel aligned, level, and plumb, within specified tolerances.

.3 Use concealed fasteners and clip attachments.

.4 Isolate aluminum from dissimilar metal, as required to prevent galvanic action.

3.4 TOLERANCES

.1 Maximum Offset From Alignment Between Adjacent Wall Panels: 3 mm.

.2 Maximum Variation from Horizontal and Vertical Plane: 12 mm in 6000 mm, non-accumulative.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Service:

.2 Make periodic visits and final inspection by manufacturer's authorized product representative as necessary to verify conformance to manufacturer's instructions and Warranty provisions.

.3 Promptly notify Consultant of non-conforming work.

3.6 ADJUSTING

.1 Make adjustments to wall panel installations not conforming to specified tolerances.

.2 Field touch-up damaged finishes to match color and finish of factory applied panel finish.

.3 Replace work which cannot be repaired so that repairs are not discernable at distance of 3000 mm.

3.7 CLEANING

.1 Dry-wipe panels as work progresses.

.2 Leave installation clean, free from residue and debris resulting from work of this Section.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 08 44 13 – Glazed Aluminum Curtain Walls

.2 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCES STANDARDS

.1 Spring Tempered Aluminum: Aluminum Association alloy AA6011.

.2 Aluminum Extrusions: Aluminum Association alloy AA6063-T5.

1.3 DESIGN REQUIREMENTS

.1 Roller blinds to be a side-by-side double roller blind with blackout fabric to the exterior and shading fabric to the interior.

.2 Design roller blinds to following requirements:

.1 Be designed in a manner that allows wear susceptible parts to be replaceable by either the user or the manufacturer.

.2 A guarantee of at least five-years of available replacement parts following discontinue of the products manufacture.

.3 Be designed in a manner that permits effective disassembly of components in order to permit recycling of materials for which recycling markets exist.

.4 Include stamps on all major plastic components indicating composition code to facilitate recycling efforts.

1.4 SUBMITTALS

.1 Instruction for replacing and repairing worn parts, including inventory numbers for parts and procedures for order replacement parts.

.2 Shop drawings reviewed by the consultant including finish materials and colour.

.3 Instructions on where recyclable parts can be returned or delivered for recycling.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 Submittal Procedures.

.2 Indicate dimensions in relation to window jambs, operator details, head and sill anchorage details, hardware and accessories details.

1.6 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit one representative working sample of each type of roller blind.

.3 Submit duplicate samples of manufacturer's standard colours for selection by Consultant. One sample to be retained by Consultant.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of waste materials in accordance with Section 01 74 21 - Construction/ Demolition Waste Management And Disposal.

1.8 WARRANTY

.1 Five (5) years warranty on fabric. One (1) year warranty on parts and motors.

Part 2 PRODUCTS

2.1 MATERIALS AND FABRICATION

.1 Blackout fabric: 4 ply opaque blackout fabric.

.2 Shading Fabric: woven extruded reinforced vinyl coated polyester yarn, 0.76 mm (0.030") thick, max. 3% open area.

.3 End Bracket: 77 mm x 96 mm two piece moulded Acrylonitrile Butadiene Styrene (ABS).

.4 Fascia: 1.7 mm thick, clear anodized extruded aluminum mounted to end brackets with back fascia for between mullion mounting.

.5 Double Roller Axle: minimum 133 mm x 154 mm thick extruded aluminum one piece profile designed to suit window span; integral slotted spline to retain the fabric edge, reinforce the tube along its entire length to serve as locking device for the sprocket clutch assembly.

.6 Drive Assembly: factory set for size and travel of shades; capable of field adjustment from exterior of shade without disassembly; with built-in shock absorber system to prevent chain breakage.

.7 Exterior Hem Bar: clear anodized extruded aluminum with plastic end finials. Hem bar shall contain an internal pocket to allow for 4 mm vertical movement.

.8 Manual Chain Operator: aluminum sprocket wheel driven by an endless #10 stainless steel bead chain of 90 pound test. Inertia braking system principle to allow for adjustment-free, non-drifting, smooth, controlled operation with positive stop action at any point of travel.

.9 Standard of Acceptance: Solarfective Teleshade or accepted substitution.

2.2 MANUAL BLINDS

.1 Blackout fabric: 4-ply blackout with an embossed vinyl face and back: Colour B05 Grey. Fire Classification: NFPA 701 Small Scale

.2 Shading Fabric: woven extruded reinforced vinyl coated polyester yarn, 0.76 mm (0.030") thick, max. 3% open area, colour to be selected by Consultant from manufacturer's standard range.

.3 Standard of Acceptance: Solarfective

2.3 MOTORIZED BLINDS

.1 Blackout fabric: 4-ply blackout with an embossed vinyl face and back: Colour B05 Grey. Fire Classification: NFPA 701 Small Scale

.2 Standard of Acceptance: Solarfective

.3 Junction box to be located within 900 mm of motor. Motor location to be determined by Solarfective representative.

.4 Motor to be sized by manufacturer and confirmed with shop drawings.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install blinds at all exterior windows except at glass block locations.

.2 Units to be full width of windows in a single unit.

.3 Include centre brackets where necessary to prevent deflection of headrail.

.4 Adjust to provide for operation without binding.

.5 Use non corrosive metal fasteners for installation, concealed in final assembly.

.6 Adjust fabric, drive assembly and chain to provide smooth operation and to fit tightly in closed position.

.7 Gaps between blinds in a glazing unit are to be places at mullion locations.

.8 Motors can be placed on either side of the motorized blinds and confirmed with shop drawings.

END OF SECTION

Part 1 WGeneral

1.1 RELATED SECTIONS

.1 Section 03 30 00 – Cast-In-Place Concrete

.2 Section 09 30 00 – Tiling

.3 Section 09 65 16 – Resilient Sheet Flooring

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A276/A276M-17, Standard Specifications for Stainless Steel Bars and Shapes.

.2 ASTM A653/A653M-15e1, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM A924-17, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.4 ASTM B221-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

.5 ASTM D2047-11, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.

1.3 COORDINATION WITH CONCRETE FLOOR SLAB PLACEMENT

.1 Entry mat is to be recessed in concrete floor slab to be flush with floor material adjacent.

1.4 ACTION AND INFORMATION SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets and include installation and maintenance instructions.

.3 Shop Drawings:

.1 Show layout and sections of typical installations, details at edges showing adjacent material, anchors, and accessories, and field measurements of slab recess.

.4 Samples:

.1 Submit not less that 150 x 150 mm square sections of material and 150 mm length of frame material in selected colour and finish.

.5 Manufacturer's Written Instructions:

.1 Submit in accordance with Section 04 05 00 - Common Work Results for Masonry.

.6 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer, post-industrial content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates regional materials.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle floor mats in accordance with Section 01 61 00 - Common Product Requirements

.2 Packaging Waste Management:

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: provide in accordance with Section 01 78 00 – Closeout Submittals.

.2 Warranty Documentation: Manufacturer to offer five (5) year warranty against defects in materials and workmanship.

Part 2 Products

2.1 ENTRY MAT SYSTEM

.1 Provide manufacturer specified, or accepted substitutions.

.2 Provide for total entry mat zone indicated on drawings (closest to exterior entry doors), EM 1: Edgewood Matting. Debris Trap, 13 mm thick tile.

.3 Mat Module Dimensions: 292 mm x 445 mm.

.4 Colours: Black.

.5 Floor recess edging: Provide continuous Schluter strip to perimeter of concrete and built-up floor recesses. Mitre cut all corner joints.

Part 3 Execution

3.1 PREPARATION

.1 Substrate must be flat and level to tolerance of no more than 3 mm in 3 m.

.2 Examine the substrates and conditions under which the work is to be performed, and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

.1 Lay mats after installation of finish flooring.

.2 Centre tiles between front and back of vestibule. Cut tiles so front and back tiles are greater than half tile size.

.3 Coordinate top of product surfaces with swinging doors to maintain under-door clearance.

3.3 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning, supplemented as follows.

.1 Remove traces of primer, grout, caulking and fill materials.

3.4 PROTECTION

.1 Protect floor mat installation in accordance with section 01 61 00 – Work Product Requirements.

.2 Provide temporary filler of plywood or fibreboard in recessed slab and cover frames with protective plywood flooring. Maintain protection until dust generating construction and exterior work is complete.

END OF SECTION

Project Manual for:

GOVERNMENT OF CANADA
WABASCA-DESMARAIS GOVERNMENT BUILDING

PROJECT NO: 9031

VOLUME 2 OF 2
DIVISIONS 15-49

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STEPHENS KOZAK ACI
ARCHITECTS AND PLANNERS

Government of Canada | Gouvernement du Canada

Canada

VOLUME 1

Document 00 - Procurement and Contracting Requirements

Division 01 - General Requirements

Division 02 - Existing Conditions

Division 03 - Concrete

Division 04 - Masonry

Division 05 - Metals

Division 06 - Wood, Plastics and Composites

Division 07 - Thermal and Moisture Protection

Division 08 - Openings

VOLUME 2

Division 21 - Fire Suppression

Division 22 – Plumbing

Division 23 - Heating, Ventilating and Air Conditioning (HVAC)

Division 32 - Exterior Improvements

Division 33 – Utilities

END OF SECTION

Part 1 General

1.1 INTENT

.1 Provide complete, fully tested and operational mechanical systems to meet requirements described herein and in complete accordance with applicable codes and ordinances. Include all costs to obtain all permits and to pay for all fees and charges, including inspection charges by the authorities that issue the permits. Coordinate all related inspections. Permits, fees and inspections including: sprinklers, fire protection, electrical, and third party engineering fees.

.2 Contract documents of the Specifications and Drawings, are generally diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.

.3 Follow manufacturer's recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents. Provide adequate access space for maintenance and service.

.4 Install material and equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment as determined by the Engineer.

1.2 WARRANTY

.1 Furnish a written guarantee stating that all work executed in this contract will be free from defective workmanship and materials for a period of one (1) year from the date of substantial performance of work. The Contractor shall repair and replace any work which fails or becomes defective during the term of the guarantee/warranty, providing the operating and maintenance instructions have been complied with. The period of guarantee specified shall not, in any way, supplant any other guarantees of a longer period provided by Manufacturers or as called for in the project documents.

1.3 OWNER REQUIREMENTS DURING WARRANTY

.1 Unless specified otherwise the Owner shall be responsible for all routine maintenance requirements as required in the manufacturer’s instructions.

1.4 REFERENCES

.1	Procurement and Contracting Requirements	Division 00
.2	General Requirements	Division 01
.3	Plumbing	Division 22

1.5 MATERIALS

.1 Materials and equipment installed shall be new, full weight and of quality specified. Use same brand or manufacturer and model for each specific application.

.2 Each major component of equipment shall bear manufacturer's name, address, catalog and serial number in a conspicuous place.

.3 Replace materials or workmanship below specified quality and relocate work wrongly placed to satisfaction of the Engineer and at no cost to the Owner.

.4 Install materials and equipment in a quality manner providing good workmanship by competent tradesmen.

1.6 AVAILABILITY OF EQUIPMENT AND MATERIALS

.1 Make known in writing to the Engineer ten (10) days prior to the bid closing date any materials specified that are required to complete the work which are not currently available or will not be available for use as called for herein. Failing to do so, it will be assumed that the most expensive substitute has been included in the bid price.

1.7 SUBSTITUTE MATERIALS AND EQUIPMENT

.1 The price submitted for this contract shall be based on the use of materials and equipment as specified or as contained within the acceptable equivalent manufacturers listed in each section.

.2 Requests for acceptance for bidding purposes of substitute materials or equipment shall be submitted in duplicate, to the Engineer no later than ten (10) working days prior to the closing date of the bid for mechanical trade, complete with all applicable technical data, including performance curves and physical details. Acceptance of requests shall only be given by addendum.

.3 The Contractor shall, in his quotation, indicate the degree of acceptance obtained from the Engineer. In the event that the product has been accepted as a "Substitution Only", this shall be stated in the quotation and the difference from the base bid price indicated.

.4 Accepted substitutions to specified products shall be equal in performance and materials to the specified product in every respect, operate as intended, meet the space, capacity, and noise requirements outlined.

.5 The Contractor shall be fully responsible for all costs for work or materials required by the trades or other contractors to accommodate use of other than specified materials or equipment.

1.8 METRIC CONVERSION

.1 All units in this division are expressed in SI units. Soft metric conversions are used throughout.

.2 Submit all shop drawings and maintenance manuals in SI units.

.3 On all submittals use the same SI units as stated in the specification.

.4 Equivalent Nominal Diameters of Pipes - Metric and Imperial

.1 Where pipes are specified with metric dimensions and only Imperial sized pipes are available, provide equivalent nominal Imperial sized pipe as indicated in the table, and provide adapters to ensure compatible connections to all metric sized fittings, equipment and piping.

.2 When CSA approved SI Metric pipes are available and are provided, the contractor shall provide adapters to ensure compatible connections between the SI Metric pipes and all new and existing pipes, fittings, and equipment.

.3 Record accurately on "as-built" drawings the type of pipe (i.e., Metric or Imperial) installed.

EQUIVALENT NOMINAL DIAMETERS OF PIPES

mm	Inches	mm	Inches	mm	Inches
3	1/8	65	2-1/2	375	15
6	1/4	75	3	450	18
10	3/8	100	4	500	20
15	1/2	125	5	600	24
20	3/4	150	6	750	30
25	1	200	8		
30	1-1/4	250	10		
40	1-1/2	300	12		
50	2				

1.9 DRAWINGS AND SPECIFICATIONS

.1 Drawings and specifications are complementary each to the other, and what is called for by one shall be binding as if called for by both.

.2 Should any discrepancy appear between drawings and specifications which leaves the Contractor in doubt as to the true intent and meaning of the plans and specifications, obtain a ruling from the Engineer in writing or by Addendum, before submitting bid documents. If this is not done, it will be assumed that the most expensive alternate has been included.

.3 Prior to construction start, examine all contract documents, including all drawings and specifications, and work of other trades to ensure that work can be satisfactorily carried out without changes to building.

1.10 COORDINATION OF WORK

.1 Cooperate and coordinate with other trades on the project.

.2 Make reference to electrical, mechanical, structural and architectural drawings when setting out work. Consult with respective Divisions in setting out locations for ductwork, equipment, and piping, so that conflicts are avoided and symmetrical even spacing is maintained. Provide coordination drawings showing the work of all trades and contractors involved, in areas of potential conflict or congestion, as requested by Engineer at no additional cost.

.3 Where dimensional details are required, work with the applicable architectural and structural drawings.

.4 Full size and detailed drawings shall take precedence over scale measurements from drawings.

1.11 CUTTING AND PATCHING

.1 Provide inserts, holes and sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves.

.2 Provide inserts or drill for expansion bolts, hanger rods, brackets, and supports.

.3 Obtain written acceptance from Engineer before drilling, coring, cutting or burning structural members. Ensure post tensioned or pre-stressed strands are located accurately and avoid with an adequate margin of safety.

.4 Provide openings and holes required in precast concrete members for mechanical work. Cast holes larger than 100 mm in diameter. Field-cut holes smaller than 100 mm if location is accepted.

.5 Patch and make good building where damaged from equipment installation, improperly located holes etc. Work to be performed by the trade or contractor responsible for that type of work.

1.12 CERTIFICATE OF SUBSTANTIAL PERFORMANCE

.1 Refer to General Conditions and Supplementary Conditions.

.2 Prior to application for a "Certificate of Substantial Performance" of the work, the contractor shall certify the following in writing to the Engineer:

.1 The systems are installed and suitable for operation for the purpose intended.

.2 All contractor system start-up and test sheets have been completed and submitted for review.

.3 All fire protection including sprinklers, fire hose cabinets, and fire extinguisher brackets are installed and operational.

.4 All piping is installed, painted and clearly identified complete with flow arrows.

.5 All valves are tagged, terminal air boxes are identified and numbered, and all equipment identified.

.6 All necessary tests and start-up procedures on equipment have been made, including those required by authorities.

.7 The building automation system seven (7) day acceptance test has been successfully completed.

.8 All building fire protection sequences for stairwell pressurization, fan shutdown, area of refuge and smoke control have been tested and certified as complete by the local authority.

.9 Following information has been submitted:

.1 Final draft of O & M Manuals.

.2 Final certificates from authorities having jurisdiction.

.3 Completed record drawings.

.3 Identify any systems which cannot be installed and/or placed in operation for reasons beyond the normal control of the contractors and submit a statement of the value of the remaining work required to complete the project.

.4 Within ten (10) days of receipt of a written application for a "Certificate of Substantial Performance", the Engineer shall visit the site.

.5 If, after the Engineer's site visit the application for a "Certificate of Substantial Performance" is not accepted, the contractor shall reapply in accordance with the Engineer's site visit report and pay for costs of re-inspection services.

1.13 INSPECTION REPORT SIGN-OFF

.1 The Mechanical Contractor is to sign off each item of each mechanical inspection report prior to a call for re-inspection by the Consultant. Sign-off shall be by a responsible and knowledgeable representative of the Contractor who has verified that the deficiency has been corrected to comply with all aspects of the Contract Documents.

1.14 CERTIFICATE OF TOTAL PERFORMANCE

.1 Refer to General Conditions and Supplementary Conditions.

.2 Prior to application for a statement of "Total Performance", the Contractor shall certify the following in writing to the Engineer:

.1 All items noted in previous site visit reports including that performed for Substantial Performance have been completed.

.2 Warranty forms are mailed to manufacturer. (Provide copy of original warranty for equipment which has a warranty period of longer than one year).

.3 Completed and accepted Operating and Maintenance (O & M) Manuals have been submitted to Owner.

.4 The Owner has received instructions in the operation and maintenance of the system.

.3 Within ten (10) days after receipt of a written application for a "Certificate of Total Performance", the Engineer shall visit the site.

.4 The Engineer shall provide one (1) visit for the purpose of reviewing the application for a "Certificate of Total Performance". Subsequent visits, if required, shall be at the expense of the contractor.

1.15 SHOP DRAWINGS

.1 All shop drawing submittals submitted in digital format. Identify materials and equipment by manufacturer, trade name, and model number. Include copies of applicable brochure or catalogue material. Do not assume applicable catalogues are available in the Engineers office. Maintenance and operating manuals are not suitable submittal material. Space must be left on the shop drawing to accommodate the Engineers review stamp. Where equipment is identified by name or number on the drawings or specification, clearly mark each shop drawing with the identical name and/or number.

.2 Clearly mark each sheet of submittal material (using arrows, underlining, or circling) to show differences from what is specified, particularly sizes, types, model numbers, rating, capacities, and options actually being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pump seals, materials or painting.

.3 Include dimensional and technical data sufficient to check if equipment meets requirements. Include wiring, piping, service connection data and motor sizes.

.4 Prior to submission to the Engineer, the Contractor shall review all shop drawings. By this review, the Contractor certifies that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data, and certifies that he has checked and coordinated each shop drawing with the requirements of the work of the Contract documents. The Contractor's review of each shop drawing shall be indicated by stamp, date and signature of a responsible person.

.5 Installed materials and equipment shall meet specified requirements regardless of whether or not shop drawings are reviewed by the Engineer.

.6 The shop drawing review by the Engineer will provide the following certification: "Review is for the sole purpose of ascertaining general conformance with design. Contractor is responsible for dimensions, fabrication and construction methods, coordination of subtrades, detail design of components, and errors or omissions on shop drawings."

1.16 TEMPORARY OR TRIAL USAGE

.1 Temporary or trial usage requested by the Owner of mechanical equipment supplied under contract shall not represent acceptance. Operate and maintain all equipment and systems during trial usage.

.2 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

1.17 ELECTRICAL MOTORS

.1 Supply mechanical equipment complete with electrical motors. Provide a complete listing of all motors required on the project within twenty (20) days of contract award. List K.W. Voltage, Phasing, efficiency etc. Provide list to Engineer and Electrical Contractor for review.

.2 Provide motors designed, manufactured, and tested in accordance with the latest edition of the following codes and standards: NEMA, EEMAC, CSA, CEC Part 1, IEEE and ANSI. All motors to be CSA labeled. All motors to be approved for use in the designated area classification by the Electrical Protection Branch, Alberta Department of Labor.

.3 Unless specified otherwise, provide motors designed for full voltage starting, EEMAC Design B. Motors driving high torque or high inertia loads may be EEMAC design C or D.

.4 Provide motors rated for continuous duty with 1.15 service factor unless specified otherwise in the driven equipment specifications. Provide all motors with thermal overload protection. Motors 30 kW and larger shall have thermistor protection.

.5 Provide motors with complete nameplate data.

.6 Provide motors with grease or oil lubricated anti-friction type ball or roller bearings.

.7 Provide motors designed with Class B insulation; Class F insulation for totally enclosed motors.

.8 Refer to electrical specifications, Section for voltage, frequency, and phase data. This shall take precedence over any reference in Division 21. Packaged equipment shall have connections as specified in Division 26.

.9 Where motor power is stated in watts or kilowatts, nominal motor horsepower multiplied by 746 or 0.746 respectively, has been used as the conversion factor.

.10 Provide specified mechanical equipment with motors equal to Magnetek "E-Plus" energy efficient motors with minimum certified efficiencies at 1800 RPM as follows:

	1200 RPM	1800 RPM	3600 RPM
0.746 kW (1 HP)	80.0%	82.5%	75.5%
1.119 kW (1½ HP)	85.5%	84.0%	82.5%
1.492 kW (2 HP)	86.5%	84.0%	84.0%
2.238 kW (3 HP)	87.5%	87.5%	85.5%
3.720 kW (5 HP)	87.5%	87.5%	87.5%
5.595 kW (7½ HP)	89.5%	89.5%	88.5%
7.460 kW (10 HP)	89.5%	89.5%	89.5%
11.190 kW (15 HP)	90.2%	91.0%	90.2%
14.92 kW (20 HP)	90.2%	91.0%	90.2%
18.650 kW (25 HP)	91.7%	92.4%	91.0%
22.38 kW (30 HP)	91.7%	92.4%	91.0%
29.84 kW (40 HP)	93.0%	93.0%	91.7%
37.30 kW (50 HP)	93.0%	93.0%	92.4%

Part 2 Products

Not applicable.

Part 3 Execution

Not applicable.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Secure and assemble all necessary literature describing the operation and maintenance of all equipment provided. Complete and transmit documentation for review to Engineer at project milestones.

.2 Operating and Maintenance Manuals.

.3 Record Drawings.

1.2 QUALITY ASSURANCE

.1 Work specified in this section shall be performed by an Independent Agency specializing in this type of work.

1.3 REFERENCES

.1 Division 22

.2 Division 23

Part 2 Products

2.1 BINDERS

.1 Provide two (2) hard copy sets and one (1) electronic copy on USB of Operations and Maintenance Manuals.

.2 Each set of manuals shall include as many binders as required to accommodate the project information.

.3 Binders shall be 216 mm x 280 mm, three (3) post, expanding spine type, with metal piano hinges and bound with heavy fabric.

.4 Maximum binder thickness when filled shall not exceed 100 mm, including a space allowance for 10% additional data.

.5 Binder colour shall be blue, Ontario buckram fabric, colour #OBV460.

.6 Project title and identification shall be silk screened on the front cover and spine. All lettering and borders shall be white.

.7 Binder spine identification to include Volume #, Set #, Title Description, Facility Name and Facility Location.

.8 Contractor to submit proof of cover layout for review prior to ordering binders.

2.2 TABS

.1 The divider tabs shall be laminated Mylar plastic and coloured according to division and section.

.2 Plastic tabs with typewritten card inserts will not be accepted.

.3 Each tab to include tab number and title printed on the tab.

.4 The colouring for tabs for individual sections is as follows:

Red - Fire Protection

2.3 MANUAL DIVISIONS

.1 Organize each manual into the following divisions.

.1 Operation Division.

.2 Maintenance Division.

.3 Contract Documentation Division.

2.4 OPERATIONS DIVISION

.1 The operations division shall have all data organized into sections according to the system category with individual divider tabs as follows:

.1 FPN - Fire Protection Systems

.2 Organize data for each system category (section) into individual sub-systems. Provide an index for each system category and a divider tab for each individual system.

.3 For each individual sub-system include the following:

.1 System Description - Provide details of system type, composition, areas served, location in the building, design criteria and function of major components. All equipment arranged to operate together as one system shall be considered part of that system description. Design criteria shall, at minimum, include the following:

.1 Hydraulic calculations.

.2 Occupancy type and densities.

.3 Water supply: static and dynamic pressures used for design.

.4 Referenced design standard.

.2 System Schematic - Provide a system schematic showing all components comprising the system.

.3 Operating Instructions - Provide, in "operator" layman language, the specific instructions for start-up, shutdown of each system component. Include exact type and specific location of each valve, switch and device to be used in the system operation. Identify safety devices and interlocks that must be satisfied in order for the equipment to start. Also, list conditions to be fulfilled before attempting equipment start-up, i.e. valves position correct, glycol mixture concentration proper, piping filled with fluid, etc.

.4 Equipment Identification - Provide data for each system component on equipment identification forms equal to the standard forms obtained from the design consultant.

The consultant shall provide one (1) sample reproducible copy of a form for use by the contractor. New forms produced by the contractor shall follow the same format as the sample form and contain all required information.

.5 Maintenance Division

.1 Organize data into the following sections with divider tabs:

.1 Maintenance Tasks and Schedules.

.2 Spare Parts.

.3 Suppliers and Contractors.

.4 Tags and Directories.

.2 Maintenance Tasks and Schedules - Organize data according to the system category, with further breakdown into individual systems as used in the operations division of the manual. Provide section index and divider tabs for each system category. Summarize maintenance tasks from manufacturer's maintenance brochures, for each component of each system in the following format:

.1 Daily.

.2 Weekly.

.3 Monthly.

.4 Semi-annually.

.5 Annually.

.6 When Required.

.3 Spare Part List - Organize data according to the system category, with further breakdown into individual systems as used in the operations division of the manual. Provide section index and divider tabs for each system category. Summarize from manufacturers maintenance brochures the recommended spare parts for each component of each system.

.4 Suppliers and Contractor List - Provide summary of Suppliers and Contractors for each components of each system. List name, address and telephone number of each.

.5 Tags and Directories - Provide a copy of the Mechanical Drawing, List, Valve Tag List, Piping Identification Schedule and all other directories as specified in the contract documents.

.6 Contract Documentation Division

.1 Organize all data required by the construction contract into sections, with divider tabs, as follows:

.1 Drawings List.

.2 Shop Drawings and Product Data.

.3 Certifications.

.4 Warranties and Bonds.

.5 Maintenance Brochures.

.6 Reports.

.2 Shop Drawings and Product Data - Provide final copies of all shop drawings and product data required by the contract documents. Include section index and divider tabs. Maximum of twenty-five (25) sheets or one (1) system shop drawing per tab.

.3 Certifications - Provide copies of Contractor Certifications for the performance of product and systems. Include copies of all pressure tests for piping and ductwork systems, equipment alignment certificates, local authority inspection reviews, backflow prevention certification, and fire protection certifications. Include section index and divider tabs with maximum of twenty-five sheets (25) or one (1) report per tab.

.4 Warranties and Bonds - Include one (1) copy each of the Contractor's, warranty, manufacturers' warranties longer than one (1) year, the bond, and any service contract provided by the contractor. Provided section index.

.5 Maintenance Brochures - Include copies of all manufacturers' printed maintenance brochures pertaining to each product, equipment or system. provide section index and divider tabs. Maximum of twenty-five (25) sheets or one (1) system brochure per tab.

.6 Reports - Include copies of all reports relating to the testing, adjusting and balancing of equipment and systems, water treatment reports and manufacturer’s start-up reports, as required by the contract specification sections.

.7 Submissions and Acceptance

First Draft
Submission

.1 Contractor shall submit a draft copy of the operations and maintenance manuals for format review at the 50% construction completion stage.

.2 The draft submission is to be bound in 3 ring loose leaf type binders and shall include the following information:

.1 A table of contents for the complete manual.

.2 Index of each division of the manual.

.3 Index of each section of the operations and maintenance divisions.

.4 A sample operations division write-up for a typical system, including sample schematic.

.5 A sample maintenance division write-up for the same typical system.

.6 Sample proof of binder covers and spines.

.3 On completion of review of the first draft submission the consultant will return the copy of the manual with review comments for resubmission.

Provisional Edition

The contractor shall submit two (2) copies of the provisional edition of the manual at the 75% construction completion stage.

The provisional edition shall be complete in all respects, except for reports and certificates to be produced during the facility start-up phase. This manual shall have the same physical format, including divider tabs and indices, as the final edition of the manual. This provisional edition may be bound in standard three- ring loose leaf binders.

One (1) copy of the provisional edition shall be kept on site as an interim reference for all parties engaged in the facility start-up phase, and shall be used to familiarize and train the operating staff.

The second copy shall be returned to the contractor with review comments.

The contractor shall update contents of the site copy of the provisional edition manual as new information is generated during the facility start-up phase.

Final Edition

Prior to final acceptance the contractor shall submit four (4) copies of the final edition of the manual.

This final edition shall include all outstanding project information and conform to all requirements listed in this document.

2.5 RECORD DRAWINGS

.1 Refer to Contract Closeout Requirements.

.2 The contractor shall keep, on site, available to the Engineer at all times and particularly for each regularly scheduled site meeting, a complete set of prints, edge bound, that are to be updated daily showing any and all deviations and changes from the Contract Drawings. This set of drawings is to be used only for this purpose, and must not be used as the daily general reference set.

.3 Provide record drawings which identify location of smoke and fire dampers, major control lines, access doors, tagged valves, and actual room names or numbers. As well, deviations that are to be recorded shall include, in general, items that are significant or are hidden from view and items of major importance to future operations and maintenance, and to future alterations and additions including cleanouts and isolation valves.

Part 3 Execution

3.1 GENERAL

.1 Submit documents to the Engineer for acceptance prior to transmitting to the Owner.

3.2 RECORD DRAWINGS

.1 Enter dimensions from building line to all shut-off valves, and other similar elements.

.2 At substantial completion, transfer all deviations, including those called up by addenda, revisions, clarifications, shop drawings, and change orders, to a set of disks to AutoCAD. Drafting quality layers, symbols, etc. shall be identical to original drawings. Prior to substantial performance, turn over a completed set of disks and a complete set of record drawings.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Demonstration of fire suppression equipment and systems operations.

.2 Instruction seminars for Owner's personnel.

1.2 QUALITY ASSURANCE

.1 Work specified shall be performed by the fire suppression subtrade.

1.3 REFERENCES

.1 Division 22

.2 Division 23

.3 Division 28

Part 2 Products

.1 Not Applicable.

Part 3 Execution

3.1 GENERAL

.1 Contractor shall arrange for presentation and demonstration of fire suppression equipment and systems by appropriate specialists and shall ensure that required manufacturer's representatives are in attendance.

.2 Coordinate demonstration and instruction agenda and schedule with the Owner and Engineer.

.3 Coordinate demonstration and instruction agenda and schedule for work performed outside the contract with the owner and engineer.

.4 Provide personnel when necessary to ensure proper detailed training is provided for all mechanical systems.

3.2 DEMONSTRATIONS

.1 Demonstrate specific starting and stopping and general maintenance requirements for each major piece of equipment. Ensure all labeling and identification is completed.

.2 Demonstrate the following systems, in the form of instruction seminars and contractor-guided tour of the facility.

.1 Fire Protection Systems

.3 Demonstrate the following pieces of equipment.

.1 Sprinkler Valve Assemblies.

.2 Preaction Sprinkler System.

.4 Refer to sample mechanical system agenda schedules in section 3.3 following for identifying the proposed sequence of demonstrations. Sequence of demonstration and duration of training seminars to suit project. Submit agenda for review by Engineer one (1) month prior to demonstration.

.5 Answer all questions raised by Owner at demonstrations; if unable to satisfactorily answer questions immediately, provide written response within three (3) days.

.6 Provide sign off sheets for each session. Sign off sheets to have attendees, date, subject, presentation by and comments. Attach the sign off sheets to the agenda and submit one (1) copy to the engineer following training seminars.

MECHANICAL SYSTEMS AGENDA (SAMPLE)

Mechanical Systems Agenda

Topic: Fire Suppression Systems

Day: 1

Start Time: 8:00 am

Meeting Place: _____

Approximate Duration: 4 hours

Agenda
.1 8:00 am: Classroom Presentation
.2 9:15 am – 11:00 am: Site Walkthrough
.3 11:00 am – Noon: Final Questions and Sign-Off Log Sheet

Personnel to be in Attendance:

.1 Mechanical Contractor and fire suppression subtrade.
.2 Maintenance Staff

Presentation Format: _____

Classroom: _____

Introduction:

.1 Distribute handouts of system description.
.2 Reference to equipment operation brochures as required.
.3 Detailed system overview by fire suppression subtrade.
.4 Review of system installations using record drawings.

Site Tour:

.1 Fire suppression subtrade to outline location of main piping runs, isolation valves, service access points.
.2 Provide written instructions on how to start and stop all systems and demonstrate using instructions during tour.

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Test sprinkler system piping.

1.2 QUALITY ASSURANCES

.1 Test equipment and material where required by specification or authority having jurisdiction to demonstrate its proper and safe operation.

.2 Test procedures in accordance with applicable portions of NFPA and other recognized test codes.

.3 Perform tests on site to the satisfaction of the Engineer.

.4 Piping, fixtures or equipment shall not be concealed or covered until installation is reviewed and accepted by the Engineer. Provide written notice to the Engineer at least three (3) days in advance of tests or concealing of piping.

.5 Coordinate with engineer at start of the project, those tests that will require witnessing by the Engineer.

.6 Submit sample test certificate forms for review two (2) weeks prior to any testing on site.

1.3 SUBMITTALS

.1 Obtain certificates of approval and acceptance, complying with rules and regulations from authorities having jurisdiction. Submit copies to be included in Operating and Maintenance Manuals.

.2 Perform tests as specified. Include test certificates in Operating and Maintenance Manuals.

1.4 LIABILITY

.1 Take charge of plant during tests, assume responsibility for damages in the event of injury to personnel, building or equipment and bear costs for liability, repairs and restoration in this connection.

1.5 REFERENCES

.1 Division 22

.2 Division 23

Part 2. Products

Not Applicable

Part 3. Execution

3.1 PRESSURE TESTS

.1 Provide equipment, materials and labour for tests and pay expenses. Use test instruments from approved laboratory or manufacturer and furnish certificate showing degree of accuracy and date of calibration. Install permanent gauges and thermometers used for tests just prior to tests to avoid possible changes in calibration.

.2 Carry out tests for eight (8) hour period and maintain pressure with no appreciable pressure drop. Where leakage occurs, repair and re-test and pay necessary costs for re-witnessing.

.3 Sprinkler System: Test as required by current edition of NFPA 13 and authorities having jurisdiction.

.4 Underground Fire Mains: Test as required by current edition of NFPA 24, and by authority having jurisdiction.

.5 When using water as test medium for preact sprinkler systems, evacuate and dehydrate the piping and certify the lines are dry. Use agency specializing in this type of work.

.6 Should tests indicate defective work or variance with specified requirements, make changes immediately to correct the defects. Correct leaks by re-making joints in screwed fittings, cutting out and re-welding welded joints, re-making joints in copper lines. Do not caulk.

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Performance testing of equipment.

.2 Manufacturer's startup of equipment.

1.2 QUALITY ASSURANCE

.1 Use factory trained representatives and submit manufacturer's check sheets for starting all systems and equipment.

.2 Testing and certification of each backflow prevention device shall be by an "Approved Cross Connection Installation Specialist". One (1) copy of the certificate to be submitted to the Water Purveyor, and one (1) copy is to be inserted in each O & M manual.

.3 Prior to starting, testing and adjusting processes, verify with Engineer any tests required to be witnessed. Provide sufficient notice to Engineer prior to commencement of procedures.

.4 Engineer shall be allowed to witness any testing, adjusting and starting procedures.

.5 Assume all costs associated with starting and testing, including the supply of testing medium.

.6 Prior to starting equipment or systems, secure and review manufacturer's installation, operation, and starting instructions. Read in conjunction with procedures defined herein.

.7 Use manufacturer's or supplier's starting personnel where required to ensure integrity of manufacturer's warranty.

.8 Compare installations to published manufacturer's data and record discrepancies. Items potentially detrimental to equipment performance shall be corrected prior to equipment starting.

.9 Some processes involved in starting procedures defined in this section may be duplications of authorities' verification. To facilitate expedient completion of project, arrange for authorities to assist or witness these procedures.

.10 All starting, testing, and procedures shall be in accordance with the testing requirements of NFPA 20 fire pumps, and of the authorities having jurisdiction.

.11 Personnel involved in starting, testing, balancing and adjusting procedures shall be experienced in the design and operation of fire suppression equipment and systems being checked and shall be able to interpret results of the readings and tests.

.12 Assume all liabilities associated with starting, testing and balancing procedures.

1.3 REFERENCES

.1 Division 22

.2 Division 23

Part 2. Products

Not Applicable.

Part 3. Execution

3.1 GENERAL

.1 Conduct performance tests to demonstrate equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct tests as soon as conditions permit. Make changes, repairs, and adjustments required prior to operating tests.

.2 Meet with Division 26 manufacturers, suppliers, and other specialists as required to ensure all phases of work are properly coordinated prior to commencement of each particular testing procedure. Establish all necessary manpower requirements.

.3 Operate and test motors and speed switches for correct wiring and sequences and direction of rotation. Check and record overload heaters in motor starters.

.4 Confirm voltages and operating amperages at full load.

.5 Failure to follow instructions pertaining to correct starting procedures may result in re-evaluation of equipment by an Independent Testing Agency selected by Owner at Contractor's expense. Should results reveal equipment has not been properly started, equipment may be rejected, removed from site, and replaced. Replacement equipment shall also be subject to full starting procedures, using same procedures specified on the originally installed equipment.

3.2 PROCEDURES

.1 Procedure shall be identified in the following five (5) distinct phases:

.1 Pre-Starting: Visual inspection.

.2 Starting: Actual starting procedure.

.3 Post-Starting: Operational testing, adjusting or balancing, and equipment run-in phase.

.4 Pre-Interim Acceptance of the Work: Final cleaning, re-testing, balancing and adjusting, and necessary maintenance.

.5 Post-Interim Acceptance of the Work: Repeat tests and fine-tuning resulting from corrective action of deficiency clean-up.

.2 Check specified and shop drawing data against installed data.

.3 Check the installation is as defined by contract documents and as per manufacturer's recommendations including manufacturer's installation check sheets.

3.3 CONTRATOR TESTING RESPONSIBILITIES

.1 Sprinkler Systems

.1 Record incoming water pressure to building once a day for ten (10) days.

.2 Record flow and pressure.

.3 Test sprinkler system as per NFPA 13.

.2 Fire Extinguishers

.1 Check that no pressure drop occurs over a twenty (20) day period.

END OF SECTION

Part 1. General

1.1 QUALITY ASSURANCE

.1 Welding materials, fabrication standards and labour qualifications must conform to ANSI/ASME B31.1, ANSI B16.25, ASME Section IX, and the Provincial Board of Labour Regulations.

.2 Use welders fully qualified and licensed by Provincial Authorities.

.3 Automatic Sprinkler System Piping: NFPA No. 13, Standard for the Installation of Sprinkler Systems.

.4 Domestic Water Piping: Federal, Provincial and Municipal codes.

.5 All steel piping below grade shall be yellow jacketed.

.6 Non specified pipe joining and pipe fitting methods such as T-drill and Press Fit are not permitted in any piping system covered under Division 21.

Part 2. Products

2.1 PIPE

	Service	Material
.1	Equipment drains and overflows	Schedule 40, galvanized steel, ASTM A120
		Type 'L' hard copper, ASTM B88M
.2	Fire protection	As per NFPA 13 and NFPA 14

2.2 FITTINGS AND JOINTS

	Service	Material	Joint
.1	Fire protection	Malleable iron or cast iron	Screwed or Flanged
		Banded malleable Iron or steel	Grooved Mechanical
		Steel, same Schedule as pipe	Welded

NOTE: Grooved mechanical fittings are only permitted in areas where piping is exposed and in T-bar ceiling spaces. Grooved mechanical couplings are not permitted in concealed space such as walls or non-accessible ceiling spaces.

.2 Use factory fabricated butt welded fittings for welded steel pipes.

.3 Use long radius elbows for steel and cast iron water piping.

2.3 UNIONS, FLANGES AND COUPLINGS

.1 Size 50 mm and under: 1035 kPa malleable iron, bronze to iron ground joint unions for threaded ferrous piping, air tested for gas service, all bronze for copper piping.

.2 Sizes 65 mm and over: 1035 kPa forged steel welding neck flanges for ferrous piping, 1035 kPa bronze slip-on flanges for copper piping.

.3 Flange bolting: For systems up to 120°C, use carbon steel stud bolts, semi-finished, and heavy hex nuts, ASTM A307-GrB. For systems up to 215°C, use alloy steel bolts ASTM A193-GrB7, and semi-finished heavy hex nuts ASTM A194-Gr2H

.4 Where permitted by the Engineer, use grooved mechanical couplings to engage and lock grooved or shouldered pipe ends and to allow for some angular deflection, contraction and expansion.

1. Couplings consist of malleable iron housing-clamps, C-shaped composition sealing gasket EPDM Grade `E' and steel bolts.
2. Use galvanized couplings for galvanized pipe.
3. Rigid grooved mechanical couplings shall have an angle bolt pattern design and shall provide system support and hanging requirements in accordance with ASME B31.1. Rigid couplings shall be used in all locations unless otherwise noted. Standard of acceptance Victaulic Style 07.
4. Flexible grooved mechanical couplings shall only be used around equipment to attenuate noise and vibration. Noise and vibration reduction at mechanical equipment is achieved by installing three flexible couplings near the vibrations source. Standard of acceptance Victaulic Style 77, 75.

Part 3. Execution

3.1 PREPARATION

.1 Ream pipes and tubes. Clean off scale and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.

.2 Protect all steel pipes when stored on site from external conditions and ensure protective coating remains intact. If in the opinion of the engineer, deterioration of the protective coating has instigated corrosion, all rust must be removed down to bare metal and prime coated with red oxide paint.

.3 Use manufacturer roll grooving tools to groove pipe in accordance with manufacturer’s specifications. Use copper rolls for copper pipe and stainless steel rolls for stainless steel pipe as provided by Manufacturer.

3.2 CONNECTION

.1 Screw joint steel piping up to and including 40 mm. Weld piping 65 mm and larger, including branch connections. Screw or weld 50 mm piping for liquid systems, weld 50 mm piping for air and gas systems.

.2 Make screwed joints with full cut standard taper pipe threads with accepted Teflon tape or non-toxic joint compound applied to male threads only, equal to Jet-Lube V-2 multi-purpose thread sealant.

.3 Use galvanized couplings with galvanized pipe.

.4 Make connections to equipment, specialty components, and branch mains after isolation valves, with unions or flanges.

.5 Provide dielectric type connections wherever jointing dissimilar metals in open systems. Brass adapters and valves are acceptable.

.6 Use grooved mechanical couplings and mechanical fasteners as manufactured by Victaulic where allowed, in accessible locations and mechanical rooms and where access can be obtained without removal of equipment or other materials such as ductwork etc.

1. All grooved components shall be of one manufacturer and conform to local code approval.

2. A gauged torque wrench must be used if required by the manufacturer.

3.3 ROUTE AND GRADES

.1 Route piping in orderly manner and maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run piping within open open web steel joist space, as close to steel deck as possible with drops to required weights. Group piping wherever practical at common elevations. Install concealed pipes close to the building structure to keep furring to a minimum.

.2 Slope water piping 0.2% and provide hose bibb drains at low points.

.3 Equip low points with 20 mm drain valves and hose nipples.

.4 Make reductions in water pipes with eccentric reducing fittings installed to provide drainage and venting. Top flat for water.

.5 Grade horizontal drainage and vent piping 2% minimum.

.6 Pipe the discharge from all relief valves, safety valves, vents, drains, equipment blowdowns, water columns, and overflows to the nearest building drain.

.7 Coordinate pipe routing with other mechanical and electrical trades. Access to equipment is not to be obstructed by fire suppression piping. Fire suppression piping is not to be installed below fan coil units.

3.4 INSTALLATION

.1 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.

.2 Provide clearance for proper access to valves, air vents, drains and unions.

.3 Install piping material specified as inside the building to 3000 mm outside of building.

.4 Yellow jacket all buried steel lines. Test all buried lines prior to backfill with holiday detector, “JEEPING”. All lines exposed to outdoors (unless insulated and clad) to be painted. Repair any damaged covering.

3.5 WELDED PIPE BRANCH CONNECTIONS

.1 Make branch connections according to the following schedule:

Legend:
T: Forged tee or reducing tee
S: Socolet
W: Weldolet

HEADER	15 mm	20 mm	25 mm	30 mm	40 mm	50 m	65 mm	75 mm	100 mm	150 mm	200 mm	250 mm	300 mm
15 mm	T												
20 mm	T	T											
25 mm	T	T	T										
30 mm	T	T	T	T									
40 mm	T	T	T	T	T								
50 m	S	S	S	T	T	T							
65 mm	S	S	S	S	T	T	T						
75 mm	S	S	S	S	S	T	T	T					
100 mm	S	S	S	S	S	T	T	T	T				
150 mm	S	S	S	S	S	W	T	T	T	T			
200 mm	S	S	S	S	S	W	W	W	T	T	*T*		
250 mm	S	S	S	S	S	W	W	W	W	T	*T*	T	
300 mm	S	S	S	S	S	W	W	W	W	W	*T*	T	T
	15	20	25	30	40	50	65	75	100	150	*200*	250	300

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Gate valves.

.2 Check valves.

.3 Drain valves.

1.2 MANUFACTURER

.1 Provide valves of the same type by the same manufacturer throughout.

.2 Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.

.3 All valves shall meet the requirements of the Manufacturers Standardization Society, Standard Practise standards, latest edition., SP-70 Cast Iron Gate Valves, SP-71 Cast Iron Check Valves, SP-80 Bronze Gate, Globe, Angle and Check Valves and SP-82 for pressure testing.

1.3 SHOW DRAWINGS

.1 Submit copies of valves "ordering schedule" for review before ordering valves.

.2 Submit detailed shop drawings clearly indicating make, model, size, pressure rating, materials of construction and intended service.

Part 2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Gate Valves: Jenkins, Crane, Toyo, Kitz.

.2 Swing Check Valves: Jenkins, Crane, Toyo, Kitz, Mueller SPX, Moygro.

.3 Drain Valves: Dahl, Crane, Jenkins, Toyo, Kitz, Hammond.

2.2 DOMESTIC COLD WATER SYSTEM

.1 Cast iron wafer full-lug body, Stainless steel shaft keyed to disk, NDI, replaceable EPDM seat, lever lock handle operator with multiple position lock plate for valve sizes to 100 mm, heavy duty gear handwheel operator with position indicator for valve sizes 150 mm and over. Minimum bi-directional rating 1000 kPa, 121°C. Full rating for end of line or isolation shut off service. DeZurik Fig. 632 R.S., Bray Series 31 c/w trim 119, Kitz #6122 EL, Apollo #143CBE.

2.3 FIRE PROTECTION SYSTEM

.1 Gate Valves up to 50 mm: Bronze body, threaded ends, O.S. and Y, rising stem, screw-in bonnet, solid wedge, rating 1380 kPa water, Underwriters listed. Jenkins Figure 820J.

.2 Gate Valves over 50 mm: Cast iron body, flanged ends, O. S. and Y, rising stem, bronze trim, solid wedge, wheel handle, rating 1380 kPa. Underwriters listed. Jenkins Figure 825AJ.

.3 Gate Valves Underground: Cast iron body, mechanical joint or flanged ends, inside screw, non-rising stem, bronze trim, solid wedge, square operating nut, rating 1380 kPa water, Underwriters listed. Indicator post operator, Underwriters listed.

.4 FM and ULC approved, cast iron lug-wafer body, bronze disc, BUNA-N liner. 1380 kPa at 68°C. Jenkins Figure 2232 BUJ, Grinnell Model WC-8282-3.

.5 Swing Check Valves up to 50 mm: Bronze body threaded ends, screw-in cap, renewable composition disc rating 2070 kPa W.O.G. Jenkins Figure 4475J, Milwaulkee #510.

.6 Swing Check Valves 65 mm and Over: Cast iron body, flanged ends, bolted cover, regrind-renew bronze disc and seat ring, rating 1205 kPa water. Underwriters listed. Jenkins figure 477. Check valves serving Siamese connections provided with rubber faced disc. Jenkins Figure 477J

.7 All operable valves to be complete with supervisory switches, valve operators.

2.4 VALVE OPERATORS

.1 Provide suitable hand wheels for gate, globe or angle and drain valves, and inside hose bibbs.

.2 Provide one plug cock wrench for every ten (10) plug cocks sized 50 mm and smaller, minimum of one (1). Provide each plug cock sized 65 mm and larger with a wrench, with set screw.

.3 Provide valves larger than 100 mm located more than 2.1 m from floor in equipment rooms with chain operated sheaves. Extend chains to 1.5 m above floor and hook to clips to arrange to clear walking aisles.

Part 3. Execution

3.1 INSTALLATION AND APPLICATION

.1 Install valves with stem upright or horizontal, not inverted.

.2 Install valves for shut-off and isolating service, to isolate all equipment, parts of systems, or vertical risers.

.3 Provide drain valves at main shut-off valves, low points of piping and apparatus and terminal units.

.4 Size drain lines and drain valves equal to size of apparatus drain connection.

.5 For pipe sizes 20 mm and over, minimum drain size to be 20 mm.

.6 Provide hose thread connection with cap and chain for 20 mm drain valves located in ceiling and public areas.

.7 Provide male NPT nipples with threaded pipe cap for drain sizes over 20 mm where not piped directly to floor drains.

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Pipe hangers and supports

.2 Sleeving for mechanical equipment

1.2 REFERENCE STANDARDS

.1 Automatic sprinkler pipe supports shall meet the requirements of NFPA No. 13, Standard for the Installation of Sprinkler Systems.

1.3 GENERAL REQUIREMENTS

.1 Provide hangers and supports to secure piping and equipment in place, prevent vibration, maintain grade, provide for expansion and contraction.

.2 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.

.3 Select hangers and supports for the service and in accordance with manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.

.4 Fasten hangers and supports to building structure or inserts in concrete construction.

.5 Provide and set sleeves or block-outs required for equipment, including openings required for placing equipment.

.6 Provide sleeves for all piping through rated assemblies.

.7 Provide sleeves for all piping through ceilings, floors and footings.

.8 Do not weld piping, ductwork or equipment supports to building metal decking or building structural steel supports unless prior written acceptance has been obtained from the structural engineer.

.9 Obtain acceptance prior to drilling for inserts and supports for piping system. Discuss and obtain acceptance for hanging systems and methods with Structural Engineer.

.10 Obtain acceptance prior to using percussion type fastenings.

.11 Use of piping or equipment for hanger supports and use of perforated band iron, wire or chain as hangers is not permitted.

1.4 SUBMITTALS

.1 Submit shop drawings of each factory fabricated component.

Part 2. Products

2.1 INSERTS

.1 Inserts shall be galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.

.2 Size inserts to suit threaded hanger rods.

2.2 PIPE HANGERS AND SUPPORTS

.1 Hangers, Pipe Sizes 15 mm to 40 mm: Adjustable wrought steel clevis.

.2 Hangers, Pipe Sizes 50 mm and over: Adjustable wrought steel clevis.

.3 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods. Cup washers for hot piping below 150 mm.

.4 Wall Support, Pipe Sizes to 80 mm: Cast iron hook.

.5 Wall Support, Pipe Sizes 100 mm and Over: Welded steel bracket and wrought steel clamp, adjustable steel yoke and cast iron roll for hot pipe sizes 150 mm and over.

.6 Vertical Support: Steel riser clamp.

.7 Floor Support, Pipe Sizes to 100 mm and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier or steel support.

.8 Floor Support, Hot Pipe Sizes 125 mm and over: Adjustable cast iron roll and stand, steel screws and concrete pier to steel support.

.9 Design hangers so they cannot become disengaged by movements of supported pipe.

.10 Provide copper plated hangers and supports for copper piping.

.11 Provide galvanized hangers and supports for galvanized piping.

.12 Support all piping below grade and under floor slabs in *3.2 mm* continuous cadmium plated channel.

.1 Support channel with cadmium plated clevis hangers and rods. Install supports on centres as specified in 3.2.

.2 Extend cadmium plated hanger rods *450 mm* above slab rebar and bend back over rebar so as to provide a minimum of *450 mm* of support in slab.

.3 Do not stress rod when bending

2.3 HANGER RODS

.1 Provide cadmium rods, threaded both ends, threaded one end, or continuous threaded

2.4 SLEEVES

.1 Pipes through Floors: Form with steel pipe or accepted PVC sleeves.

.2 Pipes through Beams, Walls, Fire Proofing, Footings, Potentially Wet Floor: Form with steel pipe.

.3 Size large enough to allow for movement due to expansion and to provide for continuous insulation.

2.5 SEALS

.1 Provide modular mechanical type seals between pipes and sleeves where passing through perimeter walls below grade (basement). These to consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve when linking bolts are tightened in sequence. Equal to "Link-seal" by Thunderline.

Part 3. Execution

3.1 INSERTS

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over 100 mm.

.3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed 100 mm minimum square steel plate and nut above slab.

3.2 PIPE HANGERS AND SUPPORTS

.1 Support horizontal steel and copper piping as follows:

Nominal Pipe Size (mm)	Distance Between Supports (mm)		Hanger Rod Diameter (mm)
	Steel	Copper	
15 to 20	1800	1500	10
25 to 40	2100	1800	10
50 to 65	3000	2400	10
80 to 100	3600	3000	16
150 to 300	4200	4000	22
350 to 450	6000		25

.2 Install hangers to provide minimum 15 mm clear space between adjacent work.

.3 Place a hanger within 300 mm of each horizontal elbow.

.4 Use hangers which are vertically adjustable 40 mm minimum after piping is erected.

.5 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.6 Where practical, support riser piping independently of connected horizontal piping.

3.3 SLEEVES

.1 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeve.

.2 Extend sleeves through potentially wet floors 25 mm above finished floor level. Caulk sleeves full depth and provide floor plate.

.3 Piping passing through floor, ceiling or wall, close off space between duct and sleeve with non-combustible insulation. Caulk both sides.

.4 Piping passing through perimeter walls below grade, mechanical room floor, close off space between pipe and sleeve with synthetic rubber compound mechanical type seals.

.5 Sleeves provided through walls or floors where liquids could potentially pass from one side to the other, provide sleeves with a 25 mm 'flange' welded to the external face of the sleeve at the mid-point of the thickness of the structure to provide a water stop.

.6 Install chrome plated escutcheons where piping passes through finished surfaces.

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Painting and Identification for fire suppression work.

1.2 REFERENCES

.1 Division 09

.2 Division 22

.3 Division 23

1.3 QUALITY CONTROL

.1 Coordinate colour coding of piping and equipment with work of Section 09 90 00.

.2 Colour code mechanical equipment, piping and exposed ductwork. Refer to colour schedule at end of this section.

.3 Legend and direction of flow arrows shall consist of adhesive backed labels, yellow colour, with minimum 20 mm high black lettering equal to Brady System B-500, vinyl cloth labels for non-insulated surfaces; and Brady B946 for insulated surfaces.

1.4 EQUIPMENT PROTECTION AND CLEAN-UP

.1 Ensure that new and existing equipment and surfaces are carefully covered with tarping, or heavy duty plastic. Ensure that spills and splatter on finishes and equipment are cleaned up totally and promptly.

Part 2. Products

Not Applicable

Part 3. Execution

3.1 GENERAL

.1 Paint exposed piping in non-service spaces as per architect. Paint exposed piping in service and mechanical spaces and in ceiling spaces as per colour schedule at end of this section.

.2 Provide 20 mm diameter brass, lamacoid or metal photo black numbers, secured to valve stem with key chain.

.3 Provide neat, typewritten directories, giving valve number, services and location. Frame one copy under glass for wall mounting as directed, second copy to be forwarded to Owner. Include copies in O & M Manuals.

.4 Identify all equipment excluding pipe and duct with screwed down lamacoid plates having 6 mm minimum letter size. Identification to match as built drawings equipment name and number.

.5 Identify the location of the following items of equipment which are concealed above a ceiling with Avery "Data Dots". The colours shall conform to the following schedule:

.1 Fire, smoke, and sprinkler equipment red

.6 When T-bar ceilings are installed, adhere "Data Dots" on T-bar framing adjacent to panel to be removed.

3.2 COLOUR CODE SCHEDULE

.1 Colour numbers are called for in Canadian Government Specification No. 5-GP 1a. Colours assigned from CGSB 1-GP-12c for colour code identification.

.1 Mechanical Primary Colours for Pipe Lines/Equipment

Yellow	505-102
Light Blue	502-106
Green	503-107
Orange	508-102
Brown	504-103
Red	509-102
White	513-101
Aluminum	515-101
Purple	501-101
Grey	501-107

.2 Secondary Colours For Bands

Red	509-102
Orange	508-102
Blue	502-106

.3 Banding

Red	to indicate extremely hazardous
Orange	to indicate mildly hazardous material
Blue	to indicate non-hazardous material

.2 Identification Symbols and Colours for Piping

	Pipe Colour	Stripe Colour	Symbol
Sprinkler	Red	None	
Carbon Dioxide (Fire)	Red	None	C02

.3 Equipment Bases/Housekeeping Pads:

.1 Grey, with 100 mm yellow and black angled bands around edges.

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Equipment, piping, including sprinkler heads, valves, hangers and supports, sleeves, fire department connections, and accessories

.2 Contractor shall be responsible for coordination of all fire alarm interlocks with Division 28.

1.2 REFERENCES

.1 Division 22

.2 Division 23

.3 Division 28

1.3 GENERAL REQUIREMENTS

.1 Provide complete sprinkler system as required by local codes and as indicated on drawings. Size of sprinkler system based on applicable occupancy group for type of building.

.2 Provide sprinklers for areas as indicated and as required, including specialized rooms. Run piping concealed above furred ceilings and in joist to minimize obstructions. Expose only heads.

.3 Hydraulically size sprinkler system based on the actual water supply data which must be obtained from municipal utility.

1.4 QUALITY ASSURANCE

.1 Sprinkler equipment and installation shall be in accordance with the current edition of NFPA 13 - Standard for the Installation of Sprinkler Systems.

.2 Sprinkler equipment and installation shall be in accordance with the current standards required by IAO, Insurers Advisory Organization, Owner's Underwriters and approved by the Authority Having Jurisdiction.

.3 Sprinkler equipment shall be installed by qualified contractors licensed and regularly engaged in installation of automatic fire sprinkler equipment.

1.5 SUBMITTALS

.1 Refer to Section 01 33 00, Submittal Procedures.

.2 Submit preliminary layout showing only head locations for review by the Architect. Refer to architectural plans for ceiling coordinated head locations, space all others to Code Standard.

.3 Submit shop drawings, hydraulic calculations and equipment data of entire sprinkler system. Submitted drawings to be designed and stamped by a Professional Engineer licensed to practice in the Province of Alberta.

.4 Submit for acceptance, sample of all types of sprinkler heads to be used.

.5 Refer to Section 01 78 00, Closeout Submittals.

1.6 ENGINEERING DESIGN CRITERIA

.1 Design system in accordance with NFPA 13, using following parameters:

.1 Hazard:

.1 To suit occupancy classification based on the quantity and/or combustibility of the building contents.

.2 Pipe size and layout:

.1 Hydraulic design in accordance with NFPA standards and the Owner's Insurance Underwriter requirements, whichever is more stringent.

.2 Sprinkler head layout: to NFPA 13 or as directed by Authority Having Jurisdiction.

.3 Water Supply:

.1 Conduct flow and pressure test of water supply in vicinity of project to obtain criteria for bases of design in accordance with NFPA 13.

.4 Zoning:

.1 System zoning as indicated or in accordance with NFPA standards or as identified on floor plans; whichever is more stringent.

1.7 MAINTENANCE DATA AND MATERIALS

.1 Provide maintenance data for incorporation into manual specified in Operation and Maintenance Data.

.2 Provide maintenance materials in accordance with Maintenance Materials, Special Tools and Spare Parts.

.3 Provide spare sprinklers and tools as indicated in 2.11 – Spare Parts Cabinet.

Part 2. Products

2.1 ACCEPTABLE CONTRACTORS

.1 SimplexGrinnell, Vipond, Viking, Gisborne.

2.2 PIPE, FITTINGS, VALVES, SUPPORTS, SLEEVES

.1 Pipe and fittings and joints to conform to Section 21 05 09, Pipe & Pipe Fittings for Fire Suppression.

.2 Valves shall conform to Section 21 05 23, General Duty Valves for Water Based Fire Suppression Systems.

.3 Pipe hangers, supports and sleeves shall conform to Section 21 05 29, Hangers and Supports for Water Based Fire Suppression Piping.

.4 Pipe and valve identification shall conform to Section 21 05 53, Painting and Identification for Fire Suppression.

2.3 SPRINKLER HEAD

.1 Temperature rating on fusible links shall suit specific hazard area and ceiling temperature with minimum margin of safety 10°C.

.2 For suspended/drywall ceilings, provide concealed pendant type sprinkler heads with white plated finish and white escutcheon.

.3 For exposed areas, provide standard upright type with brass finish.

.4 For sidewall application, provide sidewall type with white plated finish and white escutcheon.

.5 For areas where the sprinkler head may be subject to freezing, provide ULC Listed semi-recessed type sprinkler heads with white plated finish and white escutcheon.

.6 For Secure Area between gridlines 7-10 and B, provide Viking: Model HQR-2 - Institutional quick response standard coverage/extended coverage flush pendent sprinkler.

.1 Sprinkler Base Part No. 10554

.2 Sprinkler Identification No. VK410

.3 Escutcheon Package Base Part No. 10627

2.4 SUPERVISORY SWITCHES

.1 General: to NFPA 13 and ULC listed for fire service.

.2 All valves that control the supply of water to automatic sprinklers shall be electrically supervised to indicate a supervisory signal on the fire alarm system.

.3 Isolation valves supervisory switch:

.1 ULC listed supervisory switch one or two sets single pole double throw contacts normally open or normally closed contacts. Contacts to be rated a minimum 15.0 Amps at 125/250VAC and 2.5 Amps at 30VDC.

.4 Water flow switch:

.1 ULC listed paddle type waterflow switch with retard device with one (1) or two (2) sets of single pole double throw normally open or normally closed contacts. Contacts to be rated a minimum 15.0 Amps at 125/250VAC and 2.0 Amps at 30VDC. Cover shall incorporate tamper resistant screws.

2.5 FIRE DEPARTMENT CONNECTION

.1 Provide two-way standard fire department connection with chrome plated finish, local fire department thread, plugs and chains, 12 mm automatic drip marked "Sprinkler Fire Department Connection". Fire department connection type to match Municipal District of Opportunity 17 requirements.

.2 To ANSI/NFPA 13 and ULC listed, Siamese type, location as indicated. Thread specifications to be compatible with local fire department.

.3 Siamese fire department connection for sprinkler system shall match connection for standpipe and hose system.

2.6 PRESSURE GAUGES

.1 ULC listed and to Meters and Gauges for Fire Suppression Systems.

.2 Shall have maximum limit of not less than twice normal working pressure at point where installed.

.3 A pressure gauge with a connection not smaller than 6mm shall be installed at the system main drain, at each main drain associated with a floor control valve, and on the inlet and outlet side of each pressure-reducing valve. Each gauge connection shall be equipped with a shutoff valve and provisions for draining.

2.7 SPARE PARTS CABINET

.1 For storage of maintenance materials, spare sprinkler heads and sprinkler wrench.

.2 Construct to sprinkler head manufacturers standard.

.3 Provide on wall near sprinkler valve, cabinet containing extra sprinkler heads of each type and a wrench suitable for each head type. Six (6) extra sprinkler heads for less than 300 sprinklers, 12 for 300 to 1000 sprinklers, and 24 for over 1000 sprinkler heads of each type.

2.8 BACKFLOW PREVENTOR

.1 Provide on sprinkler take-off from water supply ULC approved double check valve assembly with all necessary test cocks, drain valves and OS & Y gate valves on both sides of check valves.

2.9 ANTIFREEZE SYSTEMS

.1 Provide a ULC approved reduced pressure backflow prevention assembly with OS&Y gate valves, drain funnel and test cocks. Drain funnel to be permanently piped to a floor drain.

.2 Provide diaphragm type expansion tank c/w pressure gauge. The expansion tank to be sized to suit capacity of piping in accordance with NFPA 13.

.3 Provide fill connection and drain connections with all necessary valves in accordance with NFPA 13.

.4 Antifreeze system to be filled with 50% propylene glycol 50% water mixture to maintain protection from freezing conditions. Verify that the solution will provide protection to -40^{o}C.

Part 3. Execution

3.1 INSTALLATION

.1 Install, inspect and test to acceptance with NFPA 13 and local authorities.

.2 Protect sprinkler heads against mechanical injury with standard guards when necessary.

.3 Locate outside alarms on wall of building adjacent to Siamese fire department connection.

.4 Provide on sprinkler system take-off from water supply ULC approved double check valve assembly.

.5 All sprinkler system isolation valves, including those on glycol loops (in areas subject to freezing), shall have fire alarm contacts that can be monitored on the building fire alarm system. Coordinate contact type and wiring with Division 26.

.6 Centre heads in one direction in ceiling tile. Sprinkler head locations shall be located symmetrically within each room or area but shall not exceed the manufactures ULC listed maximum spacing.

.7 Locate zone shut-off valves visible from the floor. Do not conceal from view, locate in janitor, storage rooms, or stairwells as accepted by the Engineer.

.8 Arrange sprinkler piping and provide auxiliary drain valves such that it is completely drainable. Extend drain lines to the floor level within the reach of a floor drain with a 15 m hose.

.9 Provide sprinkler flow test connections as per NFPA 13.

.10 Identify all piping and isolation valves in accordance with Section 21 05 53, Painting and Identification for Fire Suppression.

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Fire extinguishers and fire extinguisher cabinets.

1.2 GENERAL REQUIREMENTS

.1 Provide portable hand extinguishers where indicated on drawings and specified herein.

1.3 QUALITY ASSURANCE

.1 Fire protection equipment and installation shall be approved by local Fire Commissioner.

.2 Equipment and installation shall meet the requirements of NFPA No. 10 Portable Fire Extinguishers.

1.4 SUBMITTALS

.1 Submit shop drawings for review.

Part 2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Fire extinguishers: National, Flag, Kidde, CFH.

.2 Fire extinguisher cabinets: Williams Brothers, National Fire Equipment

2.2 PORTABLE HAND FIRE EXTINGUISHERS

.1 Multi-purpose Dry Chemical ABC (Type 1): Stored pressure with hose and shut-off nozzle or integral shut-off nozzle and mounting brackets 4.5 kg capacity rating 4A:60BC.

.2 Carbon Dioxide: Hose and horn discharge, self-closing lever or squeeze grip operated, insulated handle fully charge and complete with mounting brackets, 2.25 kg capacity, rating 5BC.

2.3 FIRE EXTINGUISHER CABINETS AND BRACKETS

.1 Surface mount Fire Extinguisher Cabinet: 1.6 mm steel construction with 2.7 mm fully opening door in adjustable frame, 6 mm wired glass full panel door approved latching device, prime coat.

.2 Semi Recessed Fire Extinguisher Cabinet: 1.6 mm steel construction with 2.7 mm fully opening door with acrylic bubble canopy for installation in a 100 mm wall, approved latching device, gray baked enamel finish size to accommodate 4.5kg CO2, dry chemical or 10L stored pressure water extinguisher.

.3 Recessed Fire Extinguisher Cabinet: 1.6 mm steel construction with 2.7 mm fully opening door in adjustable frame, 6 mm wired lexan full panel door, approved latching device, gray baked enamel finish, size to accommodate 4.5kg dry chemical fire extinguisher.

Part 3. Execution

3.1 INSTALLATION

.1 Install extinguisher cabinet so that the bottom of the extinguisher cabinet is 914 mm from the floor.

.2 Use extinguisher cabinet mounting hardware appropriate to the fire extinguisher cabinet. Minimum two screws each at both the top and bottom rear of cabinet anchored to the building structural members or backing attached to the structural members.

3.2 SCHEDULES

Fire Extinguisher Type	Cabinet Type	Size	Rating	Type
FEX-1	Semi-Recessed	4.5kg	4A:60BC	Dry Chemical
FEX-2	Wall Hook	4.5kg	4A:60BC	Dry Chemical
FEX-3	Recessed (Fire Rated, Lockable)	4.5kg	4A:60BC	Dry Chemical
FEX-4	Wall Hook	2.25kg	5BC	Carbon Dioxide

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Secure and assemble all necessary literature describing the operation and maintenance of all equipment provided. Complete and transmit documentation for review to Engineer at project milestones.

.2 Operating and Maintenance Manuals

.3 Record Drawings

1.2 QUALITY ASSURANCE

.1 Work specified in this section shall be performed by an Independent Agency specializing in this type of work.

1.3 REFERENCES

.1 Division 00

.2 Division 01

.3 Division 21

.4 Division 23

Part 2. Products

2.1 OPERATING AND MAINTENANCE MANUALS

.1 Refer to Operating and Maintenance Data.

.2 Refer to Project Record Documents.

2.2 BINDERS

.1 Provide two (2) hard copy sets of Operations and Maintenance Manuals and one (1) electronic copy on USB.

.2 Each set of manuals shall include as many binders as required to accommodate the project information.

.3 Binders shall be 216 mm x 280 mm, three (3) post, expanding spine type, with metal piano hinges and bound with heavy fabric.

.4 Maximum binder thickness when filled shall not exceed 100 mm, including a space allowance for 10% additional data.

.5 Binder colour shall be blue, Ontario buckram fabric, colour #OBV460.

.6 Project title and identification shall be silk screened on the front cover and spine. All lettering and borders shall be white.

.7 Binder spine identification to include Volume #, Set #, Title Description, Facility Name and Facility Location.

.8 Contractor to submit proof of cover layout for review prior to ordering binders.

2.3 TABS

.1 The divider tabs shall be laminated Mylar plastic and coloured according to division and section.

.2 Plastic tabs with typewritten card inserts will not be accepted.

.3 Each tab to include tab number and title printed on the tab.

.4 The colouring for tabs for individual sections is as follows:

.1 Yellow Miscellaneous Systems

.2 Purple Plumbing Systems

2.4 MANUAL DIVISIONS

.1 Organize each manual into the following divisions.

.1 Operation Division

.2 Maintenance Division

.3 Contract Documentation Division

2.5 OPERATIONS DIVISIONS

.1 The operations division shall have all data organized into sections according to the system category with individual divider tabs as follows:

.1 MIS Miscellaneous Systems

.2 PLG Plumbing Systems

.2 Organize data for each system category (section) into individual sub-systems. Provide an index for each system category and a divider tab for each individual system.

.3 For each individual sub-system include the following:

.1 System Description - Provide details of system type, composition, areas served, location in the building, design criteria and function of major components. All equipment arranged to operate together as one system shall be considered part of that system description. Design criteria shall, at minimum, include the following:

.1 Future load allowances

.2 Standby capabilities

.3 Calculated load and design capacity of domestic water supply mains.

.4 Calculated load and design capacity of drainage mains.

.2 System Schematic - Provide a system schematic showing all components comprising the domestic hot/cold/recirculation water systems, fuel oil system, compressed air system.

.3 Operating Instructions - Provide, in "operator" layman language, the specific instructions for start-up, shutdown and seasonal changeover of each system component. Include exact type and specific location of each switch and device to be used in the system operation. Identify safety devices and interlocks that must be satisfied in order for the equipment to start. Also, list conditions to be fulfilled before attempting equipment start-up, i.e. valves position correct, glycol mixture concentration proper, piping filled with fluid, filters/strainers in place, etc.

.4 Equipment Identification - Provide data for each system component on equipment identification forms equal to the standard forms obtained from the design consultant.

The consultant shall provide one sample reproducible copy of a form for use by the contractor. New forms produced by the contractor shall follow the same format as the sample form and contain all required information.

.5 Maintenance Division

.1 Organize data into the following sections with divider tabs:

.1 Maintenance Tasks and Schedules.
.2 Spare Parts.
.3 Suppliers and Contractors.
.4 Tags and Directories.

.2 Maintenance Tasks and Schedules - Organize data according to the system category, with further breakdown into individual systems as used in the operations division of the manual. Provide section index and divider tabs for each system category. Summarize maintenance tasks from manufacturer’s maintenance brochures, for each component of each system in the following format:

.1 Daily.
.2 Weekly.
.3 Monthly.
.4 Semi-annually.
.5 Annually.
.6 When Required.

.3 Spare Part List - Organize data according to the system category, with further breakdown into individual systems as used in the operations division of the manual. Provide section index and divider tabs for each system category. Summarize from manufacturers maintenance brochures the recommended spare parts for each component of each system.

.4 Suppliers and Contractor List - Provide summary of Suppliers and Contractors for each components of each system. List name, address and telephone number of each.

.5 Tags and Directories - Provide a copy of the Mechanical Drawing, List, Valve Tag List, Piping Identification Schedule and all other directories as specified in the contract documents.

.6 Contract Documentation Division

.1 Organize all data required by the construction contract into sections, with divider tabs, as follows:

.1 Drawings List.
.2 Shop Drawings and Product Data.
.3 Certifications.
.4 Warranties and Bonds.
.5 Maintenance Brochures.
.6 Reports.

.2 Shop Drawings and Product Data - Provide final copies of all shop drawings and product data required by the contract documents. Include section index and divider tabs. Maximum of twenty-five (25) sheets or one (1) system shop drawing per tab.

.3 Certifications - Provide copies of Contractor Certifications for the performance of product and systems. Include copies of all pressure tests for piping and ductwork systems, equipment alignment certificates, local authority inspection reviews, backflow prevention certification, and fire protection certifications. Include section index and divider tabs with maximum of twenty-five sheets (25) or one report per tab.

.4 Warranties and Bonds - Include one copy each of the Contractor's, warranty, manufacturers' warranties longer than one year, the bond, and any service contract provided by the contractor. Provided section index.

.5 Maintenance Brochures - Include copies of all manufacturers' printed maintenance brochures pertaining to each product, equipment or system. Provide section index and divider tabs. Maximum of twenty-five (25) sheets or one system brochure per tab.

.6 Reports - Include copies of all reports relating to the testing, adjusting and balancing of equipment and systems, water treatment reports and manufacturer’s start-up reports, as required by the contract specification sections.

.7 Submissions and Approvals

.1 <u>First Draft Submission</u>

.1 Contractor shall submit a draft copy of the operations and maintenance manuals for format review at the 50% construction completion stage.

.2 The draft submission is to be bound in 3 ring loose leaf type binders and shall include the following information:

.1 A table of contents for the complete manual.

.2 Index of each division of the manual.

.3 Index of each section of the operations and maintenance divisions.

.4 A sample operations division write-up for a typical system, including sample schematic.

.5 A sample maintenance division write-up for the same typical system.

.6 Sample proof of binder covers and spines.

.3 On completion of review of the first draft submission the consultant will return the copy of the manual with review comments for resubmission.

.2 Provisional Edition

.1 The contractor shall submit two (2) copies of the provisional edition of the manual at the 75% construction completion stage.

.2 The provisional edition shall be complete in all respects, except for reports and certificates to be produced during the facility start-up phase. This manual shall have the same physical format, including divider tabs and indices, as the final edition of the manual. This provisional edition may be bound in standard three-ring loose leaf binders.

.3

.4 One copy of the provisional edition shall be kept on site as an interim reference for all parties engaged in the facility start-up phase, and shall be used to familiarize and train the operating staff.

.5 The second copy shall be returned to the contractor with review comments.

.6 The contractor shall update contents of the site copy of the provisional edition manual as new information is generated during the facility start-up phase.

.3 Final Edition

.1 Prior to final acceptance the contractor shall submit four (4) copies of the final edition of the manual.

.2 This final edition shall include all outstanding project information and conform to all requirements listed in this document.

2.6 RECORD DRAWINGS

.1 Refer to Contract Close-Out Requirements.

.2 The contractor shall keep, on site, available to the Engineer at all times and particularly for each regularly scheduled site meeting, a complete set of prints, edge bound, that are to be updated daily showing any and all deviations and changes from the Contract

Drawings. This set of drawings is to be used only for this purpose, and must not be used as the daily general reference set.

.3 Provide record drawings which identify location of smoke and fire dampers, major control lines, access doors, tagged valves, and actual room names or numbers. As well, deviations that are to be recorded shall include, in general, items that are significant or are hidden from view and items of major importance to future operations and maintenance, and to future alterations and additions including cleanouts and isolation valves.

Part 3. Execution

3.1 GENERAL

.1 Submit documents to the Engineer for approval prior to transmitting to the Owner.

3.2 RECORD DRAWINGS

.1 Enter dimensions from building line to all buried services, including coordinates of manholes, catch basins, tanks, outside shut-off valves, and other similar elements.

.2 Service connections to water and sewer lines entering a building shall be recorded as to horizontal dimension from a convenient building element with suitable depth elevations relating to main floor level and sea level datum.

.3 Sewer and water lines which are placed beneath floor slabs shall be located such that each point of entry, change in direction, and irregularity is located by dimension from column grid lines on the record drawings. Depth below slabs shall be given.

.4 At substantial completion, transfer all deviations, including those called up by addenda, revisions, clarifications, shop drawings, and change orders, to a set of disks to AutoCAD. Drafting quality layers, symbols, etc. shall be identical to original drawings. Prior to substantial performance, turn over a completed set of electronic record drawings.

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Performance testing of equipment

.2 Manufacturer's startup of equipment

1.2 QUALITY ASSURANCE

.1 Use factory trained representatives and submit manufacturer's check sheets for starting all systems and equipment.

.2 Testing and certification of each backflow prevention device shall be by an "Approved Cross Connection Installation Specialist". One copy of the certificate to be submitted to the Water Purveyor, and one copy is to be inserted in each O & M manual.

.3 Prior to starting, testing, balancing, adjusting, and cleaning processes, verify with Engineer any tests required to be witnessed. Provide sufficient notice to Engineer prior to commencement of procedures.

.4 Engineer shall be allowed to witness any testing, adjusting, starting, and cleaning procedures.

.5 Assume all costs associated with starting and testing, including the supply of testing or cleaning medium.

.6 Prior to starting equipment or systems, secure and review manufacturer's installation, operation, and starting instructions. Read in conjunction with procedures defined herein.

.7 Use manufacturer's or supplier's starting personnel where required to ensure integrity of manufacturer's warranty.

.8 Compare installations to published manufacturer's data and record discrepancies. Items potentially detrimental to equipment performance shall be corrected prior to equipment starting.

.9 Some processes involved in starting procedures defined in this section may be duplications of authorities' verification. To facilitate expedient completion of project, arrange for authorities to assist or witness these procedures.

.10 All starting, testing, and procedures shall be in accordance with applicable portions of ASME, ASHRAE, AABC, CSA, NFPA, SMACNA, ASTM, ASPE and as required and outlined in these specifications. In particular note the testing requirements of NFPA-20 fire pumps, and of the authorities having jurisdiction.

.11 Personnel involved in starting, testing, balancing and adjusting procedures shall be experienced in the design and operation of mechanical equipment and systems being checked and shall be able to interpret results of the readings and tests.

.12 Assume all liabilities associated with starting, testing and balancing procedures.

1.3 REFERENCES

.1 Division 01

.2 Division 21

.3 Division 23

Part 2. Products

Not applicable

Part 3. Execution

3.1 GENERAL

.1 Conduct performance tests to demonstrate equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct tests as soon as conditions permit. Make changes, repairs, and adjustments required prior to operating tests.

.2 Gas fired appliances rated in excess of 117 kW shall be subjected to an operational test established by the Gas Protection Branch and shall pass this test before being approved for operation.

.3 Meet with Division 26 manufacturers, suppliers, and other specialists as required to ensure all phases of work are properly coordinated prior to commencement of each particular testing procedure. Establish all necessary manpower requirements.

.4 Operate and test motors and speed switches for correct wiring and sequences and direction of rotation. Check and record overload heaters in motor starters.

.5 Confirm voltages and operating amperages at full load.

.6 Failure to follow instructions pertaining to correct starting procedures may result in re-evaluation of equipment by an Independent Testing Agency selected by Owner at Contractor's expense. Should results reveal equipment has not been properly started, equipment may be rejected, removed from site, and replaced. Replacement equipment shall also be subject to full starting procedures, using same procedures specified on the originally installed equipment.procedures

3.2 PROCEDURES

.1 Procedure shall be identified in the following five (5) distinct phases:

.1 Pre-Starting: Visual inspection.

.2 Starting: Actual starting procedure.

.3 Post-Starting: Operational testing, adjusting or balancing, and equipment run-in phase.

.4 Pre-Interim Acceptance of the Work: Final cleaning, re-testing, balancing and adjusting, and necessary maintenance.

.5 Post-Interim Acceptance of the Work: Repeat tests and fine-tuning resulting from corrective action of deficiency clean-up.

.2 Check specified and shop drawing data against installed data.

.3 Check the installation is as defined by contract documents and as per manufacturer's recommendations including manufacturer's installation check sheets.

.4 Include for the costs of an independent testing agency, selected by the Owner, to take samples of all chemically treated hydronic systems, perform lab analysis of the chemical treatment levels, and submit a written report of their findings to the Owner. Should chemical treatment levels not meet the requirements of the specifications, the Contractor shall adjust treatment levels accordingly and cover the costs of the independent testing agency to take additional samples and tests.

3.3 CONTRACTOR TESTING RESPONSIBILITIES

.1 The contractor shall be required to provide the following tests as part of his construction contract. For each test, a test form is to be filled out, witnessed, kept on site for the consultant to verify at any time during construction and then they are to be included in the final submission of the contractor O&M manuals.

- .1 Plumbing Systems
  - .1 Domestic Water
    - .1 Piping to be tested to 1035 kPa for eight (8) hours.
    - .2 Conduct pipe flushing and cleaning program with all fixtures in place.
    - .3 Conduct a water analysis after shock treatment of piping system.
  - .2 Drainage System
    - .1 Conduct a standing water test (30 kPa to 75 kPa) over eight (8) hour period.
  - .3 Water Softening Equipment
    - .1 Acceptance tests to prove performance guarantee.

END OF SECTION

Part 1. General

1.1 QUALITY ASSURANCE

.1 Domestic Water, Drainage and Vent Piping: Federal, Provincial and Municipal codes.

.2 Non specified pipe joining and pipe fitting methods such as T-drill and Press Fit are not permitted in any piping system covered under Division 22.

.3 Welding materials, fabrication standards and labour qualifications must conform to ANSI/ASME B31.1, ANSI B16.25, ASME Section IX, and the Provincial Board of Labour Regulations.

.4 Use welders fully qualified and licensed by Provincial Authorities.

.5 Gas Piping: National Standard of Canada CAN1-B149.1 (latest edition), installation Code for Natural Gas Burning Appliances and Equipment.

.6 .All below grade steel piping shall be yellow jacketed.

Part 2. Products

2.1 PIPE

	Service	Material
.1	Sanitary drainage, and vent, inside building, above ground	`DWV' copper, ASTM B306 System 15-XFR PVC – DWV CSA B602 & listed to ULC 102.2-10 for flame and smoke spread rating/Smoke Development Classification limits 25/50. Any penetration through a fire rated separation shall be protected with a device certified to CAN4-S115 and pressure tested to 50 Pa. Notwithstanding other specification sections, this fire protection device shall be supplied and installed by the Contractor.
.2	Sanitary drainage, and vent, inside building, below ground	PVC-DWV, CAN3B182 Any penetration through a fire rated separation shall be protected with a device certified to CAN4-S115 and

	Service	Material
		pressure tested to 50 Pa. Notwithstanding other specification sections, this fire protection device shall be supplied and installed by the Contractor.
.3	Sanitary drainage and vent, outside building	PVC, SDR-35 for sizes to 300 mm 12 in., ASTM-D3034, complete with tracer wire. Concrete pipe for sizes over 300 mm 12 in.
.4	Storm drainage, inside building, above ground	Cast iron, CSA B70 DWV Copper, ASTM B306 System 15-XFR PVC – DWV CSA B602 & listed to ULC 102.2-10 for flame and smoke spread rating/Smoke Development Classification limits 25/50. Any penetration through a fire rated separation shall be protected with a device certified to CAN4-S115 and pressure tested to 50 Pa. Notwithstanding other specification sections, this fire protection device shall be supplied and installed by the Contractor

.5	Storm drainage, inside building, below ground	PVC – DWV CAN3-B182 and CAN4-S102.2. Any penetration through a fire rated separation shall be protected with a device certified to CAN4-S115 and pressure tested to 50 Pa. Notwithstanding other specification sections, this fire protection device shall be supplied and installed by the Contractor.
.6	Storm drainage, outside building	PVC, SDR-35 for sizes to 300 mm 12 in., ASTM-D3034, complete with tracer wire. Concrete pipe for sizes over 300 mm 12 in.
.7	Domestic water, above ground (inside building)	Type `L' hard copper for cold water and Type 'K' hard copper for hot water and recirc. water for sizes up to 100 mm 4 in., ASTM B88M Schedule 10 Stainless Steel Ductile Iron centrifugally cast for cold water main sizes 100 mm 4 in. and larger, ANSI/AWWA C151/A21.51. No steel piping allowed for domestic hot water.

.8	Domestic Water (buried inside building)	Type `K' soft copper, ASTM B88M Multi-purpose Composite Pressure Pipe, CSA B137.9, ASTM F128-1
.9	Domestic water service	Type `K' soft copper, ASTM B88M below ground PVC, Class 150, conforming to CSA B137.3 and AWWA C900, complete with tracer wire Multi-purpose Composite Pressure Pipe, CSA B137.9, ASTM F128-1
.10	Hot water and glycol heating to 120°C	Steel, Sch.40, ASTM A53, Grade B heating to 120°C
.11	Natural gas, Propane Grade B	Steel, Sch.40, ASTM A53. For underground pipe, pipe jacket shall be from extruded fire retardant polyethylene. Pipe to conform to ASTM E-84 flame spread rating and shall not exceed 25 and ASTM E-84 smoke density rating and shall not exceed 50. Polyethylene is to be resistant to UV and chlorinated plastics such as PVC are not permitted.
.12	Equipment drains and overflows	Sch.40, galvanized steel, ASTM A120 Type `L' hard copper ASTM B88M
.13	Chilled water and glycol	Steel, Sch.40, ASTM A53, Grade B

2.2 FITTINGS AND JOINTS

	Service	Material	Joint
.1	Sanitary drainage and vent inside building, above ground	Wrought or Cast copper	50-50 Solder
		PVC – DWV	Solvent weld
.2	Sanitary drainage and vent, inside building, below ground	PVC-DWV	Solvent weld
.3	Sanitary drainage and vent, outside building	PVC- Gravity Sewer	Hub & spigot with gasket
		Concrete	Hub & spigot
.4	Storm drainage, inside building, above ground	Cast iron	Gasket & clamp
		Wrought or cast copper	50-50 solder
.5	Storm drainage, inside building, below ground	PVC-DWV	Solvent weld
		Asbestos cement	Hub & spigot with gasket
.6	Storm drainage, outside building	PVC-Gravity sewer	Hub & spigot with gasket
		Concrete	Hub & spigot
.7	Domestic water, above ground	Wrought copper, bronze	Lead free 95-5 solder, brazed for pipes over 50 mm

	Service	Material	Joint
		Cast bronze	Screwed
		Stainless Steel	Welded
.8	Domestic water, buried	PVC	Hub & spigot, with "O" ring
		Copper pipe	No joints permitted underground
.9	Hot water and glycol heating 120°C	Banded malleable iron, 1033 kPa, up to 50 mm.	Screwed,
		Steel, same schedule as pipe, for sizes 50 mm. and larger	Welded
		Wrought copper,	95-5 solder, brazed bronze, for pipes over 50 mm.
		Cast brass	Screwed
		Cast bronze	Flare tube
.10	Natural gas, propane	Banded malleable iron, 1033 kPa for sizes 40 mm and under	Screwed
		Steel, same schedule as pipe, for sizes 50 mm and larger: and for high pressure(over 860 kPa)- all sizes; and for piping installed	Welded

	Service	Material	Joint
		outdoors - all sizes	
.11	Equipment drains and overflows	Galvanized banded malleable iron	Screwed
		Wrought copper, bronze	50-50 solder
		Cast brass	Screwed
.12	Chilled water and glycol	Banded malleable iron, 1033 kPa, sizes up to 50 mm.	Screwed
		Steel same schedule as pipe for sizes 150 mm and larger	Welded
		Wrought copper, bronze	95-5 solder, brazed for pipes over 50 mm in easily accessible areas and mechanical rooms.
		Cast brass	Screwed
		Cast bronze	Flared tube
.13	Use factory fabricated butt welded fittings for welded steel pipes.		
.14	Use long radius elbows for steel and cast iron water piping, including grooved mechanical fittings.		

Part 3. Execution

3.1 PREPARATION

.1 Ream pipes and tubes. Clean off scale and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.

3.2 CONNECTION

.1 Use galvanized couplings with galvanized pipe.

.2 Make connections to equipment, specialty components, and branch mains after isolation valves, with unions or flanges.

.3 Provide dielectric type connections wherever jointing dissimilar metals in open systems. Brass adapters and valves are acceptable.

.4 Use insulating plastic spacers for copper pipe installation in metal studs.

3.3 ROUTE AND GRADES

.1 Route piping in orderly manner and maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls. Group piping wherever practical at common elevations. Install concealed pipes close to the building structure to keep furring to a minimum.

.2 Slope water piping 0.2% and provide hose bibb drains at low points.

.3 Provide air collection chambers with manual air vent at all high points of system. Collection chambers to be 25 mm dia or line size whichever is greater and 150 mm high minimum. Square tees may only be used to assist with complete venting and draining.

.4 Make reductions in water and steam pipes with eccentric reducing fittings installed to provide drainage and venting. Top flat for water.

.5 Grade horizontal drainage and vent piping 2% minimum.

.6 Pipe the discharge from all relief valves, safety valves, vents, drains, equipment blowdowns, water columns, and overflows to the nearest building drain.

.7 Coordinate pipe routing with other mechanical and electrical trades. Access to equipment is not to be obstructed by fire suppression piping. Fire suppression piping is not to be installed below fan coil units.

3.4 INSTALLATION

.1 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.

.2 Provide clearance for proper installation of insulation and for access to valves, air vents, drains and unions.

.3 Install piping material specified as inside the building to 2500 mm outside of building.

.4 Support all below grade piping from structural slab above as per section 22 05 29.

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Flexible pipe connections.

.2 Expansion joints and compensators.

.3 Pipe loops, offsets, and swing joints.

1.2 REFERENCE STANDARDS

.1 Conform to Standards of "Expansion Joint Manufacturers Association" and manufacturer's recommendations.

1.3 SHOP DRAWINGS

.1 Flexible pipe connector shop drawing data shall include maximum allowable temperature and pressure rating, overall face-to-face length, live length, hose wall thickness, hose convolutions per 300 mm and per assembly, fundamental frequency of assembly, braid structure and total number of wires in braid.

.2 Expansion joint shop drawings shall include maximum allowable temperature and pressure rating, and maximum expansion compensation.

1.4 INSPECTION

.1 Provide inspection services by flexible pipe manufacturer's representative for final installation and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

Part 2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Flexible pipe connections: Mason, Flexonics, Minnesota Flexible Corporation.

.2 Expansion joints and compensators: Flexonics, Mason.

2.2 FLEXIBLE PIPE CONNECTORS

.1 Flexible Rubber Spools: Neoprene twin sphere connector of molded multiple plies of nylon tire cord fabric and neoprene, rated for 1035 kPa at 120°C. Union end connections for sizes 50 mm and under; floating galvanized ductile iron flanges for sizes over 50 mm.

.2 Spherical Rubber Spools: Neoprene single sphere elbow connector, construction and service rating same as 2.2.1 above.

.3 Braided Spools for Copper Piping: Stainless steel inner core and braid brazed to copper tube ends, suitable for 1035 kPa at 120°C.

.4 Braided Spools for Steel Piping: Stainless steel inner core and braid welded to steel pipe nipples, threaded for pipe up to 50 mm diameter, flanged for 65 mm diameter pipe and over. Suitable for service at 1035 kPa at 120°C.

2.3 EXPANSION JOINTS

.1 Copper piping: Laminated stainless steel bellows brazed to copper tube ends, internal guide, stainless steel external shroud. Suitable for 1035 kPa at 260°C.

2.4 PIPE GUIDES

.1 Four (4) finger "spider" inside a guiding sleeve formed of two halves suitable for clamping onto pipe.

.2 Guided sleeve formed of two parts, suitable to be bolted to supporting structure.

.3 Guide length to be minimum 300 mm.

Part 3. Execution

3.1 APPLICATION

.1 Provide flexible pipe connectors on pipes connected to equipment supported by vibration isolation and where indicated on the drawing.

.2 Provide structural work and equipment required to control expansion and contraction of piping, loops, pipe offsets, and swing joints and provide expansion joints where indicated or required.

.3 Provide pipe guides as required to ensure correct pipe alignment for expansion joints. Minimum two guides on each side of expansion joints.

3.2 INSTALLATION

.1 Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end.

.2 Rigidly anchor pipe to building structure at points shown, and where necessary provide pipe guides so that movement takes place along axis of pipe only.

.3 Install flexible connectors and expansion joints in accordance with manufacturer's instructions.

.4 Do not compress or expand connector during installation.

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Provide meters and gauges and taps where shown on drawings and/or specified herein.

.2 Submit shop drawings of proposed products to the engineer for review.

.3 Submit data sheets on thermometers and pressure gauges indicating service, and temperature or pressure ranges, to the engineer for review.

.4 Submit list of all meters, including location, service, flow and corresponding reading for flow.

Part 2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1	Thermometers:	Marsh, Weksler, Trerice, Ashcroft, Wika.
.2	Pressure gauges:	Marsh, Trerice, Ashcroft, Wika, Weksler.
.3	Static pressure gauges:	Dwyer, Magnehelic.
.4	Positive displacement meters:	Neptune, Rockwell, Badger.
.5	Venturi Flow Meters:	Gerand, Preso.
.6	Digital Turbine Flow Meters:	Unicon

2.2 THERMOMETERS

.1 Dial Thermometers: 80 mm diameter dial in drawn steel case, bimetallic helix actuated, brass separable socket or flange and bushing, glass cover, adjustable pointer.

.2 Mercury Thermometer: Red reading mercury filled, 2° graduations, plastic or aluminum case, 230 mm scale, straight shank, separable socket, adjustable angle.

2.3 PRESSURE/TEMPERATURE TAPS (PETE'S PLUGS)

.1 Fitting to allow a 3 mm O.D. plug-in gauge to measure temperature or pressure.

- .1 Maximum pressure: 3450 kPa.
- .2 Maximum temperature: 135°C.

.2 Fitting constructed of:

- .1 6 mm NPT brass body with hex head screw cap and gasket.
- .2 Protective screw cap to have retaining strap.
- .3 Two self-closing valves constructed of nordel.

.3 Test kit including the following:

- .1 One 65 mm diameter pressure gauge with 3 mm O.D. plug-in stem.
- .2 Two 45 mm diameter temperature gauges with 3 mm O.D. x 125 mm plug-in stem, range 0 to 110°C.

.3 All above in protective carrying case with operating instructions.

.4 Installation:

.1 Install pressure/temperature taps into threaded pipe nipples welded to wall of pipe. Locate fittings in accessible spaces.

.2 Provide one pressure/temperature taps test kit.

2.4 PRESSURE GAUGES

.1 100 mm diameter, drawn steel case, phosphor bronze bourdon tube, brass movement, extruded brass socket, 1% midscale accuracy, front calibration adjustment, black figures on white background. Pressure gauges shall be liquid filled with ½% accuracy in locations subject to vibration (on pumps, air handling units, and chillers), and 1% accuracy in all other locations. Provide needle valve and syphon for steam service, pulsating damper and ball valve for water service.

2.5 STATIC PRESSURE GAUGES

.1 Dial Gauge: 100 mm dial, diaphragm actuated, suitable for positive, negative, or differential pressure measurement. Accuracy within ±2% of full scale, complete with static pressure tips and mounting accessories.

.2 Inclined Vertical Manometer: molded plastic manometer, accuracy within ±3% of full scale, suitable for positive, negative or differential pressure measurement, complete with static pressure tips, and mounting accessories.

2.6 POSITIVE DISPLACEMENT METERS

.1 Nutating disc measuring chamber, disc material to suit fluid encountered, odometer-type direct reading totalizer counter with six (6) numerical wheels for cumulative readings.

2.7 VENTURI FLOW METERS

.1 Provide calibrated venturi flow meter elements where shown on drawings.

.2 Each venturi element shall be complete with safety shut-off valves and quick coupling connections. A permanent metal tag shall be attached with a chain showing designed flow rates, meter readings for designed flow rates, metered fluid, line size and tag number.

.3 Supplier to select flow meters to provide mid-range reading on portable meter specified below. Flow meters selected with readings less than 25% of full scale will not be accepted.

.4 Liquid Service:

.1 Venturis 50 mm and smaller to be brass threaded.

.2 Venturis 65 mm and larger to be steel for butt weld installation.

.3 Rating: 1750 kPa, 120°C.

.5 Accuracy of flow measuring elements shall be ±1%. Permanent head loss not to exceed 10% of differential pressure reading.

.6 Venturis are required to be selected to provide a pressure differential of not less than 381 mm W.G. and not more than 1143 mm W.G.

.7 Provide a portable meter set of dry diaphragm type with a round 150 mm diameter dial. Meter range shall be 0 - 1524 mm W.G. with a 270° dial. All wetted parts shall be of copper construction. Meter shall include pulsation damper, equalizing valve, 2-bleed valves, master chart for direct conversion of meter readings to metric engineering units, rust proof carrying case, two 3-m each rubber test hoses with brass quick connect valves to venturi element.

Part 3. Execution

3.1 INSTALLATION

.1 Install positive displacement meters with isolating valves. Provide valved bypass for liquid service meters.

.2 Install flow meters in uninterrupted straight pipe, minimum 2 pipe diameters downstream and 5 pipe diameters upstream, or according to manufacturer's recommendations.

.3 Provide one pressure gauge per pump installing taps before strainers and on suction and discharge of pump. Pipe to gauge.

.4 Select gauges so that normal operating point is approximately mid-point of instrument range.

.5 On pipes 65 mm and smaller, place well in tee used in lieu of an elbow to accommodate well.

3.2 METERS AND GAUGES INSTALLATION SCHEDULE

.1 Positive Displacement Meter:

- .1 Domestic Cold Water.
- .2 Heating System Make-up.
- .3 Chilled Water System Make-up.
- .4 and where shown on drawings.

.2 Flow Meters:

- .1 Where shown on drawings.

.3 Pressure Gauges:

- .1 Heat exchangers, (inlets and outlets).
- .2 Pumps.
- .3 Expansion Tanks.
- .4 Pressure Tanks.
- .5 Domestic Cold Water to Sprinkler.
- .6 Leaving side of automatic make-up valves.
- .7 Leaving side of pressure reducing valves.
- .8 And where shown on drawings.

.4 Pressure/Temperature Taps - Pete's Plugs:

- .1 All control sensor tappings.

.2 All lines to three-way control valves.

.5 Thermometers:

.1 Supply and return headers of central equipment.

.2 Heat exchangers, inlet and outlet tube and shell side.

.3 and where shown on drawings.

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Gate valves.

.2 Globe or angle valves.

.3 Ball valves.

.4 Check valves.

.5 Plug cocks.

.6 Butterfly valves.

.7 Drain valves.

.8 Hose bibbs.

.9 Strainers.

.10 Suction guides with strainers

1.2 MANUFACTURER

.1 Provide valves of the same type by the same manufacturer throughout.

.2 Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.

.3 All valves shall meet the requirements of the Manufacturers Standardization Society, Standard Practice standards, latest edition. SP-67 Butterfly Valves, SP-70 Cast Iron Gate Valves, SP-71 Cast Iron Check Valves, SP-80 Bronze Gate, Globe, Angle and Check Valves and SP-82 for pressure testing.

.4 Ball valves to be ULC listed, SP. 110 Standard.

1.3 SHOP DRAWINGS

.1 Submit copies of valves "ordering schedule" for review before ordering valves.

.2 Submit detailed shop drawings clearly indicating make, model, size, pressure rating, materials of construction and intended service.

Part 2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1	Gate Valves:	Jenkins, Crane, Toyo, Kitz.
.2	Globe Valves:	Jenkins, Crane, Toyo, Kitz.
.3	Angle Valves:	Jenkins, Crane, Toyo, Kitz.
.4	Swing Check Valves:	Jenkins, Crane, Toyo, Kitz, Mueller SPX, Moygro.

.5	Silent Check Valves:	Val-Matic, APCO, Stream Flo, Duo-CheckII, Mueller SPX.
.6	Ball Valves:	Jenkins, Crane, Toyo, Kitz, MAS.
.7	Plug Cocks:	Newman-Milliken, DeZurik.
.8	Eccentric Plug and Ball-centric:	DeZurik, Homestead.
.9	Butterfly Valves:	Keystone, DeZurik, Crane, Jenkins, ITT, Grinnell, Bray, Lunkenheimer, Toyo, Mueller SPX, Apollo, Kitz.
.10	Drain Valves:	Dahl, Crane, Jenkins, Toyo, Kitz, Hammond.
.11	Hose Bibbs:	Dahl, Crane, Jenkins, Toyo, Hammond Kitz.
.12	Strainers:	Jenkins, Crane, Toyo, Kitz, Mueller SPX.
.13	Suction Guides:	Armstrong, Bell & Gossett.

2.2 DOMESTIC COLD WATER SYSTEM

.1 Globe Valves up to 50 mm: Bronze body, screw over bonnet, threaded ends rating 1035 kPa steam, solder ends rating 2070 kPa water. Jenkins Figure 106-BJ, Figure106-BPJ, Crane #7TF, Toyo #221, Kitz #09, Kitz #10.

.2 Globe Valves 65 mm and Over: Cast iron body, flanged ends, O.S. and Y, renewable bronze seat ring, fully guided bronze disc. Rating 860 kPa steam. Jenkins Figure 2342J, Crane #351, Toyo #400A, Kitz #76.

.3 Ball Valves up to 50 mm: 2 piece bronze body, full port, chrome plated, solid bronze ball, threaded or solder ends, TFE seat and packing. 4134 kPa non-shock WOG rating. Jenkins Figure 901J, Toyo #5044A, Toyo #5049A, Kitz #58, Kitz #59.

.4 Butterfly Valves: Cast iron wafer full-lug body, Stainless steel shaft keyed to disk, NDI replaceable EPDM seat, lever lock handle operator with multiple position lock plate for valve sizes to 100 mm, heavy duty gear handwheel operator with position indicator for valve sizes 150 mm and over. Minimum bi-directional rating 1000 kPa, 121°C. Full rating for end of line or isolation shut off service. DeZurik Fig. 632 R.S., Bray Series 31 c/w trim 119, Kitz #6122 EL, Apollo #143CBE.

.5 Swing Check Valves up to 50 mm: Bronze body screw-in cap, renewable no. 125 composition disc, threaded ends 860 kPa steam. Jenkins Figure 4475J, Toyo #236T.

.6 Swing Check Valves 65 mm and Over: Cast iron body, regrind-renew swing check, bolted cover, flanged ends, bronze disc and seat ring, rating 860 kPa steam. Jenkins Figure 587J, Kitz #78, Toyo #435A, Kitz #78.

.7 Silent Check Valves for Pump Discharge up to 50 mm: Bronze body, SS stem, 316 SS spring, Teflon disc and seat ring, 430 SS seat screw, threaded ends. 1380 kPa water. Val Matic VM-S1400.

.8 Silent Check Valves for Pump Discharge 50 mm and Over: Wafer style, cast iron body, 316 SS seat, plug, spring and bushing. ANSI Class 125. Val Matic, Series 1400, Moyes & Groves W12A-I6V, Centerline Series 800.

.9 Drain Valves up to 50 mm: Forged brass body, brass cap, stem, and ball. Teflon stem seals and Teflon seat. Hose thread end. Working pressure 1725 kPa at 121°C. Dahl 50.430, Jenkins Fig 901CJ, Toyo #5046, Kitz #68AC.

.10 Drain Valves 65 mm and Over: Bronze body, bronze ball, threaded ends, twin seal Teflon seats and Viton seals, "O" ring, lever handle, rating 2070 kPa at 121°C water. Jenkins Figure 32BJ.

2.3 DOMESTIC HOT WATER SYSTEM

.1 Valves to be used in the hot water section of the system shall be exactly as specified in the cold water section, with one exception; that all composition disc valves shall be fitted with discs suitable for hot water, rated for 2756 kPa at 94°C.

2.4 DOMESTIC HOT WATER RECIRCULATING SYSTEM

.1 Circuit Balancing Valves: Suitable for throttling. All metal parts non-ferrous, die cast non porous copper alloy. Flow measuring accuracy ±2%. Positive shut-off, drain connection with cap. Memory balancing feature. Fittings for connection of portable differential pressure meter. Tour and Anderson, Bell & Gossett circuit setter.

2.5 DOMESTIC WATER SYSTEM HOSE BIBBS

.1 Bronze body globe valve, renewable composition disc, threaded inlet, "garden hose" thread outlet, rating 2070 kPa water. Jenkins Figure 1112-A, Hammond #710.

.2 Non-freeze nickel-bronze recessed wall hydrant, concealed 20 mm hose connection, galvanized casing, removable key, polished bronze inlet connection to suit installation. Roto-Tech-Smith RS-5500 Series.

2.6 VALVE OPERATORS

.1 Provide suitable hand wheels for gate, globe or angle, radiation and drain valves, and inside hose bibbs.

.2 Provide one plug cock wrench for every ten plug cocks sized 50 mm and smaller, minimum of one. Provide each plug cock sized 65 mm and larger with a wrench, with set screw.

.3 Provide valves larger than 100 mm located more than 2.1 m from floor in equipment rooms with chain operated sheaves. Extend chains to 1.5 m above floor and hook to clips to arrange to clear walking aisles.

2.7 STRAINERS

.1 Size 50 mm and under: Screwed brass or iron body, Y pattern with 0.75 mm stainless steel perforated screen. R-W/Toyo 380 Kitz #15.

.2 Size 65 mm to 100 mm: Flanged iron body, Y pattern with 1 mm stainless steel perforated screen. R-W/Toyo #381, Kitz #80

.3 Size 125 mm and larger: Flanged iron body, Y pattern with 3 mm stainless steel perforated screen.

.4 Screen free area shall be minimum three times area of inlet pipe.

2.8 PUMP SUCTION GUIDE AND STRAINER

.1 Pump Suction Guides and Strainer: angle pattern with combination diffuser-strainer, flow straightening vanes, adjustable support foot. Strainer shall have minimum five (5) times pipe cross section free area. Body to be of cast iron construction with Class 150 flanged, NPT connections as required to match valve connections. Suction diffuser body rated for 1200 kPa at 121°C. Strainer to be designed to withstand full pump differential head.

Part 3. Execution

3.1 INSTALLATION AND APPLICATION

.1 Install valves with stem upright or horizontal, not inverted.

.2 Install valves for shut-off and isolating service, to isolate all equipment, parts of systems, or vertical risers.

.3 Where butterfly valves are installed, provide threaded lug type valves on flanged systems.

.4 Install globe or angle valves for throttling service and control device or meter by-pass.

.5 Use memory balancing valves in domestic hot water recirculating systems.

.6 Provide drain valves at main shut-off valves, low points of piping and apparatus and terminal units.

.7 Size drain lines and drain valves equal to size of apparatus drain connection.

.8 For pipe sizes 20 mm and over, minimum drain size to be 20 mm.

.9 Provide hose thread connection with cap and chain for 20 mm drain valves located in ceiling and public areas.

.10 Provide male NPT nipples with threaded pipe cap for drain sizes over 20 mm where not piped directly to floor drains.

.11 Provide valved drain and hose connection off the bottom of all strainers.

.12 Provide to the owner at project completion, one pressure differential flow meter where circuit balancing valves are specified and installed.

.13 Install strainers on the inlet to all pumps. Use temporary strainers during construction and system cleaning. Remove temporary and install permanent strainers prior to system balancing.

.14 Install suction guides on the inlet to all pressure booster pumps.

.15 Install combination suction guides with strainers on the inlet to all pressure booster pumps.

.16 Mount all strainers that are installed on horizontal piping on steam systems, with the centerline of the basket/screen at the same elevation as the centerline of the attached pipe.

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Pipe hangers and supports.

.2 Flashing for mechanical equipment.

.3 Sleeving for mechanical equipment.

.4 Pipe anchors.

.5 Access Doors.

1.2 REFERENCE STANDARDS

.1 Pipe supports shall meet the requirements of ANSI B31.1 Power Piping.

1.3 GENERAL REQUIREMENTS

.1 Provide hangers and supports to secure equipment in place, prevent vibration, maintain grade, provide for expansion and contraction.

.2 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.

.3 Select hangers and supports for the service and in accordance with manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.

.4 Fasten hangers and supports to building structure or inserts in concrete construction.

.5 Provide and set sleeves or block-outs required for equipment, including openings required for placing equipment.

.6 Provide sleeves for all piping through rated assemblies. In non-rated assemblies, provide sleeves for all heating, cooling, steam, condensate, domestic hot, domestic cold, and domestic recirculation piping. Sleeves to be sized to allow insulation to pass through and to project through both sides of wall.

.7 Provide sleeves for all piping through ceilings, floors and footings.

.8 Provide sleeves for duct penetrations through walls, ceilings, floors and footings. Provide locations and dimensions for block-outs imbedded material if provided by others.

.9 Do not weld piping or equipment supports to building metal decking or building structural steel supports unless prior written approval has been obtained from the structural engineer.

.10 Obtain approval prior to drilling for inserts and supports for piping system. Discuss and obtain approval for hanging systems and methods with Structural Engineer.

.11 Obtain approval prior to using percussion type fastenings.

.12 Use of piping or equipment for hanger supports and use of perforated band iron, wire or chain as hangers is not permitted.

1.4 SUBMITTALS

.1 Submit shop drawings of each factory fabricated component.

.2 Submit samples of hangers and access doors with shop drawing submittal.

Part 2. Products

2.1 INSERTS

.1 Inserts shall be galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.

.2 Size inserts to suit threaded hanger rods.

2.2 PIPE HANGERS AND SUPPORTS

.1 Hangers, Pipe Sizes 15 mm to 40 mm: Adjustable wrought steel ring.

.2 Hangers, Pipe Sizes 50 mm and over: Adjustable wrought steel clevis.

.3 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods. Cast iron roll and stand for hot pipe sizes 150 mm and over. Cup washers for hot piping below 150 mm.

.4 Wall Support, Pipe Sizes to 80 mm: Cast iron hook.

.5 Wall Support, Pipe Sizes 100 mm and Over: Welded steel bracket and wrought steel clamp, adjustable steel yoke and cast iron roll for hot pipe sizes 150 mm and over.

.6 Vertical Support: Steel riser clamp.

.7 Floor Support, Pipe Sizes to 100 mm and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier or steel support.

.8 Floor Support, Hot Pipe Sizes 125 mm and over: Adjustable cast iron roll and stand, steel screws and concrete pier to steel support.

.9 Design hangers so they cannot become disengaged by movements of supported pipe.

.10 Provide copper plated hangers and supports for copper piping.

.11 Provide galvanized hangers and supports for galvanized piping.

.12 Support all piping below grade and under floor slabs in 3.2 mm continuous cadmium plated channel or approved pipe hangers.

1. Support channel with cadmium plated clevis hangers and rods. Install supports on centres as specified in 3.2.
2. Extend cadmium plated hanger rods 450 mm above slab rebar and bend back over rebar so as to provide a minimum of 450 mm of support in slab.
3. Do not stress rod when bending

2.3 HANGER RODS

.1 Provide steel hanger rods, threaded both ends, threaded one end, or continuous threaded.

2.4 FLASHING

.1 Steel Flashing: 0.5 mm galvanized steel.

.2 Lead Flashing: 24.4 kg/m² sheet lead for waterproofing, 4.88 kg/m² sheet lead for soundproofing.

.3 Safes: 24.4 kg/m² sheet lead or 0.5 mm neoprene.

.4 Caps: Steel, 0.8 mm minimum, 1.6 mm at fire resistance structures.

2.5 SLEEVES

.1 Pipes through Floors: Form with steel pipe or approved PVC sleeves.

.2 Pipes through Beams, Walls, Fire Proofing, Footings, Potentially Wet Floor: Form with steel pipe.

.3 Size large enough to allow for movement due to expansion and to provide for continuous insulation.

2.6 SEALS

.1 Provide modular mechanical type seals between pipes and sleeves where passing through perimeter walls below grade (basement). These to consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve when linking bolts are tightened in sequence. Equal to "Link-seal" by Thunderline.

2.7 ACCESS DOORS

.1 Steel frame access panel with stainless steel piano-type hinge, channel reinforced steel door panel, three "Symmons" fasteners per door. Door panel recessed to receive ceiling or wall material to give finished appearance showing only hinge and fasteners. Provide acoustic gasket between door panel perimeter and steel frame. Rated access doors shall be UL-listed. All access doors in public areas to be lockable type (pin torx secure fasteners).

Part 3. Execution

3.1 INSERTS

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over 100 mm or ducts over 1500 mm wide.

.3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed 100 mm minimum square steel plate and nut above slab.

3.2 PIPE HANGERS AND SUPPORTS

.1 Support horizontal steel and copper piping as follows:

Nominal Pipe Size mm	Distance Between Supports mm		Hanger Rod Diameter mm
	Steel	Copper	
15 to 20	1800	1500	10
25 to 40	2100	1800	10
50 to 65	3000	2400	10
80 to 100	3600	3000	16
150 to 300	4200	4000	22
350 to 450	6000		25

.2 Install hangers to provide minimum 15 mm clear space between finished covering and adjacent work.

.3 Use oversize hangers to accommodate pipe insulation thickness. For pipes up to 50 mm use high density rigid pipe insulation at hanger location, with an insulation protection shield. For pipes 65 mm and over use insulation protection saddle.

.4 Place a hanger within 300 mm of each horizontal elbow.

.5 Use hangers which are vertically adjustable 40 mm minimum after piping is erected.

.6 Support cast iron horizontal drainage pipe near each hub and on each side of gasket and clamp joints, with 1500 mm maximum spacing between hangers.

.7 Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.

.8 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.9 Where practical, support riser piping independently of connected horizontal piping.

3.3 EQUIPMENT BASES AND SUPPORTS

.1 Provide reinforced concrete housekeeping bases poured directly on structural floor slab 100 mm thick minimum, extended 100 mm minimum beyond machinery bedplates for equipment. Provide templates, anchor bolts and accessories required for mounting and anchoring equipment. All base mount pumps, compressors, tanks, boilers, AHU's, MUA units and domestic hot water tanks to have a housekeeping pad.

.2 Construct supports of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

.3 Provide rigid anchors for ducts and pipes immediately after vibration isolation connections to equipment unless spring hangers are specified.

3.4 FLASHING

.1 Flash and counterflash where mechanical equipment passes through weather or waterproofed walls, floors and roofs.

.2 Flash vent and soil pipes projecting 80 mm minimum above finished roof surface with lead worked 25 mm minimum into hub, 200 mm minimum clear on sides with minimum

600 mm x 600 mm sheet size. For pipes through outside walls, turn flange back into wall and caulk.

.3 Flash floor drains over finished areas with lead 250 mm clear on sides with minimum 900 mm x 900 mm sheet size. Fasten flashing to drain clamp device.

.4 Provide curbs for mechanical roof installations 200 mm minimum high. Flash and counterflash with galvanized steel, soldered and made waterproof.

.5 Provide continuous lead or neoprene safes below air supply casings, built-up mop sinks, shower stalls, shower room floors located above finished rooms. Solder at joints, flash into floor drains and turn up 150 mm into walls or to top of curbs and caulk into joints.

.6 Provide lead acoustic flashing around pipes passing from equipment rooms, installed according to manufacturer's data for sound control.

3.5 SLEEVES

.1 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeve.

.2 Extend sleeves through potentially wet floors 25 mm above finished floor level. Caulk sleeves full depth and provide floor plate.

.3 Piping passing through floor, ceiling or wall, close off space between duct and sleeve with non-combustible insulation. Caulk both sides.

.4 Piping passing through perimeter walls below grade, mechanical room floor, roof or wall, close off space between pipe and sleeve with synthetic rubber compound mechanical type seals.

.5 Sleeves provided through walls or floors where liquids could potentially pass from one side to the other, provide sleeves with a 25 mm 'flange' welded to the external face of the sleeve at the mid-point of the thickness of the structure to provide a water stop.

.6 Install chrome plated escutcheons where piping passes through finished surfaces.

3.6 ACCESS DOORS

.1 Provide access doors for maintenance or adjustment purposes for all mechanical system components including:

.1 Valves.

.2 Cleanouts and traps.

.3 Expansion joints.

.4 Control components.

.2 Mark removable ceiling tiles used for access with color coded pins. See Painting and Identification.

.3 Sizes to be 600 mm x 600 mm minimum.

.4 Provide UL-listed fire rated access doors installed in rated walls and ceilings.

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Supply all labour, materials, and equipment required and necessary to isolate and restrain the equipment as indicated on the drawings and specified herein and guarantee the function of the materials and equipment supplied.

1.2 QUALIFICATION

.1 All vibration isolators and bases shall be supplied by an approved supplier with the exception of isolators which are factory installed and are standard equipment with the machinery.

.2 Provide shop and placement drawings for all vibration isolation elements for review, before materials are ordered. The drawings shall bear the stamp and signature of the responsible supplier's technical representative.

.3 The work shall be carried out in accordance with the specification and, where applicable, in accordance with the manufacturer's instructions and only by workmen experienced in this type of work.

1.3 INSPECTION

.1 A qualified representative of the isolator manufacturer shall inspect the isolated equipment after installation and submit a concise report stating any deficiencies in the installation

Part 2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Vibro Acoustic, Vibron, IAC, Mason, Korfund, Vibro Acoustics Western.

2.2 ISOLATORS

.1 Spring isolators located out of doors or in humid areas shall have Rustoleum Painted housing and neoprene coated springs, unless otherwise indicated on drawings.

.2 Isolation mounts for equipment with operating weights substantially different from the installed weights shall have adjustable limit stops.

2.3 OPEN SPRING ISOLATORS

.1 Springs shall be "Iso-Stiff" having equal stiffness in the horizontal and vertical planes with a working deflection between 0.3 and 0.6 of solid deflection.

.2 Spring mounts shall be complete with leveling devices, minimum 6 mm thick neoprene sound pads, and zinc chromate plated hardware.

.3 Sound pads shall be sized for a minimum deflection of 1.2 mm and shall meet the requirements for neoprene isolators.

2.4 NEOPRENE HANGERS

.1 All neoprene isolators shall be tested to ASTM specifications.

.2 Where a ribbed pad is used, the height of the ribs shall not exceed 0.7 times the width of the rib. A steel layer shall be used to distribute the load in a multi-layered unit.

.3 Neoprene pads or elements shall be selected at the manufacturer's optimum recommended loading and shall not be loaded beyond the limit specified in the neoprene manufacturer's literature.

2.5 SPRING HANGERS

.1 Hangers capable of a 10° misalignment shall be provided unless otherwise specified.

Part 3. Execution

3.1 APPLICATION

.1 Provide vibration isolation for mechanical motor driven equipment throughout, unless specifically noted otherwise.

.2 Set steel bases for 25 mm clearance between housekeeping pad and base. Set concrete inertia bases for 50 mm clearance. Adjust equipment level.

.3 Deflections 12 mm and over shall use steel spring isolators.

.4 Deflections 5 mm and under shall use neoprene isolators.

.5 All equipment mounted on vibration isolators shall have a minimum clearance of 50 mm to other structures, piping, equipment, etc. All isolators shall be adjusted to make equipment level.

.6 Prior to making piping connections to equipment with operating weights substantially different from installed weights, the equipment shall be blocked up with temporary shims to the final heights. When full load is applied, the isolators shall be adjusted to take up the load just enough to allow shim removal.

.7 Adjustable, horizontal stabilizers on close spring isolators shall be adjusted so that the side stabilizers are clear under normal operating conditions.

.8 All piping connections to isolated equipment shall be supported resiliently for the following distances or to the nearest flexible pipe connector:

Pipe Size	Distance, m
15 - 40 mm	3.0
50 - 65 mm	4.5
75 - 100 mm	7.0
125 - 200 mm	9.0
225 - 275 mm	13.5
300 - 350 mm	15.0

.9 The three closest hangers to the vibration source shall be selected for the lesser of a 25 mm static deflection or the static deflection of the isolated equipment. The remaining

isolators shall be selected for the lesser of the 25 mm static deflection or 1/2 the static deflection of the isolated equipment.

.10 Spring hangers shall be installed without binding.

.11 Adjust isolators as required and ensure springs are not compressed.

.12 Provide neoprene side snubbers or retaining springs where side torque or thrust may develop.

.13 Where movement limiting restraints are provided, they shall be set in a position with minimum 6 mm air gap. Restraints, isolator equipment and attachment points shall be designed to withstand the impact of the isolated equipment subjected to an acceleration not exceeding 3 g without permanent distortion or damage.

.14 Wiring connections to isolated equipment shall be flexible.

3.2 PERFORMANCE

.1 Install isolators of type and deflection as indicated on the Isolation Schedule or according to the following table, whichever provides the greater deflection.

.2 The required static deflection of isolators for equipment exceeding 0.35 kW is indicated below. Spring isolators shall be "open spring". Closed spring isolators shall only be used where specified.

Machine Speed r/min	Slab on Ground Under 15 kW	Structural Slab Over 15 kW	Normal	Critical
Under 400	Special*	Special*	Special*	Special*
400 - 600	25 mm	50 mm	90 mm	Special*
600 - 800	12 mm	25 mm	50 mm	90 mm
800 - 1100	5 mm	12 mm	25 mm	50 mm
1100 - 1500	3 mm	4 mm	5 mm	12 mm

*"Special" indicates as directed by the acoustical consultant.

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Painting and Identification for plumbing systems.

1.2 RELATED REQUIREMENTS

.1 Submittals — Division 01

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 Painting of mechanical work

1.4 QUALITY CONTROL

.1 Coordinate colour coding of piping and equipment

.2 Colour code mechanical equipment, piping and exposed ductwork. Refer to colour schedule at end of this section.

.3 Legend and direction of flow arrows shall consist of adhesive backed labels, yellow colour, with minimum 20 mm high black lettering equal to Brady System B-500, vinyl cloth labels for non-insulated surfaces; and Brady B946 for insulated surfaces.

1.5 EQUIPMENT PROTECTION AND CLEAN-UP

.1 Ensure that new and existing equipment and surfaces are carefully covered with tarping, or heavy duty plastic. Ensure that spills and splatter on finishes and equipment are cleaned up totally and promptly.

Part 2. Products

Not Applicable

Part 3. Execution

3.1 GENERAL

.1 Identify piping with labels, colour bands, and flow arrows. On all systems, except for Natural Gas and Non-potable water systems, provide identification at 15 m maximum intervals, before and after pipes passing through walls, at all sides of tees, behind access doors and in equipment rooms as required.

.2 Provide Continuous identification on Natural Gas and Non-potable water piping systems in exposed and concealed locations.

.3 Apply colour bands at both ends of the label with primary colour bands used to secure both ends of individual labels. Refer to colour schedule at end of this section.

.4 Provide 20 mm diameter brass, lamacoid or metal photo black numbers, secured to valve stem with key chain.

.5 Provide neat, typewritten directories, giving valve number, services and location. Frame one copy under glass for wall mounting as directed, second copy to be forwarded to Owner. Include copies in O & M Manuals.

.6 Identify all equipment excluding pipe and duct with screwed down lamacoid plates having 6 mm minimum letter size. Identification to match as built drawings equipment name and number.

.7 Identify electric starting switches, thermostats controlling motors, remote push button stations, and controls equipment supplies under this division with lamacoid plates having6 mm minimum letter size. Identification to state equipment controlled and match to control shop drawing identification numbers.

.8 Identify the purpose of duct access panels with self-adhesive Brady stick-on coloured labels. Apply labels conforming to the following schedule:

	Colour:	Letters:
Cleaning and service access	yellow	C.A.

Note: Provide black lettering in all cases.

.9 Identify the location of the following items of equipment which are concealed above a ceiling with Avery "Data Dots". The colours shall conform to the following schedule:

Concealed equipment and cleaning access:	Yellow
Control equipment, including control and valves:	Black
Pipe mounted equipment with the exception of fire, smoke, sprinkler and control equipment	Green

.10 When T-bar ceilings are installed, adhere "Data Dots" on T-bar framing adjacent to panel to be removed.

.11 Provide the following label on Non-Potable Water piping in accessible or exposed locations: “WARNING: NON-POTABLE WATER – DO NOT DRINK”.

.12 Provide signage in the washrooms which have plumbing fixtures served by Non-potable water equal to the requirements of CSA standard B128.1-06 & B128.2-06. The sign shall be not less than 100mm x 100mm.

3.2 COLOUR CODE SCHEDULE

.1 Colour numbers are called for in Canadian Government Specification No. 5-GP 1a. Colours assigned from CGSB 1-GP-12c for colour code identification.

.1 Mechanical Primary Colours for Pipe Lines/Equipment

Yellow	505-102
Light Blue	502-106
Green	503-107
Orange	508-102
Brown	504-103
Red	509-102
White	513-101

Aluminum	515-101
Purple	501-101
Grey	501-107

.2 Secondary Colours For Bands

Red	509-102
Orange	508-102
Blue	502-106

.3 Banding

Red	To indicate extremely hazardous
Orange	To indicate mildly hazardous material
Blue	To indicate non-hazardous material

.2 Identification Symbols and Colours for Piping

	Pipe Colour	Stripe Colour	Symbol
Domestic Cold Water	Light Blue	None	Cold Wat.
Domestic Hot Water	Green	Orange (60°C to 100°C)	Hot Wat. R.
Domestic Hot Water Recirc	Green	Blue (Below 60°C)	Hot Wat. R.
Drains	Aluminum		
Vent	Aluminum		
Pumps (Regular)	Aluminum		
Supports	Black		
Uninsulated Valves	High Heat Aluminum		
Handles	Black Machinery Enamel		
Motor Guards	Red Machinery Enamel		
Hangers, Brackets, Hanger Rods	Black Machinery Enamel		

.3 Equipment Bases/Housekeeping Pads:

.1 Grey, with 100 mm yellow and black angled bands around edges.

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Equipment insulation.

.2 Adhesives, tie wires, tapes.

.3 Recovering.

1.2 QUALITY ASSURANCE

.1 Insulation shall be installed by skilled workmen regularly engaged in this type of work.

.2 Materials shall meet or exceed fire and smoke hazard ratings as stated in this section and defined in applicable building codes.

1.3 SUBMITTALS

.1 Submit shop drawings which indicate complete material data, "K" value, temperature rating, density, finish, recovery jacket of materials proposed for this project and indicate thickness of material for individual services.

1.4 JOB CONDITIONS

.1 Deliver material to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness.

.2 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

1.5 ALTERNATIVES

.1 Alternative insulations are subject to approval. Alternatives shall provide the same thermal resistance within 5%, at normal conditions as material specified.

Part 2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Owen's Corning/Fiberglas Canada Inc., Manson, Knauf Fiberglass.

2.2 GENERAL

.1 Insulation Materials, Recovery Jackets, Vapour Barrier Facings, Tapes and Adhesives: Composite fire and smoke hazard ratings shall not exceed 25 for flame spread and 50 for smoke developed.

.2 All insulation materials shall meet Building Code Standards, and packages or containers of such materials shall be appropriately labeled.

.3 Insulate fittings and valve bodies with preformed insulated fittings.

2.3 MATERIALS

.1 Roof Drains: Flexible fibrous glass or mineral fibre insulation, "K" value maximum 0.035 W/m. °C at 24°C with factory applied reinforced aluminum foil vapour barrier. Service temperature -14°C to 50°C.

.2 Hot Equipment: Rigid fibrous glass, or mineral fibre insulation, "K" value maximum 0.035 W/m. °C, at 24°C. Service temperature -14°C to 200°C.

.3 Cold Equipment: Rigid fibrous glass, or mineral fibre insulation, with factory applied reinforced aluminum foil vapour barrier, "K" value maximum 0.035 W/m. °C, at 24°C. Service temperature -10°C to 100°C.

.4 Recovery Jackets:

.1 ULC listed canvas: 220 g/m2 plain weave cotton fabric with

.2 ULC listed dilute fire retardant lagging adhesive.

Part 3. Execution

3.1 PREPARATION

.1 Do not install covering before piping and equipment has been tested and approved.

.2 Ensure surface is clean and dry prior to installation. Ensure insulation is dry before and during application. Finish with systems at operating conditions.

3.2 INSTALLATION

.1 Ensure insulation is continuous through inside walls. Pack around pipes with fire proof self-supporting insulation material, properly sealed.

.2 Locate insulation or cover seams in least visible locations.

.3 Provide recovering jackets on exposed insulation throughout, including equipment rooms.

.4 Flare out staples may be used to secure jacket laps on hot systems. Staples are to be applied on 100 mm centres.

.5 Roof Drains: Adhere flexible insulation with adhesive applied to all laps. Provide annealed tie wire tied at 400 mm centers for securing insulation. Butt insulation and seal joints and breaks with 50 mm of foil tape adhered over joint. If exposed, use pre-formed pipe covering insulation c/w canvas recovery.

.6 Equipment: Apply insulation with edges tightly butted, joints staggered and secured in place by metal bands. Where necessary, weld on suitable anchors. Provide sufficient clearance around openings for normal operation of equipment. Finish surface of cold equipment insulation with vapour barrier jacket sealed with vapour barrier adhesive. Make uneven surfaces smooth with insulating cement.

3.3 INSULATION INSTALLATION THICKNESS SCHEDULE

Equipment	Pipe Sizes mm	Insulation Thickness mm	Recovery Jacket
Roof Drains, Vertical connections below roof drains and 3 m of horizontal piping	All sizes	25	Canvas
Water softener tanks		25	Aluminum

NOTE: Pipe insulation for piping installed in 38 x 92 mm wall cavity can be reduced to 15 mm, for pipe sizes 40 mm to 65 mm. Install insulation to thickness specified for piping outside the wall cavity.

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Piping insulation

.2 Adhesives, tie wires, tapes.

.3 Recovering

1.2 QUALITY ASSURANCE

.1 Insulation shall be installed by skilled workmen regularly engaged in this type of work.

.2 Materials shall meet or exceed fire and smoke hazard ratings as stated in this section and defined in applicable building codes.

1.3 SUBMITTALS

.1 Submit shop drawings which indicate complete material data, "K" value, temperature rating, density, finish, recovery jacket of materials proposed for this project and indicate thickness of material for individual services.

1.4 JOB CONDITIONS

.1 Deliver material to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness.

.2 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

1.5 ALTERNATIVES

.1 Deliver material to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness.

.2 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

Part 2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Owen's Corning/Fiberglas Canada Inc., Manson, Knauf Fiberglass.

2.2 GENERAL

.1 Insulation Materials, Recovery Jackets, Vapour Barrier Facings, Tapes and Adhesives: Composite fire and smoke hazard ratings shall not exceed 25 for flame spread and 50 for smoke developed.

.2 All insulation materials shall meet Building Code Standards, and packages or containers of such materials shall be appropriately labeled.

.3 Insulate fittings and valve bodies with preformed insulated fittings.

2.3 MATERIALS

.1 Cold Piping: Formed fine fibrous glass or formed mineral fibre pipe insulation, with factory applied vapour barrier jacket, factory moulded to conform to piping, “K" value maximum 0.035 W/m. °C at 24°C. Service temperature: 4°C to 100°C

.2 Hot Piping: Formed fine fibrous glass or mineral fibre pipe insulation, with factory applied general purpose jacket, factory moulded to conform to piping, "K" valuemaximum 0.035 W/m. °C, at 24°C. Service temperature up to 150°C

.3 Plumbing Vents: Flexible fibrous glass or mineral fibre insulation, "K" value maximum 0.035 W/m. °C at 24°C with factory applied reinforced aluminium foil vapour barrier. Service temperature -14°C to 50°C

.4 Recovery Jackets:

.1 ULC listed canvas: 220 g/m2 plain weave cotton fabric with

.2 ULC listed dilute fire retardant lagging adhesive.

Part 3. Execution

3.1 PREPARATION

.1 Do not install covering before piping and equipment has been tested and approved.

.2 Ensure surface is clean and dry prior to installation. Ensure insulation is dry before and during application. Finish with systems at operating conditions.

3.2 INSTALLATION

.1 Ensure insulation is continuous through inside walls. Pack around pipes with fire proof self-supporting insulation material, properly sealed.

.2 Insulate complete system including piping, fittings, valves, unions, flanges, strainers. Do not insulate flexible connections and expansion joints. Terminate insulation neatly with plastic material troweled on a bevel.

.3 Finish insulation neatly at hangers, supports and other protrusions.

.4 Locate insulation or cover seams in least visible locations. Locate seams on piping in ceiling spaces on the underside of the pipe.

.5 Provide recovering jackets on exposed insulation throughout, including equipment rooms. Insulation located in crawl spaces, pipe shafts and suspended ceiling spaces is not considered exposed. Make smooth uneven insulated surfaces before recovering.

.6 Cover insulation exposed to outdoors with aluminum jacket secured with aluminum bands on 200 mm centres. Lap circumferential joints 75 mm minimum and seal with compatible waterproof lap cement. Lock form longitudinal joints and seal.

.7 Cold Piping: Seal lap joints with 100% coverage of vapour barrier adhesive. Seal butt joints with 50 mm wide strips of vapour barrier sealed with vapour barrier adhesive. For

fittings and valves, apply hydraulic insulating cement; or apply factory fabricated insulation half shells, seal all laps and joints.

.8 Flare out staples may be used to secure jacket laps on hot systems. Staples are to be applied on 100 mm centres.

.9 Hot Piping: For fittings and valves, apply hydraulic insulating cement; or apply factory fabricated insulation half shells.

.10 Plumbing Vents: Adhere flexible insulation with adhesive applied to all laps. Provide annealed tie wire tied at 400 mm centers for securing insulation. Butt insulation and seal joints and breaks with 50 mm of foil tape adhered over joint. If exposed, use pre-formed pipe covering insulation c/w canvas recovery.

3.3 INSULATION INSTALLATION THICKNESS SCHEDULE

Piping	Pipe Sizes mm	Insulation Thickness mm	Recovery Jacket
Domestic cold water piping	15 to 40 50 & over	15 25	Canvas
Domestic hot water supply & recirculation piping	15 to 40 50 & over	15 25	Canvas
Roof drains, vertical connections below roof drains and 3m of horizontal piping,	All sizes	25	Canvas
Vents within 3 m of roof outlet.	All sizes	25	Canvas

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Provide for flushing and disinfection of domestic water systems.

.2 Isolate and bypass equipment listed in Clause 3.1.

1.2 ACCEPTABLE AGENCY

.1 Chemical treatment agency shall provide equipment, chemicals and site supervision so as to fully comply with all requirements and their intent contained within this specification section.

1.3 QUALITY ASSURANCE

.1 Provide chemical treatment as specified herein and provide written reports. Reports shall be signed by the chemical treatment agency, mechanical contractor and commissioning agency.

.2 Include for the costs of an independent testing agency, selected by the Owner, to take samples of domestic water, perform lab analysis of the chemical treatment levels, and submit a written report of their findings to the Owner. Should the lab results prove that standards for drinking water quality have not been met; the Contractor shall correct the deficiency and cover the costs of the independent testing agency to take additional samples and tests.

1.4 SUBMITTALS

.1 Submit procedure instructions and analysis reports to be used on this project.

.2 Provide written reports containing procedure of system cleaning and degreasing, giving times, dates, conditions of water and problems and actions encountered.

.3 Comply with Section on Closeout Submittals.

Part 2. Products

2.1 MATERIALS

.1 Provide sufficient chemicals to treat domestic water systems and test the systems from the time of activation and acceptance of the building.

.2 Chemicals used must comply with environmental and health standards applicable to the usage on this project.

Part 3. Execution

3.1 SYSTEM CLEANING

.1 Ensure reasonable care is exercised to prevent debris, dirt and other foreign material from entering the pipe during construction. This is to include proper protection of piping on

site prior to installation, temporary caps on partial systems, and complete evacuation of moisture within systems being hydrostatically pressure tested.

.2 Chemical treatment agency shall, in conjunction with the mechanical contractor, review connections for complete draining and venting of the systems. The mechanical contractor shall provide adequate drain connections to completely drain the systems within one hour.

.3 Protect and/or remove control devices from systems during cleaning. All terminal control valves shall be in open position during cleaning. Particular attention is to be made to control valves which have a normally closed position.

.4 Make systems completely operational, totally filled, thoroughly vented, and completely started.

.5 All domestic hot, cold and domestic recirculation water systems will be required to be flushed and disinfected. Add chlorine to water in system to 50 milligrams per litre and let stand for 24 hours. Check chlorine content after 24 hours and insure the content is not less than 20 milligrams per litre. If less than 20 milligrams per litre repeat process. Flush system until the chlorine content of water being drained is equal to the chlorine content of the make-up water. Utilize plumbing fixtures (i.e. lav, sinks, flushometers, etc.) for drainage.

END OF SECTION

PART 1. GENERAL

1.1 SCOPE

.1 Plumbing fixtures and trim

.2 Thermostatic mixing valves

1.2 GENERAL REQUIREMENTS

.1 Provide new fixtures, CSA approved, free from flaws and blemishes with finished surfaces clear, smooth and bright.

.2 Provide CSA approved plumbing fittings. Visible parts of fixture brass and accessories shall be heavily chrome plated.

.3 Fixtures shall be product of one manufacturer. Fittings of same type shall be of product of one manufacturer.

.4 Protect fixtures against use and damage during construction.

1.3 JOB CONDITIONS

.1 Check millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

1.4 SUBMITTALS

.1 Submit shop drawings for review.

PART 2. Products

2.1 WATER CLOSET (WC-1)

.1 Bowl: **American Standard Madera** floor mount flushometer valve toilet, 419mm height, vitreous china, elongated bowl, low consumption 4.2LPF, EverClean surface, fully glazed 54mm trapway, 38mm rear spud inlet, 2 bolt caps, direct-fed siphon jet action, condensation channel. 1000gram MaP score, Provide floor flange, flange bolts and gasket. ADA compliant.

.2 Seat: Heavy duty, open front, less cover w/ slow close hinges. American Standard #5901.100

.3 Flush Valve: **Sloan #140-1.28 ES-S TMP Wall Box** 'Royal Optima' Concealed, sensor activated Royal model water closet flushometer, enclosed behind 343x343 wall frame with a stainless steel access panel, for floor mounted back spud bowl, 4.2LPF, synthetic rubber diaphragm with fautl filtered fixed bypass, self-adaptive infrared sensor with indicator light, walk-by delay, courtesy flush override, integral solenoid operator,

adjustable tailpiece, sweat solder adapter, high back pressure vacuum breaker flush connection, ADA Compliant, Sloan #EL 154 120/24 VAC 50 VA Transformer.

2.2 WATER CLOSET (WC-2)

.1 Bowl: **American Standard Madera** floor mount flushometer valve toilet, 419mm height, vitreous china, elongated bowl, low consumption 4.2LPF, EverClean surface, fully glazed 54mm trapway, 38mm top spud inlet, 2 bolt caps, direct-fed siphon jet action, condensation channel. 1000gram MaP score, Provide floor flange, flange bolts and gasket. ADA compliant.

.2 Seat: Heavy duty, open front, less cover w/ slow close hinges. American Standard #5901.100

.3 Flush Valve: **Sloan #111-1.28 ES-S TMP** 'Royal Optima' Exposde, sensor activated Royal model water closet flushometer, for floor mounted top spud bowl, 4.2LPF, synthetic rubber diaphragm with fautl filtered fixed bypass, self-adaptive infrared sensor with indicator light, walk-by delay, courtesy flush true mechanical override, integral solenoid operator, adjustable tailpiece, sweat solder adapter, high back pressure vacuum breaker flush connection, ADA Compliant, Sloan #EL 154 120/24 VAC 50 VA TransformerSeat: Heavy duty, open front, less cover w/ slow close hinges. American Standard #5901.100

2.3 WATER CLOSET (WC-3)

.1 Base: **Willoughby 1806 Series**, Floor mounted, Ligature-resistant 450mm combination LAV/Toilet, Suicide Resistant Combination Fixture, serviceable from accessible pipe chase, wall sleeve, 14gauge type 304 stainless steel, seamless welded construction, polished satin finish, sound-deadened with fire resistant material, hemispherical cabinet, 190mm wall thickness, wall waste outlet. Toilet is concealed blowjet type with elongated bowl, self-draining rim and integral seat with high polish finish, trap has 89mm seal and will pass 54mm ball, provide 1.28 GPF flush valve. Lavatory is 380x330x140mm lavatory “D” bowl w/ standard 40mm waste outlet. Lavatory Valve: Dual temperature, pneumatic metering, push button valve requiring less than 35kPa to activate, and comply with NSF61. Provide hemispherical penal bubbler BPH with hemispherical penal pushbutton. Wall Template. Toilet Overflow Preventer. Provide additional lead free thermostatic mixing valve to meet ASSE 1070, Bradley S59-4008. **CONFIRM ORIENTATION PRIOR TO ORDERING.**

2.4 URINAL (UR-1)

.1 Urinal: Vitreous china, wash out, wall hung urinal with flushing rim, extended shields, integral trap, stainless steel strainer, 20 mm back spud and steel support hangers. **American Standard “Washbrook #6590.525**.

.2 Flush Valve: **Sloan #186-0.125 HEU-SG** Exposed, high efficiency urinal flush valve unit for 200m top spud urinal, low consumption (0.5 Lpf), factory set flow, quiet action, dual linear filtered bypass diaphragm, adjustable tailpiece, vacuum breaker, ADA compliant, non-hold-open handle extended. Saniguard antimicrobial coating on handle

2.5 LAVATORY (LAV-1)

.1 Lavatory: Vitreous china, white, self-rimming, counter-top lavatory, two rear overflow holes, faucet deck, faucet holes 102mm on center, 441mm x 279mmx 133mm, ADA compliant, 32mm trap, chrome adjustable "P-trap" with extension, P-Trap to be insulated and cladded. **American Standard Cadet Universal Counter-Top Sink**

.2 Trim: ADA Complaint, chrome plated brass, sensor activated, complete with waterproof circuit control module, serviceable filtered solenoid valve, aerator/spray head with pressure compensating flow control, flexible hose connection supplied between module and spout, flow rate 1.9 lpm, below deck thermostatic mixing valve, vandal resistant spray head. **Sloan Optima Plus model ETF-600-BDT**. Chrome Plated brass grid strainer w/ 30mm outlet tube (ETF-460-A), 120VAC/24VAC 60Hz box mount transformer (ETF-248-40)

2.6 STAINLESS STEEL SINGLE COMPARTMENT SINK (SK-1)

.1 Bowl: Compartment size of 508mm x 356mm x 203mm, Overall size 562mm x 478mm x 203mm ., Type 304 stainless steel, #4 satin finish on exposed surfaces, self-rimming bowl single compartment with under coating, 90 mm crumb cup, cutout template, 4 holes drilled in ledgeback complete with under deck clamps. **FRANKE KINDRED LBS4008P-1/Custom**

.2 Trim: Single handle faucet, kitchen deck faucet, all metal fabricated body, 221mm spout, 5.7lpm vandal resistant aerator, lever handle return to neutral position when facuet is off, red/blue indicator, for hot/cold, diamond coated ceramic cartridge, adjustable handle limit stop, 10mm copper supply tubes, 1143mm hose and spray attachment with anti-siphon device, ADA **DELTA 400LF-HDF**, integral stainless steel basket strainer/stopper, tailpiece, P-trap with cleanout.

2.7 STAINLESS STEEL SINK (SK-2)

.1 Bowl: Compartment size of 508mm x 356mm x 203mm, Overall size 562mm x 478mm x 203mm ., Type 304 stainless steel, #4 satin finish on exposed surfaces, self-rimming bowl single compartment with under coating, 90 mm crumb cup, cutout template, 3 holes drilled in ledgeback complete with under deck clamps. **FRANKE KINDRED LBS4008P-1/3**

.2 Trim: Double handle faucet, heavy duty cast brass, 203mm center two handle, polished chrome plated finish brass swing spout, metal hold-down package, 5.7lpm vandal resistant flow control aerator, 76mm hooded lever handles (with temperature indicator), ADA, **DELTA 26C3142-TI-LS**

2.8 CUSTOM WALL HUNG STAINLESS STEEL SINK (SK-3)

.1 Bowl: Compartment size of 457mm x 533mm x 254mm, Overall size 914mm x 610mm x 254mm ., Type 304 stainless steel, seamless welded construction, 40mm diameter roll rim on front and sides, exposed exterior surfaces polished with a standard brush finish, interior surfaces polished with a hand-blended finish, drainboard on right, wall mounting

brackets, 200mm backslpash, 3 holes drilled in backsplash. (Similar to Just Manufacturing Model A-46712)

.2 Trim: Double handle wall mount faucet, heavy duty cast brass, 203mm center two handle, polished chrome plated finish, 205mm tubular swing spout brass swing spout, 5.7lpm vandal resistant flow control aerator, 102mm hooded blade handles (with temperature indicator), ADA, **DELTA 28P4402LF**

2.9 STAINLESS STEEL SINGLE COMPARTMENT SINK (SK-4)

.1 Bowl: Compartment size of 508mm x 356mm x 203mm, Overall size 562mm x 478mm x 203mm ., Type 304 stainless steel, #4 satin finish on exposed surfaces, self-rimming bowl single compartment with under coating, 90 mm crumb cup, cutout template, 1 holes drilled in ledgeback complete with under deck clamps. **FRANKE KINDRED LBS4008P-1/1**

.2 Trim: Single handle faucet, kitchen deck faucet, all metal fabricated body, 221mm spout, 5.7lpm vandal resistant aerator, lever handle return to neutral position when facuet is off, red/blue indicator, for hot/cold, diamond coated ceramic cartridge, adjustable handle limit stop, 10mm copper supply tubes, ADA **DELTA 100LF-HDF**, integral stainless steel basket strainer/stopper, tailpiece, P-trap with cleanout

2.10 STAINLESS STEEL SINGLE COMPARTMENT SINK (SK-5)

.1 Bowl: Compartment size of 406mm x 356mm x 178mm, Overall size 460mm x 478mm x 178mm ., Type 302 stainless steel, #4 satin finish on exposed surfaces, self-rimming bowl single compartment with under coating, 90 mm crumb cup, cutout template, 3 holes drilled in ledgeback complete with under deck clamps. **FRANKE KINDRED LBS4607-1/3**

.2 Trim: Double handle faucet, heavy duty cast brass, 203mm center two handle, polished chrome plated finish brass swing spout, metal hold-down package, 5.7lpm vandal resistant flow control aerator, 76mm hooded lever handles (with temperature indicator), ADA, **DELTA 26C3142-TI-LS**

2.11 STAINLESS STEEL SINGLE COMPARTMENT SINK (SK-6)

.1 Bowl: Compartment size of 457mm x 406mm x 178mm, Overall size 508mm x 521mm x 178mm ., Type 302 stainless steel, #4 satin finish on exposed surfaces, self-rimming bowl single compartment with under coating, 90 mm crumb cup, cutout template, 3 holes drilled in ledgeback complete with under deck clamps. **FRANKE KINDRED LBS4607-1/3**

.2 Trim: Double handle faucet, heavy duty cast brass, 203mm center two handle, polished chrome plated finish brass swing spout, metal hold-down package, 5.7lpm vandal resistant flow control aerator, 76mm hooded lever handles (with temperature indicator), ADA, **DELTA 26C3142-TI-LS**

.3

2.12 SHOWER (SH-1)

.1 Trim: ADA Compliant, hand shower system with lever handle consisting of; pressure balancing thermostatic shower mixing valve with integral volume control, integral service stops, single blade style lever handle with adjustable stop screw, chrome plated brass escutcheon, chrome plated brass dome cover, T-300-V, 9.5 lpm (2.5 gpm) wall/hand shower with 1500mm flexible metal hose, in line vacuum breaker, wall connection and cradle for hand shower mounting, 760mm (30") slide bar, vandal resistant escutcheon screws. Symmons Hand Shower System No. C-96-300-B30-V-X-VP.

.2 Drain: Refer to FD-1

.3 Enclosure: Built in place tiled surround, refer to architectural dwgs and specifications. Curtain rod, rings and curtain by architectural

2.13 SHOWER (SH-2)

.1 Trim: **ACORN Penal-Ware 1743 Series**, type 304 stainless steel components with exterior polished to stain finish. 50mm projecting chrome plated brass vandal-resistant showerhead, tapered end to prevent suicide, wall sleeve,, Pneumatically operated push-button valve using atmospheric air, 9.5L/min, push-button control (located on adjacent side of wall)

.2 Thermostatic Mixing Valve, copper encapsulated thermostatic assembly with Teflon coated shuttle, combination checkstops, unions on inlets, wall support, locking temperature regulating handle, tempered outlet ball valves, colour coded dial thermometer, 32-60C temperature adjustment range, recessed cabinet with door, top inlets, top outlet, factory assembled and tested, view port **LEONARD XL-186-32-LF-RF-BWE REC-TOP-VP**

2.14 MOP SINK (MS-1)

.1 Bowl: 600 mm x 600 mm x 250 mm deep white molded stone, floor mounted sink with 25 mm wide shoulders and stainless steel strainer. **Fiat Model No. MSB-2424**.

.2 Trim: Exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, aerator, pail hook, vinyl bumper guards, stainless steel wall guards, eccentric adjustable inlets, integral screw drivers stops with covering caps and adjustable threaded wall flanges, 1500 mm of 15 mm. plain end reinforced rubber hose, hose clamp, mop hanger, . Trim to be mounted 900 mm up off the floor. **Fiat 830-AA**.

2.15 EMERGENCY SHOWER & EYEWASH STATION (ESH-1)

.1 Standard, plumbed emergency barrier free shower with eyewash combination unit. Eyewash: 5.1 gpm (0.321 L/s) with type 316 stainless steel spray head, bowl and dust cover. Showerhead: 22 gpm (1.38 L/s) flow rate, type 316 stainless steel head with stainless steel shroud. 25mm shower ball valve and 12mm stay-open eye and eye/face

wash valve manufactured of type 316 stainless steel. Barrier free pull rod handle made of type 316 stainless steel. **Bradley S19314BFSS**.

.2 Thermostatic Mixing Valve: meets ANSI Z358.1, liquid filled thermostat w/ 10year warranty, checkstops on inlet, vandal resistant temperature adjustable set point, built-in cold water bypass, positive shut-off of hot when cold supply is lost, dial thermometer, factory assembled and tested, located inside manufacturers surface mounted stainless steel cabinet. **Bradley S19-2100EFX**.

2.16 EMERGENCY EYEWASH STATIONS (EW-1)

.1 Barrier-free cabinet concealed swing down eye/face wash. Meets ANSI Z358.1, concealed fixture, activated with opening of stainless steel door, corrosion resistant stainless steel cabinet, internal drain, chrome-plated brass pipe and fittings, universal sign and inspection tag, spring softened opening, flush mounting in wall, bottom fed thermostatic mixing valve, maintenance compartment below fixture, 30mm drain with tailpiece, **Bradley S19-294HBT.**

.2 Thermostatic Mixing Valve: meets ANSI Z358.1, liquid filled thermostat w/ 10year warranty, checkstops on inlet, vandal resistant temperature adjustable set point, built-in cold water bypass, positive shut-off of hot when cold supply is lost, dial thermometer, factory assembled and tested. **Bradley S19-2000EFX.**

2.17 DRINKING FOUNTAIN: DF-1

.1 Fountain: Self-contained, wall mounted, refrigerated water cooler with bottle filling station, mechanically activated pushbar operation, electronic sensor for touchless bottle filler, laminar flow 5.7 lpm bottle filler, 11000L filter with visual monitor to indicate replacement, ADA certified, lead free design, stainless steel basin with integral drain and bubbler, light gray granite. Cooling system: hermaetically-sealed single phase compressor, fan-cooled, permanent lubricated fan motor, fully insulated, adjustable thermostat. **ELKAY EZH2O MODEL LMABF8WS** (Supply unit with 51300C_3PK replacement filters)

2.18 HOSE BIBB (NFHB) – EXTERIOR NON-FREEZE

.1 **Watts HY-725 Non-Freeze** Wall Hydrant, concealed non-freeze key operated wall hydrant with nickel bronze box and door, chrome plated hydrant face, self-draining integral vacuum breaker, 19 mm hose connection, all bronze head, locking with loose key

2.19 HOSE BIBB – INTERIOR

.1 **Acorn #8121CP 'NEPTUNE'** Hose Valve, heavy duty polished chrome cast brass body with integral cast flange, vandal-resistant lock shield bonnet with removable wheel handle, 19mm NPT female inlet and hose end vacuum breaker.

2.20 FLOOR DRAIN (FD-1)

.1 **Watts FD-100-A** Floor Drain, epoxy coated cast iron body with anchor flange, reversible clamping collar with primary & secondary weepholes, adjustable 127 mm round nickel bronze strainer, no hub outlet, trap primer connection.

2.21 FLOOR DRAIN (FD-2)

.1 **Watts Model FS-740** Floor Sink, Floor drains in water meter / sprinkler tree rooms shall be 300x300x200deep floor sink with a porcelain enamel coated iron grate, aluminum dome strainer, trap primer connection, trap primer connection

2.22 FLOOR DRAIN (FD-3)

.1 **Jay R. Smith 2005-69-CAN** Floor / Shower Drain with Heavy Duty Adjustable Strainer Head, duco cast iron body with flashing collar, 100mm NPT shank and satin nickel bronze heavy duty secured square hole grate, no hub outlet, Torx Centre Pin security screws c/w Locktite for secure installation, trap primer connection. Floor drain strainer to have openings smaller than 12mm.

2.23 FLOOR DRAIN (FD-4)

.1 **Watts FD-100-EG** Funnel Floor Drain with openings smaller than 12mm, epoxy coated cast iron body with anchor flange, reversible clamping collar with primary & secondary weepholes, adjustable nickel bronze strainer with 102 mm x 229 mm oval nickel bronze funnel, no hub outlet, trap primer connection.

2.24 ROOF DRAIN (RD-1)

.1 **Zurn Z121** Roof Drain, Dura-coated cast iron roof drain with combination membrane flashing clamp/gravel guard and low silhouette cast iron dome. No hub outlet, non-roof membrane penetrating installation

2.25 OVERFLOW DRAIN (OD-1)

.1 **Zurn Z121** Roof Drain, Dura-coated cast iron roof drain with combination membrane flashing clamp/gravel guard and low silhouette cast iron dome. No hub outlet, non-roof membrane penetrating installation, vandal-proof top, roof sump receiver, 89mm external water dam.

.2 Zurn Z199 downspout nozzle. Nickel Bronze body, decorative wall flange and outlet nozzle, removable stainless steel screen

PART 3. Execution

3.1 INSTALLATION

.1 Install each fixture with its own trap, easily removable for servicing and cleaning. At completion thoroughly clean plumbing fixtures and equipment.

.2 Provide chrome plated rigid or flexible supplies to fixtures with screw driver stops, reducers and escutcheons.

.3 Install wall mounted lavatories and urinals and water closets with approved wall carriers.

.4 Caulk gap between mop sink and wall with silicone sealant.

3.2 FIXTURES ROUGH-IN SCHEDULE

.1 Rough-in fixture piping connections in accordance with the following table of minimum sizes.

	Hot Water		Cold Water		Waste		Vent	
Lavatories	*15 mm*	*½ in.*	*15 mm*	*½ in.*	*40 mm*	*1½ in.*	*30 mm*	*1¼ in.*
Service Sink	*15 mm*	*½ in.*	*15 mm*	*½ in.*	*50 mm*	*2 in.*	*40 mm*	*1½ in.*
Kitchen Sink	*15 mm*	*½ in.*	*15 mm*	*½ in.*	*40 mm*	*1½ in.*	*30 mm*	*1¼ in.*
Drinking Fountain	--		*15 mm*	*½ in.*	*30 mm*	*1¼ in.*	*30 mm*	*1¼ in.*
Water Closet (Flush Valve)	--		*25 mm*	*1 in.*	*100 mm*	*4 in.*	*50 mm*	*2 in.*
Urinals (Flush Valve)	--		*20 mm*	*¾ in.*	*50 mm*	*2 in.*	*40 mm*	*1½ in.*
Floor Drains	--		--		*100 mm*	*4 in.*	*40 mm*	*1½ in.*
Water Closet (Tank Type)	--		*15 mm*	*½ in.*	*100 mm*	*4 in.*	*50 mm*	*2 in.*
Bath Tub	*15 mm*	*½ in.*	*15 mm*	*½ in.*	*40 mm*	*1½ in.*	*30 mm*	*1¼ in.*
Shower (Single Stall)	*15 mm*	*½ in.*	*15 mm*	*½ in.*	*50 mm*	*2 in.*	*40 mm*	*1½ in.*
Eyewash	*15 mm*	*½ in.*	*15 mm*	*½ in.*	*30 mm*	*1¼ in*	*30 mm*	*1¼ in.*

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Cleanouts.

.2 Water Hamer Arresters

.3 Floor Drains

.4 Roof drains.

.5 Cooling equipment condensate drains.

.6 Sumps.

.7 Backflow preventers.

.8 Vacuum breakers.

.9 Backwater valves.

1.2 GENERAL REQUIREMENTS

.1 Provide materials, equipment and labour to install plumbing as required by Provincial and Local Codes as specified herein.

.2 Provide drainage connections to equipment furnished in other sections of this specification and by the Owner. Refer to Section, Equipment Supplied by Others.

Part 2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1	Cleanouts:	Roto Tech Smith, Zurn, Ancon.
.2	Water Hammer Arrestors:	Roto Tech Smith, Zurn, Watts, Ancon.
.3	Floor Drains:	Roto Tech Smith, Zurn, Watts, Ancon.
.4	Backwater Valves:	Roto Tech Smith, Zurn.

2.2 CLEANOUTS AND CLEANOUT ACCESS COVERS

.1 Provide caulked or threaded type extended to finished floor or wall surface. Provide bolted coverplate cleanouts on vertical rainwater leaders only. Ensure ample clearance at cleanout for rodding of drainage system.

.2 Floor cleanout access covers in unfinished areas shall be round with nickel bronze scoriated frames and plates. Provide round access covers in finished areas with depressed centre section to accommodate floor finish. Wall cleanouts to have chrome plated caps.

.3 Cover plates in secure areas to be complete with Torx Centre Pin security screws c/w Locktite for secure installation.

2.3 WATER HAMMER ARRESTERS

.1 Fit water supply to each fixture or group of fixtures with an air chamber. Provide air chambers same size as supply line or 20 mm minimum, and minimum 450 mm long.

.2 Install stainless steel bellows type water hammer arresters on water lines connected to solenoid valves complete with accessible isolation valve.

2.4 FLOOR DRAINS

.1 Refer to Section 22 40 00.

2.5 ROOF DRAINS

.1 Refer to Section 22 40 00.

2.6 EQUIPMENT DRAINS

.1 Provide a sloped connection from packaged equipment drain pans to nearest sanitary sewer trapped connection. Slope at minimum of 0.5% grade. Drain size to be 20 mm. Trap at unit is to be deep enough to ensure a 50 mm water seal at the maximum total pressure of the fan system.

.2 Provide in each air processing unit which maintains water carry over a galvanized water proof drain pan, to be the full width of the plenum and a rim of 1/2 the plenum height in length. Drain is to be flashed into the water proof floor and is to slope to an open trapped sanitary connection at a 0.5% grade. For units exposed to freezing conditions, drain piping is to be internal to the unit and routed beneath the unit in the heated space.

2.7 SUMPS

.1 Reinforced concrete sumps shall have necessary drainage fittings, 9 mm checkered steel plate covers with gasket seal frames and anchor bolts. Provide grated cover over one sump compartment when used for area drain.

.2 Construct to local municipality standard, from precast concrete sections laid on poured-in-place reinforced concrete foundation pad. Catch basins shall be provided with heavy duty cast iron grate. Minimum 1800 mm cover over outlet and minimum 600 mm sump below outlet, unless shown otherwise.

2.8 BACKFLOW PREVENTER ASSEMBLIES

.1 Provide backflow preventer assembly complete with shut-off valves before and after check valves and test cocks. Assembly shall meet AWWA requirements and CSA B64.10 standard.

.2 Where indicated and/or required by code, provide complete reduced pressure principle type assembly, consisting of pressure differential relief valve, located between two (2) positive seating replaceable check valves with stainless steel or bronze seats. Provide strainer between gate valve and first check valve on units 50 mm and smaller. Construction to be lead free.

.3 Where indicated and/or required by code, provide complete double check valve type assembly consisting of two (2) positive sealing replaceable check valves with stainless

steel or bronze seats. Provide check valve on units 50 mm and smaller. Construction to be lead free.

2.9 VACUUM BREAKERS

.1 Provide hose connection type vacuum breaker assembly, consisting of:

.1 A check valve disc assembly to be vandal proof and drainable.

.2 Rated for freezing conditions where applicable

2.10 BACKWATER VALVE ASSEMBLIES

.1 Provide complete assembly, epoxy coated, cast-iron body, bronze flapper check valve, bolted access cover with neoprene gasket extended floor access and neoprene gasketted heavy-duty nickel-bronze cover.

Part 3. Execution

3.1 INSTALLATION

.1 Bury outside drainage pipe minimum 2400 mm.

.2 Plumbing lines installed outside the building shall be separated by a minimum of 1 m horizontally between the outside surface of the lines. The lines are not permitted to be stacked.

.3 Install cast iron connections from weeping tile to sanitary drainage system including backwater valve, deep seal P-trap and cleanout. Provide access for servicing of backwater valve.

.4 Lubricate cleanout plugs with mixture of graphite and linseed oil. Prior to building turnover, remove cleanout plugs, re-lubricate and re-install using only enough force to ensure permanent leakproof joint.

.5 Floor drains located in floating floors with no membrane provide lead flashing pan. 900 mm x 900 mm at 39 kg/m^2. Flash membrane or lead into flashing clamp on drain body.

.6 Provide trap primers on all floor and shower drains.

.7 Drainage lines shall grade 2% per foot unless otherwise noted on drawings.

.8 Plumbing vents shall be located minimum 5 m from air intakes.

END OF SECTION

Part 1. General

1.1 SCOPE

.1 Cleanouts.

.2 Roof drains.

.3 Backwater valves.

1.2 GENERAL REQUIREMENTS

.1 Provide materials, equipment and labour to install plumbing as required by Provincial and Local Codes as specified herein.

.2 Provide water and drainage connections to equipment furnished in other sections of this specification and by the Owner.

.3 Provide and include charges for connections to Municipal and Utility Company services, including costs to maintain temporary water supply pending acceptable water quality tests, where applicable.

.4 Provide an approved water meter and bypass installation conforming to Local Codes and Standards.

Part 2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1	Cleanouts:	Roto Tech Smith, Zurn, Watts, Ancon.
.2	Roof Drains:	Roto Tech Smith, Zurn, Watts, Ancon.
.3	Backwater Valves:	Roto Tech Smith, Watts, Zurn.

2.2 CLEANOUTS AND CLEANOUT ACCESS COVERS

.1 Provide caulked or threaded type extended to finished floor or wall surface. Provide bolted coverplate cleanouts on vertical rainwater leaders only. Ensure ample clearance at cleanout for rodding of drainage system.

.2 Floor cleanout access covers in unfinished areas shall be round with nickel bronze scoriated frames and plates. Provide round access covers in finished areas with depressed centre section to accommodate floor finish. Wall cleanouts to have chrome plated caps.

2.3 BACKWATER VALVE ASSEMBLIES

.1 Provide complete assembly, epoxy coated, cast-iron body, bronze flapper check valve, bolted access cover with neoprene gasket extended floor access and neoprene gasketted heavy-duty nickel-bronze cover.

Part 3. Execution

3.1 INSTALLATION

.1 Bury outside drainage pipe minimum 2400 mm.

.2 Plumbing lines installed outside the building shall be separated by a minimum of 1 m horizontally between the outside surface of the lines. The lines are not permitted to be stacked.

.3 Install cast iron connections from weeping tile to sanitary drainage including backwater valve, deep seal P-trap and cleanout. Provide access for servicing of backwater valve.

.4 Lubricate cleanout plugs with mixture of graphite and linseed oil. Prior to building turnover, remove cleanout plugs, re-lubricate and re-install using only enough force to ensure permanent leakproof joint.

.5 Drainage lines shall grade 2% per foot unless otherwise noted on drawings.

.6 Install roof drains with 800 mm x 800 mm at 39 kg/m² sheet lead.

END OF SECTION

Part 1. General

1.1 REFERENCES

.1 Division 00.

.2 Division 01.

.3 Division 21, 22, 23, 25.

1.2 INTENT

.1 Provide complete, fully tested, and operational mechanical systems to meet the requirements described herein and in complete accordance with applicable codes and ordinances.

.2 Contract documents and drawings of this Division are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.

.3 Follow manufacturers' recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents.

.4 Install equipment generally in locations and routes shown. Run piping and ductwork close to building structure, parallel to building lines to maximize head room and with minimum interference with other services and free space. Remove and replace improperly installed equipment to satisfaction of the Engineer at no extra cost.

.5 Install equipment to provide access and ease of maintenance.

.6 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Owner. Uncrate equipment, move in place and install complete; start-up and test.

.7 Install control valves, control dampers, thermal wells, and other devices on piping and ducts, furnished by Controls Contractor.

.8 Furnish a written guarantee stating that all work executed in this contract will be free from defective workmanship and materials for a period of one (1) year from the date of Substantial Performance. The Contractor shall, at his own expense, repair and replace any work which fails or becomes defective during the term of the guarantee/warranty, providing such work is not due to improper usage. The period of guarantee specified shall not in any way supplant any other guarantees of a longer period but shall be binding on work not otherwise covered.

.9 If the equipment is used during construction, the guarantee or guarantee period shall not be shortened or altered.

.10 'Provide' shall mean; supply and install'.

1.3 OWNER REQUIREMENTS DURING WARRANTY

.1 Unless specified otherwise the Owner shall be responsible for all routine maintenance requirements as required in the manufacturer's instructions.

.2 The Owner shall be responsible for supplying filters, grease, and belts.

1.4 COORDINATION OF WORK

.1 Cooperate and coordinate with other trades on the project.

.2 Make reference to electrical, mechanical, structural and architectural drawings when setting out work. Consult with respective Divisions in setting out locations for ductwork, equipment, and piping, so that conflicts are avoided and symmetrical even spacing is maintained. Jointly work out all conflicts on site before fabricating or installing any materials or equipment.

.3 Where dimensional details are required, work with the applicable architectural and structural drawings.

.4 Full-size and detailed drawings shall take precedence over scale measurements from drawings.

.5 Any areas indicted as space for future materials or equipment shall be left clear.

1.5 PERMITS

.1 All work shall comply with provincial, municipal, bylaws and authorities having jurisdiction.

.2 Obtain all permits and pay all fees applicable to the work.

.3 Contractor shall arrange for inspections of the work by the authorities having jurisdiction and shall provide certificates indicating Final Approval.

1.6 TENDER PRICE BREAKDOWN

.1 Submit a tender price breakdown within thirty (30) days of tender closing and before first progress claim, in a format required by the engineer.

.2 Submit a breakdown of the contract price using the following form within thirty (30) days of contract award and well before first progress claim for review and acceptance by Engineer.

.3 Progress claims shall be submitted using this contract price breakdown.

CONTRACT PRICE BREAKDOWN			
		MATERIAL	**LABOUR**
1.	Bonding		
2.	Supervision		
3.	Project Overheads: Shack, Telephone, etc.		
4.	Documentation		
5.	System Demonstration and Owners Instruction		
6.	Materials Testing		
7.	Equipment Testing and Start-Up (Commissioning)		
8.	Balancing		
9.	Site Services		
	• Water - On Site		
	• Sanitary - On Site		
	• Gas Service		
10.	Pre-operational Cleaning and Chemical Treatment		
11.	Water Softening Equipment		
12.	Plumbing		
	• Fixtures		
	• Piping & Valves		
	• Domestic Water Heaters		
	• Pumps		
	• Miscellaneous Equipment (List)		

CONTRACT PRICE BREAKDOWN			
		MATERIAL	**LABOUR**
13.	Heating		
	• Tanks		
	• Boilers		
	• Pumps		
	• Terminal Heating Units (Radiation)		
	• Piping & Valves		
	• Unit Heaters/Force Flows		
	• Miscellaneous Equipment (List)		
14.	Cooling		
	• Chillers		
	• Pumps		
	• Piping & Valves		
	• Dry Coolers		
	• Miscellaneous Equipment (List)		
15.	Ventilation & Air Conditioning		
	• Make-up Air Units		
	• Energy Recovery Units		
	• Fans		
	• Grilles / Diffusers / Louvres		
	• Fan Coil Units		
	• Ducts and Dampers		
	• Miscellaneous Equipment (List)		
16.	Fire Protection		
	• Sprinklers		
	• Fire Extinguishers		
17.	Insulation		
	• Piping Insulation		
	• Duct Insulation		
	• Equipment Insulation		
18.	Meters and Gauges		
19.	Duct Cleaning		

CONTRACT PRICE BREAKDOWN			
		MATERIAL	**LABOUR**
20.	Breeching & Chimneys		
	TOTAL (TO EQUAL CONTRACT PRICE)		

1.7 PROGRESS CLAIMS

.1 Submit a Progress Summary and a Detailed Price Breakdown with each Progress Claim. The Summary and Breakdown shall include all Change Orders issued.

.2 Progress claims shall not be processed past 90% of the overall Mechanical Contract until the final commissioning and prove-out has been completed. This will allow for sufficient deficiency holdbacks for problems identified during commissioning.

1.8 EXAMINATION OF SITE

.1 Before submitting tender, visit and examine the site and note all characteristics and features affecting the work. No allowances will be made for any difficulties encountered or any expenses incurred because of any conditions of the site or item existing thereon, which is visible or known to exist at the time of tender.

1.9 QUALITY OF WORK

.1 All work shall be by qualified tradesmen with valid Provincial Trade Qualification Certificates.

.2 Work which does not conform to standards accepted by the Consultant and the trade may be rejected by the Consultant. The Contractor shall redo rejected work to the accepted standard at no cost to the Owner.

1.10 METRIC CONVERSION

.1 All units in this division are expressed in SI units.

.2 Submit all shop drawings and maintenance manuals in SI units.

.3 On all submittals (shop drawings etc.) use the same SI units as stated in the specification.

.4 Equivalent Nominal Diameters of Pipes - Metric and Imperial:

.5 Where pipes are specified with metric dimensions and Imperial sized pipes are available, provide equivalent nominal Imperial sized pipe as indicated in the table, and provide at no extra cost adapters to ensure compatible connections to all metric sized fittings, equipment and piping.

.6 When CSA approved SI Metric pipes are provided, the Contractor shall provide at no extra cost adapters to ensure compatible connections between the SI Metric pipes and all new and existing pipes, fittings, and equipment.

EQUIVALENT NOMINAL DIAMETER OF PIPES					
mm	***Inches (NPS)***	***mm***	***Inches (NPS)***	***mm***	***Inches (NPS)***
3	*1/8*	*65*	*2-1/2*	*375*	*15*
6	*1/4*	*75*	*3*	*450*	*18*
10	*3/8*	*100*	*4*	*500*	*20*
15	*1/2*	*125*	*5*	*600*	*24*
20	*3/4*	*150*	*6*	*750*	*30*
25	*1*	*200*	*8*		
30	*1-1/4*	*250*	*10*		
40	*1-1/2*	*300*	*12*		
50	*2*				

1.11 METRIC DUCT SIZES

.1 The Metric duct sizes are expressed as 25 mm = 1 inch.

1.12 ALTERNATE MATERIALS AND EQUIPMENT

.1 The price submitted for this contract shall be based on the use of materials and equipment as specified or as contained within the Acceptable Manufacturers List.

.2 Requests for acceptance for tendering purposes of substitute materials or equipment shall be submitted in duplicate, to the Engineer no later than seven (7) working days prior to the closing date of the bid for mechanical trade, complete with all applicable technical data, including performance curves and physical details. Acceptance of requests shall only be given by addendum.

.3 The Contractor shall, in his quotation, indicate the degree of acceptance obtained from the Engineer. In the event that the product has been accepted as "Substitute Only", this shall be stated in the quotation.

.4 Accepted substitutions to specified products shall be equal to the specified product in every respect, operate as intended, meet the space, capacity, and noise requirements outlined.

.5 The Contractor shall be fully responsible for any additional work or materials required by the trades or other Contractors to accommodate use of other than specified materials or equipment. Extras will not be accepted to cover such work.

1.13 DRAWINGS AND SPECIFICATION

.1 Drawings and specifications are complementary each to the other, and what is called for by one shall be binding as if called for by both.

.2 Should any discrepancy appear between drawings and specifications which leaves the Contractor in doubt as to the true intent and meaning of the plans and specifications, obtain a ruling from the Engineer, before submitting a tender. If this is not done, it will be assumed that the most expensive alternate had been included.

.3 Examine all contract documents, including all drawings and specifications, and work of other trades to ensure that work is satisfactorily carried out without changes to building.

1.14 SHOP DRAWINGS

.1 Provide one (1) electronic copy for review. Provide three (3) printed copies for insertion into manuals

.2 Identify materials and equipment by manufacturer, trade name and model number. Include copies of applicable brochure or catalogue material. Do not assume applicable catalogues are available in the Engineer's office. Maintenance and operating manuals are not suitable submittal material.

.3 Clearly mark submittal material using arrows, underlining or circling to show differences from specified, e.g. ratings, capacities and options being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pumps seals materials or painting.

.4 Include dimensional and technical data sufficient to check if equipment meets requirements. Include wiring, piping, and service connection data and motor sizes.

.5 Installed materials and equipment shall meet specified requirements regardless of whether or not shop drawings are reviewed by the Engineer.

.6 Do not order equipment or material until the Engineer has reviewed and returned shop drawings.

.7 Prior to submission to the Engineer, the Contractor shall review all shop drawings.

.1 By this review, the Contractor certifies that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data, and certifies that he has checked and coordinated each shop drawings with the requirements of the work of the contract documents.

.2 The Contractor's review of each shop drawing shall be indicated by stamp, date and signature of a responsible person.

.8 Retain one (1)copy of shop drawings on site for review.

1.15 SALVAGE

.1 Remove from site all equipment, ducting or piping which is no longer required because of work under this Contract.

.2 Turnover to and deliver to the Owner's storage area all items which have been determined to have salvage value and has been removed due to the Work.

1.16 CUTTING, PATCHING AND CORING

.1 Provide holes and sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves.

.2 Drill for expansion bolts, hanger rods, brackets, and supports.

.3 Obtain written acceptance from the Engineer before cutting or burning structural members.

.4 Provide openings and holes required in precast members for mechanical work. Cast holes 100 mm. or larger in diameter. Field cut smaller than 100 mm.

.5 Patch building where damaged from equipment installation, improperly located holes etc. Use matching materials as specified in the respective section.

1.17 EXCAVATION AND BACKFILL

.1 Refer to requirements of Division 2.

.2 Provide all excavating to facilitate installation of the mechanical work, including shoring, pumping, 150 mm compacted sand bedding under and first 300 mm of compacted sand over piping and ducting.

1.18 INSTALLATION OF EQUIPMENT

.1 Pipe all equipment drains to building drains.

.2 Unions and flanges shall be provided in piping or ductwork to permit easy removal of equipment.

.3 Maintain permanent access to equipment for maintenance.

1.19 FIRE-STOPPING

.1 Fire-stop all pipe, duct, conduit and wire penetrations through floors and walls, designated as fire and/or smoke separations.

.2 Fire-stopping materials to meet ULC CAN 2S115. Acceptable Materials: by "Tremco" or "National Firestopping".

.3 Preparation of surfaces and installation of fire-stopping materials shall be carried out as per manufacturer's instructions.

1.20 CONNECTIONS TO EXISTING SERVICES

.1 Maintain liaison with the Owner and provide a schedule to interrupt, re-route or connect to water, sewer, heating, or gas systems, with minimum interruption of services.

.2 Major services shall not be interrupted before all preparatory work is completed and all required materials are on site.

.3 Interruptions and shutdowns of existing services shall be by the maintenance staff.

1.21 EQUIPMENT AND MATERIALS

.1 Materials and equipment installed shall be new, full weight and of quality specified.

.2 Each major component of equipment shall bear manufacturer's name, address, catalogue and serial number in a conspicuous place.

.3 Where two (2) or more products of the same type are required, products shall be of the same manufacturer.

.4 Make known in writing to the Engineer ten (10) days prior to the tender closing date any materials specified that are required to complete the work which are not currently available or will not be available for use as called for herein. Failing to do so, it will be assumed that the most expensive alternate has been included in the tender price.

1.22 EQUIPMENT PROTECTIONS AND CLEAN-UP

.1 Protect equipment and materials in storage on site during and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.

.2 Protect equipment with polyethylene covers and crates.

.3 Operate, drain and flush out unsealed bearings and refill with new change of oil, before final acceptance.

.4 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances.

.5 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

.6 Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not reuse existing materials and equipment unless specifically indicated.

1.23 ELECTRICAL MOTORS

.1 Supply mechanical equipment complete with electrical motors.

.2 Provide motors designed, manufactured, and tested in accordance with the latest edition of the following codes and standards: NEMA, EEMAC, CSA, CEC Part 1, IEEE and ANSI. All motors to be CSA labelled. All motors to be approved for use in the designated area classification by the Provincial Electrical Protection Branch.

.3 Unless specified otherwise, provide motors designed for full voltage starting, EEMAC Design B. Motors driving high torque or high inertia loads may be EEMAC Design C or D.

.4 Provide motors rated for continuous duty with 1.15 service factor unless specified otherwise in the driven equipment specifications. Provide all motors with thermal overload protection.

.5 Motors less than 1 hp shall be 120 V, 60 Hz, 1-phase. Motors 1 hp and larger shall be 3 phase at the indicated voltage.

.6 All motors shall be 1800 rpm where indicated.

.7 Provide motors with grease or oil lubricated anti-friction type ball or roller bearings.

.8 Provide motors designed with Class B insulation; Class F insulation for totally enclosed motors.

.9 Refer to electrical specifications, Division 26, for voltage, frequency, and phase data. This shall take precedence over any reference in Division 21, 22, and 23.

.10 Where motor power is stated in watts or kilowatts, nominal motor horsepower multiplied by 746 or 0.746 respectively, has been used as the conversion factor.

.11 Minimum certified motor efficiency shall be as outlined below;

MINIMUM CERTIFIED MOTOR EFFICIENCY (%) *				
HP	**3600 RPM**	**1800 RPM**	**1200 RPM**	**900 RPM**
1	75.5	82.5	80.0	74.0
1.5	82.5	84.0	85.5	77.0
2	84.0	84.0	86.5	82.5
3	85.5	87.5	87.5	84.0
5	87.5	87.5	87.5	85.5
7.5	88.5	89.5	89.5	85.5
10	89.5	89.5	89.5	88.5
15	90.2	91.0	90.2	88.5
20	90.2	91.0	90.2	89.5
25	90.5	91.7	91.3	89.6
30	90.8	91.9	91.4	90.7
40	91.4	92.5	92.3	90.6
50	91.9	92.7	92.3	91.3
60	92.4	93.2	92.9	91.6
75	92.5	93.5	93.1	92.8
100	93.0	93.7	93.5	92.7
125	93.6	93.9	93.6	93.4
150	93.8	94.3	94.2	93.4
200	94.3	94.5	94.6	93.9
250	95.0	95.0	95.0	95.0
300	95.0	95.0	95.0	95.0
400	95.0	95.0	95.0	95.0
500	95.0	95.0	95.0	95.0

(*) As defined in CSA C390 or IEEE 112B Nominal Standards

1.24 ACCESS DOORS

.1 Provide access doors for maintenance or adjustment purposes for all mechanical system components including:

.1 Valves;

.2 Volume and splitter dampers;

.3 Fire dampers;

.4 Cleanouts and traps;

.5 Controls, coils and terminal units;

.6 Expansion joints.

.7 Filters

.8 Strainers

.2 Non-Fire Rate Access Doors: Frame with gypsum board inlay and structural nylon corners. The door shall be tapped and finished consistent with the surrounding surface. Recess aluminum frame provides edge similar to drywall bead against which ceiling surface can be finished. Materials: Extruded Aluminum Alloy 6063-T6, gypsum board inlay, fiberglass re-enforced nylon, zinc plated screws, stainless steel springs and retaining wire. Concealed hinge for 120degree door opening and door removal. Paint as per surrounding

.3 Fire Rated Access Doors: Steel frame access panel with stainless steel piano-type hinge, channel reinforced steel door panel, three "Symmons" fasteners per door. Door panel recessed to receive ceiling or wall material to give finished appearance showing only hinge and fasteners. Provide acoustic gasket between door panel perimeter and steel frame. Rated access doors shall be UL-listed.

.4 Mark removable ceiling tiles used for access with colour coded dots.

.5 Sizes to be 200 mm x 200 mm. for cleanout, 300 mm x 300 mm. for hand 600 mm x 600 mm^2 for body access minimum.

.6 Provide UL-listed fire rated access doors installed in rated wall and ceilings.

1.25 MISCELLANEOUS METALS

.1 Provide all necessary miscellaneous metals to hang or support materials, equipment and provide access for work under this contract.

.2 All miscellaneous metals shall be prime painted.

.3 Miscellaneous metals shall include but not limited to:

.1 Hangers for equipment, piping and ductwork.

.2 Support for equipment.

.3 Access platforms and catwalks.

1.26 PIPE SLEEVES

.1 Pipe sleeves shall be provided for piping passing through walls and floors. Minimum 0.61 mm galvanized sheet metal. Sleeves shall extend 25 mm. on either side of the wall.

.2 Schedule 40 steel pipe shall be used as floor pipe sleeves in wet areas with up-stand.

.3 Pipe sleeves are not required where pipes pass through cored concrete walls or floors.

1.27 ESCUTCHEON AND PLATES

.1 Provide escutcheon and plates on piping and ductwork passing through finished walls, floors, and ceilings.

.2 Escutcheons shall be split type, stainless or chrome plated steel.

1.28 PAINTING AND IDENTIFICATION

.1 Coordinate colour coding of piping and equipment with work of Division 9.

.2 Colour code mechanical equipment, piping and exposed ductwork. Refer to colour schedule at end of this section.

.3 Legend and direction of flow arrows shall consist of adhesive backed labels, yellow colour, with minimum 20 mm. high black lettering equal to Brady System B-500, vinyl cloth labels for non-insulated surfaces; and Brady B 946 for insulated surfaces.

.4 Identify piping with labels, colour bands, and flow arrows. Provide identification at 15 m maximum intervals, before and after pipes pass through walls, at all sides of tees, behind access doors and in equipment rooms as required.

.5 Apply colour bands at both ends of the label with primary colour bands used to secure both ends of individual labels. Refer to colour schedule at end of this section.

.6 Provide 20 mm. diameter brass, with metal photo black numbers, or white lamacoid with black engraved numbers, secured to valve stem with key chain.

.7 Provide neat, typewritten directories, giving valve number, services and location. Frame one (1) copy under glass for wall mounting as directed, second copy to be forwarded to Owner. Include copies in O & M Manuals.

.8 Tag automatic controls, instruments and relays and match/key to control shop drawing identification numbers. Tag all equipment and control panels.

.9 Identify electric starting switches, thermostats controlling motors, remote push button stations, and controls equipment supplied under this division with lamacoid plates having 6 mm minimum letter size. Identification to state equipment controlled.

.10 Identify the usage of duct access panels with self-adhesive Brady stick-on coloured labels. Apply labels conforming to the following schedule.

Usage	Colour	Letters
Cleaning and service access	Yellow	C.A.
Controls, including heat sensors	Black	C.
Dampers (backdraft, balance & control)	Blue	D.
Fire dampers	Red	F.D.
Smoke dampers and detectors	Red	S.D.

*Note: Provide black lettering for yellow or white background, white for all other colours.

.11 Identify the location of the following items of equipment which are concealed above a ceiling with Avery "Data Dots." Place identification dots (12mm. diameter) on the access panel. The colours shall conform to the following schedule:

.1 Concealed equipment and cleaning access:

.1 Yellow

.2 Control equipment, including control dampers and valves, and heat sensors:

.1 Black

.3 Fire, smoke, and sprinkler equipment including dampers:

.1 Red

.4 Pipe mounted equipment with the exception of fire, smoke, sprinkler and control equipment:

.1 Green

.5 Balancing Dampers:

.1 Blue

.12 When T-bar ceilings are installed, adhere "Data Dots" on T-bar framing adjacent to panel to be removed.

1.29 COLOUR CODING SCHEDULE

.1 Colour numbers are called for in Canadian Government Specification No. 5-GP-1a. Colours assigned from CGSB 1-GP-12c for colour code identification.

.2 Mechanical Primary Colours for Pipe Lines/Equipment.

MECHANICAL PRIMARY COLOURS FOR PIPE LINES/EQUIPMENT	
Colour	**Pipe Lines/ Equipment**
Yellow	505-102
Light Blue	502-106
Green	503-107
Orange	508-102
Brown	504-103
Red	509-102
White	513-101
Aluminum	515-101
Purple	501-101
Grey	501-107

.3 Secondary Colours for Bands.

SECONDARY COLOURS FOR BANDS	
Colour	**Bands**
Red	509-102
Orange	508-102
Blue	502-106

.4 Banding.

BANDING	
Colour	**Banding**
Red	To indicate extremely hazardous material
Orange	To indicate mildly hazardous material
Blue	To indicate non-hazardous material

.5 Identification Symbols and Colour for Piping

IDENTIFICATION SYMBOLS AND COLOUR FOR PIPING			
Type	**Pipe Colour**	**Stripe Colour**	**Symbol**
Chilled Glycol Return	Green	Orange	CH.GLYR
Chilled Glycol Supply.	Green	Orange	CH.GLYS
Compressed Air	White	None	kPa Air
Condensate	Green	Orange	COND
Domestic Cold Water	Light Blue	None	DCW
Domestic Hot Water	Green	Orange	DHW
Domestic Hot Water	Green	Blue	DHWR.
Engine Exhaust	Aluminum	Orange	EXH
Heating Glycol Return	Yellow	Orange	HGLYR
Natural Gas	Orange	Red	Nat.Gas
Sprinkler	Red	None	Sprinkler
Vacuum	Aluminum	None	Vac.
Vent	Aluminum	Red/Orange	Vent
Water Softened	Blue	None	Soft Wat.

.6 Identification Symbols and Colours for Equipment

IDENTIFICATION SYMBOLS AND COLOURS FOR EQUIPMENT			
	Pipe Colour	**Stripe Colour**	**Symbol**
Boilers	Green	Red	None *25 mm1 in.* Length
Fan Guards - Motor Guards	Red Machinery Enamel		
Hangers, Brackets, Hanger Rods	Black Machinery Enamel		
Heat Exchangers	Green	Orange	None
Hot Water Storage (Uninsulated)	Aluminum	Red	None
Pumps - Fire	Red	None	None
Pumps - Regular	Aluminum	None	None
Supports	Black	None	None
Tanks - Chilled Glycol	Green	Orange	None
Tanks - Hot Water (Insulated)	Green	Orange	None
Valves Uninsulated	High Heat Aluminum		
Water Chiller Units	Green	Orange	Ch. Water

.7 Mechanical Control Systems

.1 Conduit pull boxes, terminal boxes and junction boxes - GREY Covers - GREY with black `C'.

.2 Main and secondary control panels, factory finish acceptable - control Contractor to install company label to identify.

.8 Ductwork

.1 All ductwork in mechanical rooms to be identified as follows, complete with directional arrows:

DUCTWORK IDENTIFICATION	
Return Air	R.A.
Supply Air	S.A.
Mixed Air	M.A.
Combustion Air	Comb.Air
Relief Air	Relief Air
Exhaust Air	Exh.Air.

1.30 PERFORMANCE VERIFICATION OF INSTALLED EQUIPMENT

.1 Installed mechanical equipment whose performance is questioned by the Consultant, may be subject to performance verification as specified herein.

.2 When performance verification is requested, equipment shall be tested to determine compliance with specified performance requirements.

.3 The Consultant will determine by whom testing shall be carried out. When requested, the contractor shall arrange for services of an independent testing agency.

.4 Testing procedures shall be reviewed by the Consultant.

.5 Maintain building comfort conditions when equipment is removed from service for testing purposes.

.6 Promptly provide the Consultant with all test reports.

.7 Should test results reveal that originally installed equipment meets specified performance requirements. Owner will pay all costs resulting from performance verification procedure.

.8 Should test results reveal that equipment does not meet specified performance requirements, equipment will be rejected and the following shall apply:

.1 Remove rejected equipment. Replace with equipment which meets requirements of Contract Documents including specified performance requirements.

.2 Replacement equipment will be subject to performance verification as well, using same testing procedures on originally installed equipment.

.3 Contractor shall pay all costs resulting from performance verification procedure.

1.31 TEMPORARY HEAT

.1 Do not use the permanent system for temporary heating purposes without written permission from the Engineer.

.2 Thoroughly clean and overhaul permanent equipment used during the construction period, replace worn or damaged parts before final inspection.

.3 Use of permanent systems for temporary heat shall not modify terms of warranty.

.4 Operate heating systems under conditions which ensure no temporary or permanent damage. Operate with proper safety devices and controls installed and fully operational. Operate systems only with treated water as specified.

.5 Air systems shall not be used for temporary heating.

.6 When permanent systems are used for temporary heat, provide alarm indicating system failure. Connect alarm to independent alarm company system.

.7 Where pumps are used for temporary heating, replace mechanical seals, regardless of condition, with new mechanical seals.

1.32 TEMPORARY OR TRIAL USAGE

.1 Temporary or trial usage by the Owner or Engineer of mechanical equipment supplied under contract shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

.4 Avoid thermal shock to heating system by coordination with the Owner during planning, construction and operation of temporary heating system.

.5 Return condensate to the heating plant. Meter equipment is not required.

1.33 SUBSTANTIAL AND TOTAL PERFORMANCE

.1 Prior to requesting an inspection for Substantial Performance, provide a complete list of items which are deficient.

.2 A certificate of Substantial Performance will not be granted unless the following items are completed:

.3 Heating air conditioning, plumbing and fire protection systems have been commissioned and are capable of operation with alarm controls functional and automatic controls in operation.

.4 The necessary tests on equipment and systems including those required by authorities have been completed with certificates of approval.

.5 Air and water systems have been balanced with draft report submitted to Engineer.

.6 Valve tagging and equipment identification is complete.

.7 Warranty forms have been mailed to the manufacturer. Provide copy of original warranty for equipment which has warranty period longer than one (1) year.

.8 Systems have been chemically cleaned. Flush and initiate water treatment. Provide report from manufacturer's representative to confirm status of treatment.

.9 Draft Operating/Maintenance Manuals have been submitted.

.10 Operating and Maintenance demonstrations have been provided to the Owner.

.11 Written inspection report by manufacturer's representative has been submitted for noise and vibration control devices and flexible connections.

.12 Record drawings have been submitted.

.13 Fan plenums have been cleaned, and temporary filters have been replaced with permanent filters.

.14 All seismic restraint devices have been installed.

.15 All previously identified deficiencies have been corrected.

.16 Prior to Total Performance Review provide declaration in writing that deficiencies noted at time of Substantial Performance Inspection have been corrected and the following items completed prior to the total performance review:

.17 Submit find air and water balance reports.

.18 Submit final operating and maintenance manuals.

.19 Complete final calibration.

.20 The Engineer shall provide one (1) visitation for the purpose of total performance review. Subsequent visitations if required, shall be at the expense of the Contractor.

.21 The Contractor shall provide qualified personnel in appropriate numbers to operate the facility until substantial performance is declared.

1.34 LIABILITY

.1 Assume full responsibility for laying out the work and for any damage caused to the Owner or other Sub-Contractors by improper location, or carrying out of the work.

.2 Be responsible for prompt installation of this work in advance of concrete pouring or similar work.

.3 Provide and set sleeves where required. Should any cutting or repairing of either unfinished or finished work be required, this Sub-Contractor shall direct the particular Sub-Contractor whose work is involved to do such cutting and repairing without expense to the Owner. Before being undertaken, such work shall be laid out for the Consultant's review.

.4 Examine the site and the local conditions affecting work under this Contract.

.1 Examine carefully the mechanical, electrical, structural and architectural drawings and confirm that the work under this Sub-Contract can be satisfactorily carried out without changes to the building as shown on these plans.

.2 Before commencing the work, examine the work of the other Trades and report at once any defect of interference affecting the work or warranties of this section.

.3 No extras will be subsequently allowed for such error, omission or oversight on the thorough review of the grounds, building, conditions, etc.

.5 Arrange work in co-operation with other trades in the building in such a manner as not to interfere with other work being carried on in the building and places where other pipes, ducts, conduits, cable and equipment are to be installed along with the pipes and ducts pertaining to this trade.

.1 Cooperate with the other trades to get all the pipes, ducts, conduit, etc., installed to the best advantage.

.2 When open web structural joists are used, obtain structural shop drawings to ensure adequate space is available for installation of pipes and ductwork.

.6 Where any pipes, ducts and equipment supplied by this Sub-trade must be built into the work of other trades such as masonry, structural, or plastering, be responsible for supplying the equipment to be built in or for measurements to allow the necessary openings to be left.

.1 All pipes and ducts which are to be concealed shall be installed neatly and close to the building structure so that the necessary furring can be kept as small as possible.

.2 Any pipes, ducts, or other work which are not, in the opinion of the Consultant, installed as they should be, shall be taken out and replaced without cost to the Owner.

.7 Protect finished and unfinished work from damage due to the carrying out of his work, giving special attention to the protection of building vapour barriers, waterproof membranes, etc.

.1 Cover floors and other parts of the building with tarpaulins, etc., and repair all damage to the satisfaction of the Owner and the Consultant.

.2 During freezing weather, protect all materials in such a manner that no harm can be done to installations already in place and/or to materials and equipment on the job.

.8 Be responsible for the condition of all materials and equipment supplied and for providing all necessary protection for same.

.9 Be responsible for the protection and maintenance of the work of this Section until the work has been completed and accepted by the Owner for storing materials inside and out of the way, and for cleaning up all refuse caused by this work to the Consultant's acceptance.

.10 On completion of the work, all tools and surplus and waste materials shall be removed and the work left in a clean and perfect condition.

1.35 LIABILITY INSURANCE

.1 This Sub-Contractor shall maintain such insurance as will fully protect both the Owner and himself from any and all claims, all as noted within the General Conditions as amended under Supplementary Conditions.

1.36 LAWS, PERMITS, AND FEE

.1 Give all necessary notices, obtain all necessary permits and pay all fees in order that the work hereinafter specified may be carried out. Furnish all certificates necessary to evidence that the work installed conforms with all applicable laws and regulations of all authorities having jurisdiction.

.2 All work shall be in accordance with the regulations of the following authoritative bodies, the codes in effect at the time of tender, and any other authorities having jurisdiction:

.1 Fire Marshall.

.2 Canadian Electrical Code.

.3 Local Building By-Laws.

.4 Worker's Compensation Board.

.5 Canadian Standards Association.

.6 Refrigeration Code and CSA Codes governing refrigeration plants.

.7 Canadian Gas Code B-149.1

.8 National Plumbing Code.

.9 National Building Code.

.10 Boiler and Pressure Vessel Act.

.11 National Fire Protection Association.

.12 Insurers Assurance Organization.

.13 Underwriters' Laboratories of Canada.

1.37 ACCEPTABLE MANUFACTURERS

.1 All equipment outputs shall be selected for high altitude where applicable.

.2 Requests for changes to the specification in standards, materials, equipment or installation techniques shall be submitted for review five (5) working days prior to close of bids, and if applicable will be incorporated in an Addendum to the Specification.

.1 Equipment used shall not exceed space limitations in any dimension. Replace any equipment or apparatus which does not meet this Specification at no cost.

.2 Assume full responsibility for the expense of redesign and adjustment to other parts of the building when proposing the use of acceptable substitute equipment.

.3 It is the contractor's responsibility to confirm all quantities. Dimensions, performance and accessories required for all equipment, including matching "standard" and operational accessories between substitute products/suppliers/manufacturers.

.3 Submit samples, in addition to drawings, of all items which in the Consultant's judgement, can be better examined for capacity, quality, finish or detail by sample rather than by drawings. Samples shall be submitted before equipment or material is ordered.

.4 Provide equipment from the following manufacturers. Those manufacturers not listed are considered as substitutions. All mechanical equipment shall have the manufacturers name permanently affixed to it. It is the responsibility of both the 'named' product/supplier as well as the following listed "acceptable" products/suppliers to ensure that they meet or exceed the scheduled performance and are suitable for the intended use.

.5 Alternate manufacturers may be shown along with savings if so desired, however these alternatives must be shown in addition to a manufacturer from the acceptable list.

.6 Within ten (10) days of Award of Contract, give proof of placement of orders for all major pieces of mechanical equipment and materials. Proof must be submitted in the form of a purchase order or an invoice from the supplying vendor indicating quantity, delivery date and date when manufacture of item is to commence.

.7 If requested after contract award, provide within 24 hours a list of equipment and manufacturers to be used on this project. This list shall not be deviated from unless delivery, performance, or dimension issues require a change to be reviewed by the Consultant.

.8 Equipment on acceptable manufacturers list must be equal or better in quality and performance of the model specified. Equipment which is not equal will be replaced with the specified equipment at no cost to the Owner.

.9 If shop drawings are rejected technically after 3 submissions, the Contractor at no additional expense to the Owner shall revert the specified product and manufacturer for this project.

.10 The equipment manufacturer shall ensure that the strength and anchorage of the internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

Item	Acceptable products/ Suppliers/Manufacturers
Access Doors	Fire-Rated: Acudor, E.H. Price, Maxam, Steel Brothers, Milcor, Mifab, Bauco Non-Fire Rated: Bauco
Air Handling Units	Engineered Air, Trane, Johnson Controls
Air Measuring Stations	Cambridge, Sentinel, Ebtron
Air Separators	Trane, Engineered Air, Pace, Haakon, Scott Springfield
Automatic Air Vent	Hoffman, Braukman, Sarco, Armstrong, Maid-OMist, Voss
Balancing	Chalet Balancing, R.A. Bruce & Associates, Thermo Mechanical, Aztech
Balancing Dampers	Maxam, Ruskin
Backdraft Dampers	Airolite, Vent-Aire, Penn, T.A. Morrison
Backflow Protection Watts	Febco, Clayton, Beeco, Wilkins, Ames, Conbraco
Boilers (Condensing)	Cleaver Brooks, Creek,
Bypass Filter	Sumco, GESL, Pace Chemicals, Specified Technical
Carbon Monoxide Detectors	MSA, Denco, Acme, Armstrong
Chillers (Air-Cooled Modular)	ClimaCool, Multistack, Arctic Chill, Tandem
Chimneys	Selkirk, Van Packer, Belvent, Ecco
Coils - Heating and Cooling	Trane, Aerofin, Engineered Air, Colmac
Controls (DDC)	Ascent Compass by Alerton
Damper - Backdraft	Tamco, Ruskin
Domestic Hot Water Heaters	A.O. Smith, Lochinvar, PVI
Duct Cleaning Company	Power Suction Service, Enviro-vac, Ace Mobile Power Service Ltd., Clean Air Services Ltd.
Expansion Joints	Flexonics, Hyspan, Uniroyal, Keflex, Mason, Goodall, Metraflex, Hydro Flow
Fan Coil Units	Trane, Airtherm, Engineered Air, Enviro-Tec, Johnson Controls
Fans	Jenn-Air, Greenheck, Delhi, Acme, Cook, LAU, Carnes, Nederman
Filter Gauges	Dwyer, Cambridge
Filters	Farr, Continental, Cambridge, AAF, Viledon, Tridec
Fire Dampers	Canadian Advanced Air, Maxam, Ruskin, Controlled Air, Nailor
Fire Protection - Cabinets &	Wilson & Cousins, National, Viking, General, Grinnell, NFE,

Item	Acceptable products/ Suppliers/Manufacturers
Extinguishers	CEB, Automatic
Fire Protection - Sprinklers	Grinnell, Viking, Vipond
Flexible Air Duct	Thermoflex, Wiremold, Flexmaster
Flow Meters	Western Meter, Annubar, PSE, Bell & Gossett, Armstrong
Flush Valves	Zurn, Crane, Sloan, Cambridge Brass
Force Flow Units/Unit Heaters (Hot Water)	Trane, Rosemex, McQuay, Engineered Air, Sigma
Grilles, Diffusers and Registers	E.H. Price, Krueger, Titus, Hart & Cooley, Nailor, Carnes
Insulation - Duct	Fiberglas, Knauf, Manville, Atlas, PPG, Manson, Certainteed
Insulation - Flexible Duct	Flexmaster
Insulation - Flexible Piping	Armstrong, PPG, Knauf, Manville, Manson
Insulation - Piping	Fiberglas, Knauf, Manville, Manson, Atlas, PPG, Certainteed
Jacketing Material	Childers, Fiberglas, Manville, Flamex FR Canvas
Mixing Valves	Leonard, Bradley, Powers, Symmons
Motors, Electric	Century Electric "E Plus iii", Baldor "Super-E", Toshiba "EQP 34", Teco "Max-E1"
Pipe Fittings and Flanges	Crane, Grinnell, Jenkins, Victaulic, Mech-Line
Pipe Flexible Connection	Flexonics, Metraflex, Hyspan, Hydro Flo
Pipe Supports and Hangers	Crane, Unistrut, Myatt, L.E. Taylor, Grinnell, Sarco
Plumbing Drainage Accessories	J.R. Smith, Enpoco, Zurn, Ancon, Mifab, Roto-Tech-Smith
Plumbing Brass (All to be CSA approved)	American Standard, Crane, Waltec, Moen, Kohler, Zurn, Cambridge, Chicago, Grohe
Plumbing Trim (All to be CSA approved)	American Standard, Crane, Cambridge, Kohler, Eljer, Alsons, Bradley, Powers, Symmons, Moen, Delta, Brasscraft, T & S Brass, Emco, Acorn, Leonard, Briggs, Chicago
Plumbing Fixtures (All to be CSA approved)	Crane, K.I.L., Fiat, Kohler, Eljer, American Standard, Williams, Arista Haws, Elkay, Aquarius, Jacuzzi, Sunroc, Western, Swan, Bradley, Speakman, Valley, Hytec, Watrous, Briggs, Kindred, Waltec, A.M.I., Chicago
Prisoner Cell Plumbing Fixtures (All to be CSA approved)	Acorn, Willoughby
Pressure Gauges	Weiss, Ametek, Trerice, Winters, Wika
Pressure Reducing Valves	Fisher, Masoneilon, Singer
Pumps - In-Line	Bell & Gossett, Armstrong, Grundfos, Taco, Wilo
Radiation	Sigma, Engineered Air (for bare fin only)

Item	Acceptable products/ Suppliers/Manufacturers
Relief B.D.O.B. Dampers, Penthouses	Titus, Vent Air
Relief Valves	Crosby, Sarco, Watts
Sound Attenuation - Ducts	I.A.C., Vibron, Vibro Acoustics, Wisp Air
Split System AC Units	Mitsubishi, Liebert
Strainers – Pipe	Red & White, Crane, Sarco, Armstrong, Kitz, Mueller, Plenty, Metraflex
Tanks (Expansion)	Anthes, Leitch, Armstrong, Enermax Clemmer, Westeel-Rosco, Bell & Gossett, Ferro, Expanflex, Flexcon Industries
Thermometers	Trerice, Weiss, Weksler, Winters, Wika
Valves – Ball	Red & White, Grinnell, Jenkins, Watts, Hills, Crane, McCanna, Kitz, Milwaukee, Nibco, American, Apollo, MAS
Valves – Gate & Globe	Red & White, Crane, Jenkins, Kitz Grinnell, Vogt, Milwaukee, Nibco, DeZurik, Watts, Sarco, Lunkenheimer, Keystone, Norriseal, Braukman, Demco, Victaulic
Valves - Balancing	DeZurik, Millcentric, Grinnell, T/A, Armstrong, CBV, Sarco, Kitz and Apollo
Valves - Balancing/Flow Meter	T/A, Bell & Gossett, Armstrong, Grinnell
Valves - Check Spring Loaded	Duo-Check II, Moyes & Groves, Grinnell, Crane, Conbraco
Valves – Radiation	Globe Toyo, Dahl
Valves – Spring Loaded Check	Duo-Check II, Moyes & Groves, Check Rite, Conbraco
Variable Frequency Drives	ABB, Hitachi, Mitsubishi
Vibration Control Equipment	Vibro-Acoustics, Lo-Rez, Vibron, Korfund, Mason, Vibron
Water Closet Seats	Beneke, Bemis, Olsonite, Moldex, Sperzel, Centoco

1.38 NON-SPECIFIC DATE/TIME COMPLIANCE

.1 All equipment, hardware, software and firmware (for the purposes of this clause #, the "Product") delivered or deliverables resulting from any services provided are fully Date Compliant and the Product will not adversely or materially affect the daily business operations as a result of a date related computer problem (for the purposes of this clause #, the "Warranty").

.1 Date Compliant means that the Product accurately and correctly processes and stores date/time data (including, but not limited to, calculating, comparing, displaying, recording and sequencing operations) including:

.1 Year

.2 Century

.3 Leap year calculations.

.2 Provide documentary proof of Date Compliance prior to substantial completion listing all equipment and certifying their compliance.

.3 Notwithstanding any other remedy available under this agreement or at law for breach of the Warranty, any Product that is not Date Compliant shall, within twenty-four (24) hours of receipt of notice of the breach, be repaired or replaced at the Contractors sole cost and expense, including parts, labour, transportation and insurance, so as to correct any failure to meet the Warranty.

Part 2. Products

Not applicable.

Part 3. Execution

Not applicable.

END OF SECTION

1. General

1.1 SCOPE

.1 Secure and assemble all necessary literature describing the operation and maintenance of all equipment provided. Complete and transmit documentation for review to Engineer at project milestones.

.2 Operating and Maintenance Manuals

.3 Record Drawings

1.2 QUALITY ASSURANCE

.1 Work specified in this section shall be performed by an Independent Agency specializing in this type of work.

1.3 RELATED WORK IN OTHER SECTIONS

.1	Documentation for Fire Suppression	Section 21 05 05
.2	Documentation for Plumbing	Section 22 05 05

2. Products

2.1 OPERATING AND MAINTENANCE MANUALS

.1 Operating and Maintenance Data

.2 Project Record Documents

2.2 BINDERS

.1 Provide two (2) hardcopy sets of Operations and Maintenance Manuals and one (1) electronic copy on USB.

.2 Each set of manuals shall include as many binders as required to accommodate the project information.

.3 Binders shall be 216 mm x 280 mm, three (3) post, expanding s pine type, with metal piano hinges and bound with heavy fabric.

.4 Maximum binder thickness when filled shall not exceed 100 mm, including a space allowance for 10% additional data.

.5 Binder colour shall be blue, Ontario buckram fabric, colour #OBV460.

.6 Project title and identification shall be silk screened on the front cover and spine. All lettering and borders shall be white.

.7 Binder spine identification to include Volume #, Set #, Title Description, Facility and Facility location.

.8 Contractor to submit proof of cover layout for review prior to ordering binders.

2.3 TABS

.1 The divider tabs shall be laminated mylar plastic and coloured according to division and section.

.2 Plastic tabs with typewritten card inserts will not be accepted.

.3 Each tab to include tab number and title printed on the tab.

.4 The colouring for tabs for individual sections is as follows:

Green	Air Systems
Brown	Control Systems
Blue	Cooling Systems
Orange	Heating Systems
Yellow	Miscellaneous Systems

2.4 MANUAL DIVISIONS

.1 Organize each manual into the following divisions.

.1 Operation Division.

.2 Maintenance Division.

.3 Contract Documentation Division.

2.5 OPERATIONS DIVISIONS

.1 The operations division shall have all data organized into sections according to the system category with individual divider tabs as follows:

.1	AIR	Air Systems
.2	CTL	Control Systems
.3	CLG	Cooling Systems
.4	HTG	Heating Systems
.5	MIS	Miscellaneous Systems

.2 Organize data for each system category (section) into individual sub-systems. Provide an index for each system category and a divider tab for each individual system.

.3 For each individual sub-system include the following:

.1 System Description - Provide details of system type, composition, areas served, location in the building, design criteria and function of major components. All equipment arranged to operate together as one system shall be considered part of that system description. Design criteria shall, at minimum, include the following:

.1 Occupied space conditions.

.2 Outdoor ambient conditions.

.3 Air circulation rate.

.4 Exhaust air rate.

.5 Minimum outside air.

.6 Building pressurization.

.7 Future load allowances.
.8 Standby capabilities.

.2 System Schematics - Provide a system schematic showing all components comprising the central system. Identify each component using DDC system mnemonic and generic name designation. Use this equipment designation in all references to the equipment throughout the manual.
.1 System schematics shall include: hot water heating system, chilled water cooling system, ventilation systems, heat recovery systems.

.3 Operating Instructions - Provide, in "operator" layman language, the specific instructions for start-up, shutdown and seasonal change over of each system component. Include exact type and specific location of each switch and device to be used in the system operation. Identify safety devices and interlocks that must be satisfied in order for the equipment to start. Also, list conditions to be fulfilled before attempting equipment start-up, i.e. valves position correct, glycol mixture concentration proper, piping filled with fluid, filters/strainers in place, etc.

.4 Equipment Identification - Provide data for each system component on equipment identification forms equal to the standard forms obtained from the design consultant.
.1 The consultant shall provide one sample reproducible copy of a form for use by the contractor. New forms produced by the contractor shall follow the same format as the sample form and contain all required information.

.5 Maintenance Division
.1 Organize data into the following sections with divider tabs:
.1 Maintenance Tasks and Schedules.
.2 Spare Parts.
.3 Suppliers and Contractors.
.4 Tags and Directories.
.2 Maintenance Tasks and Schedules - Organize data according to the system category, with further breakdown into individual systems as used in the operations division of the manual. Provide section index and divider tabs for each system category. Summarize maintenance tasks from manufacturer’s maintenance brochures, for each component of each system in the following format:
.1 Daily.
.2 Weekly.
.3 Monthly.
.4 Semiannually.
.5 Annually.
.6 When Required.
.3 Spare Part List - Organize data according to the system category, with further breakdown into individual systems as used in the operations division of the manual. Provide section index and divider tabs for each

system category. Summarize from manufacturers maintenance brochures the recommended spare parts for each component of each system.

.4 Suppliers and Contractor List - Provide summary of Suppliers and Contractors for each components of each system. List name, address and telephone number of each.

.5 Tags and Directories - Provide a copy of the Mechanical Drawing, List, Valve Tag List, Piping Identification Schedule and all other directories as specified in the contract documents.

.6 Contract Documentation Division

.1 Organize all data required by the construction contract into sections, with divider tabs, as follows:

.1 Drawings List.

.2 Shop Drawings and Product Data.

.3 Certifications.

.4 Warranties and Bonds.

.5 Maintenance Brochures.

.6 Reports.

.2 Shop Drawings and Product Data - Provide final copies of all shop drawings and product data required by the contract documents. Include section index and divider tabs. Maximum of twenty-five (25) sheets or one (1) system shop drawing per tab.

.3 Certifications - Provide copies of Contractor Certifications for the performance of product and systems. Include copies of all pressure tests for piping and ductwork systems, equipment alignment certificates, local authority inspection reviews, backflow prevention certification, and fire protection certifications. Include section index and divider tabs with maximum of twenty-five sheets (25) or one report per tab.

.4 Warranties and Bonds - Include one copy each of the Contractor's, warranty, manufacturers' warranties longer than one year, the bond, and any service contract provided by the contractor. Provided section index.

.5 Maintenance Brochures - Include copies of all manufacturers' printed maintenance brochures pertaining to each product, equipment or system. provide section index and divider tabs. Maximum of twenty-five (25) sheets or one system brochure per tab.

.6 Reports - Include copies of all reports relating to the testing, adjusting and balancing of equipment and systems, water treatment reports and manufacturer’s start-up reports, as required by the contract specification sections.

.7 Submissions and Approvals:

.1 First Draft Submission:

.1 Contractor shall submit a draft copy of the operations and maintenance manuals for format review at the 50% construction completion stage.

.2 The draft submission is to be bound in 3 ring loose leaf type binders and shall include the following information:

.1 A table of contents for the complete manual.

.2 Index of each division of the manual.

.3 Index of each section of the operations and maintenance divisions.

.4 A sample operations division write-up for a typical system, including sample schematic.

.5 A sample maintenance division write-up for the same typical system.

.6 Sample proof of binder covers and spines.

.3 On completion of review of the first draft submission the consultant will return the copy of the manual with review comments for resubmission.

.2 Provisional Edition

.1 The contractor shall submit two (2) copies of the provisional edition of the manual at the 75% construction completion stage.

.2 The provisional edition shall be complete in all respects, except for reports and certificates to be produced during the facility start-up phase. This manual shall have the same physical format, including divider tabs and indices, as the final edition of the manual. This provisional edition may be bound in standard three-ring loose leaf binders.

.3 One copy of the provisional edition shall be kept on site as an interim reference for all parties engaged in the facility start-up phase, and shall be used to familiarize and train the operating staff.

.4 The second copy shall be returned to the contractor with review comments.

.5 The contractor shall update contents of the site copy of the provisional edition manual as new information is generated during the facility start-up phase.

.3 Final Edition

.1 Prior to final acceptance the contractor shall submit four (4) copies of the final edition of the manual.

.2 This final edition shall include all outstanding project information and conform to all requirements listed in this document

2.6 RECORD DRAWINGS

.1 Refer to Section on Contract Close-Out Requirements.

.2 The contractor shall keep, on site, available to the Engineer at all times and particularly for each regularly scheduled site meeting, a complete set of prints, edge bound, that are to

be updated daily showing any and all deviations and changes from the Contract Drawings. This set of drawings is to be used only for this purpose, and must not be used as the daily general reference set.

.3 Provide record drawings which identify location of smoke and fire dampers, major control lines, access doors, tagged valves, and actual room names or numbers. As well, deviations that are to be recorded shall include, in general, items that are significant or are hidden from view and items of major importance to future operations and maintenance, and to future alterations and additions including cleanouts and isolation valves.

3. Execution

3.1 GENERAL

.1 Submit documents to the Engineer for approval prior to transmitting to the Owner.

3.2 RECORD DRAWINGS

.1 At substantial completion, transfer all deviations, including those called up by addenda, revisions, clarifications, shop drawings, and change orders, to a set of disks to AutoCAD. Drafting quality layers, symbols, etc. shall be identical to original drawings. Prior to substantial performance, turn over a completed set of disks and a complete set of record drawings.

.2 Each “record” shall bear the Contractor’s identification, the date of record and the notation “We hereby certify that these drawings represent the “Work Record of Construction”. The Contractor’s signature and company seal shall be placed below that notation.

END OF SECTION

1. General

1.1 SCOPE

.1 Demonstration of HVAC equipment and systems operations.

.2 Instruction seminars for Owner's personnel.quality assurance

1.2 QUALITY ASSURANCE

.1 Work specified shall be performed by the Mechanical Trade, and his Subtrades and Suppliers.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 Demonstration and Training — Section 01 79 00

.2 Demonstration and Owner's Instructions for Fire Suppression Systems — Section 21 05 06

.3 Demonstration and Owner's Instructions for Plumbing Systems

.4 Instrumentation and Control for HVAC

2. Products

Not Applicable.

3. Execution

3.1 GENERAL

.1 Mechanical Trade shall arrange for presentation and demonstration of HVAC equipment and systems by appropriate specialists and shall ensure that required manufacturer's representatives are in attendance.

.2 Coordinate demonstration and instruction agenda and schedule with the Owner and Engineer.

.3 Coordinate demonstration and instruction agenda and schedule for work performed outside the contract with the owner and engineer.

.4 Provide personnel when necessary to ensure proper detailed training is provided for all mechanical systems.

3.2 DEMONSTRATIONS

.1 Demonstrate specific starting and stopping and general maintenance requirements for each major piece of equipment. Ensure all labeling and identification is completed.

.2 Demonstrate the following systems, in the form of instruction seminars and contractor-guided tour of the facility.

.1 Hydronic Heating Systems.

.2 Hydronic Cooling Systems.

.3 Air Systems

.4 Control Systems

.5 Chemical Treatment Systems

.6 Balancing

.3 Demonstrate the following pieces of equipment.

.1 Hot Water Boilers

.2 Chillers

.3 Fans/Air Handling Units

.4 Terminal Air Units

.5 Pumps

.4 Refer to sample mechanical system agenda schedules in section 3.3 following for identifying the proposed sequence of demonstrations. Sequence of demonstration and duration of training seminars to suit project. Submit agenda for review by Engineer one month prior to demonstration.

.5 Answer all questions raised by Owner at demonstrations; if unable to satisfactorily answer questions immediately, provide written response within three (3) days.

.6 Provide sign off sheets for each session. Sign off sheets to have attendees, date, subject, presentation by and comments. Attach the sign off sheets to the agenda and submit a copy to the engineer following training seminars.

3.3 MECHANICAL SYSTEMS AGENDA (SAMPLES)

Mechanical Systems Agenda (Sample)

(Sample) Topic: Heating System

Day: 1

Start Time: 8:00 am

Meeting Place:

Approximate Duration: 7.5 hours

Agenda:
.1 8:00 am - Classroom presentation
.2 Contractor / Supplier:

Lunch Break: 12:00 to 1:00

Agenda:
.3 1:00 pm - Site walkthrough
.4 4:00 pm - Final questions and sign-off log sheet

Personnel to be in Attendance:

.1 Mechanical contractor and subtrades (as required)
.2 Maintenance staff

Presentation Format: Classroom:

Introduction

.1 Pass out hand-outs of system description
.2 Reference to equipment operation brochures as required.
.3 Detailed system overview by mechanical trade, subtrades and suppliers
.4 Review of system installations by the mechanical trades using record drawings

Site Tour:

.1 Mechanical Trade to outline location of main piping runs, isolation valves, service access points.
.2 Review service procedures for heating boiler and circulation pumps.
.3 Terminal hot water heating units to be reviewed for service and operation.
.4 Gas Fired equipment to be reviewed and dismantled as required to demonstrate servicing and operation.
.5 Provide written instructions on how to start and stop all equipment and demonstrate using instructions during tour.

Mechanical Systems Agenda (Sample)

(Sample) Topic:	Cooling System
Day:	1
Start Time:	8:00 am
Meeting Place:	
Approximate Duration:	4 hours
Agenda:	.1 8:00 am - Classroom psresentation .2 Contractor / Supplier: .3 10:00 am – Site walkthrough .4 11:30 am – Final questions and sign-off log sheet:
Personnel to be in Attendance:	.1 Mechanical contractor and subtrades (as required) .2 Maintenance staff
Presentation Format:	Classroom: Introduction .1 Pass out hand-outs of system description .2 Reference to equipment operation brochures as required. .3 Detailed system overview by mechanical trade, subtrades and suppliers .4 Review of system installations by the mechanical trades using record drawings Site Tour: .1 Mechanical trade to outline location of main piping runs, isolation valves, service access points. .2 Review service procedures for chiller and circulation pumps. .3 Coils, expansion tanks and accessories to be reviewed for service and operation. .4 Provide written instructions on how to start and stop all equipment and using instructions during tour.

END OF SECTION

1. General

1.1 SCOPE

.1 Test heating water piping.

.2 Test chilled glycol piping.

.3 Test ductwork.

1.2 QUALITY ASSURANCE

.1 Test equipment and material where required by specification or authority having jurisdiction to demonstrate its proper and safe operation.

.2 Test procedures in accordance with applicable portions of ASME, ASHRAE, SMACNA and other recognized test codes.

.3 Perform tests on site to the satisfaction of the Engineer.

.4 Piping, fixtures or equipment shall not be concealed or covered until installation is inspected and approved by the Engineer. Provide written notice to the Engineer at least three (3) days in advance of tests or concealing of piping.

.5 Coordinate with engineer at start of the project, those tests that will require witnessing by the Engineer.

.6 Submit sample test certificate forms for review two (2) weeks prior to any testing on site.

1.3 SUBMITTALS

.1 Obtain certificates of approval and acceptance, complying with rules and regulations from authorities having jurisdiction. Submit copies to be included in Operating and Maintenance Manuals.

.2 Perform tests as specified. Include test certificates in Operating and Maintenance Manuals.

1.4 LIABILTY

.1 Take charge of plant during tests, assume responsibility for damages in the event of injury to personnel, building or equipment and bear costs for liability, repairs and restoration in this connection.

1.5 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 Starting and Adjusting

.2 Documentation for HVAC Systems Section 23 05 05

.3 Commissioning Section 01 91 13

2. Products

Not Applicable.

3. Execution

3.1 PRESSURE TESTS

.1 Provide equipment, materials and labour for tests and pay expenses. Use test instruments from approved laboratory or manufacturer and furnish certificate showing degree of accuracy and date of calibration. Install permanent gauges and thermometers used for tests just prior to tests to avoid possible changes in calibration.

.2 Carry out tests for 8 hour period and maintain pressure with no appreciable pressure drop. Where leakage occurs, repair and re-test and pay necessary costs for re- witnessing.

.3 Closed Loop Piping Systems: Test to 1-1/2 times maximum working pressure or 1035 kPa, whichever is greater, water pressure measured at system low point.

.4 Ducts: Check for audible leaks at 500 Pa above associated fan external static pressure.

.5 Medium Pressure Ductwork: Check for audible leaks. Test for tightness as specified by the SMACNA Manuals with maximum leakage of 1/2% at any branch or main duct at 3.0 kPa static pressure for round ductwork and 2.0 kPa static pressure for rectangular ductwork.

.6 Check systems during application of test pressure including visual check for leakage of water test medium, soap bubble test for air.

.7 During heating and cooling piping system tests, check linear expansion at elbows, U bends, expansion joints and offsets for proper clearance.

.8 When using water as test medium for system not using water, evacuate and dehydrate the piping and certify the lines are dry. Use agency specializing in this type of work.

.9 Check systems during application of test pressure including visual check for leakage of water test medium, soap bubbler test for air or nitrogen test medium and halide torch for refrigerant medium.

.10 Should tests indicate defective work or variance with specified requirements, make changes immediately to correct the defects. Correct leaks by re-making joints in screwed fittings, cutting out and re-welding welded joints, re-making joints in copper lines. Do not caulk.

3.2 TESTING OF SOLDERED COPPER JOINTS

.1 Submit two (2) sample soldered copper pipe joints prepared by each tradesmen to be used on the project, to the engineer within two (2) months of contract award. These samples may be subjected to radiographic testing to verify quality of workmanship.

.2 Remove ten (10) samples of soldered copper pipe joints on heating system during construction as selected by the engineer and remake joints removed. Arrange and pay for radiographic testing of removed joints to verify quality of workmanship.

.3 Rejection of a sample will require re-test of adjacent joints at the contractor's expense.

.4 Failure of more than 75% of the above removed samples will necessitate removal and replacement of all joints completed up to the time of test, at contractor’s expense.

END OF SECTION

1. General

1.1 SCOPE

.1 Performance testing of equipment.

.2 Manufacturer's startup of equipment.

1.2 QUALITY ASSURANCE

.1 Use factory trained representatives and submit manufacturer's check sheets for starting all systems and equipment.

.2 Testing and certification of each backflow prevention device shall be by an "Approved Cross Connection Installation Specialist". One copy of the certificate to be submitted to the Water Purveyor, and one copy is to be inserted in each O & M manual.

.3 Prior to starting, testing, balancing, adjusting, and cleaning processes, verify with Engineer any tests required to be witnessed. Provide sufficient notice to Engineer prior to commencement of procedures.

.4 Engineer shall be allowed to witness any testing, adjusting, starting, balancing, and cleaning procedures.

.5 Assume all costs associated with starting and testing, including the supply of testing or cleaning medium.

.6 Prior to starting equipment or systems, secure and review manufacturer's installation, operation, and starting instructions. Read in conjunction with procedures defined herein.

.7 Use manufacturer's or supplier's starting personnel where required to ensure integrity of manufacturer's warranty.

.8 Compare installations to published manufacturer's data and record discrepancies. Items potentially detrimental to equipment performance shall be corrected prior to equipment starting.

.9 Some processes involved in starting procedures defined in this section may be duplications of authorities' verification. To facilitate expedient completion of project, arrange for authorities to assist or witness these procedures.

.10 All starting, testing, and procedures shall be in accordance with applicable portions of ASME, ASHRAE, AABC, CSA, NFPA, SMACNA, ASTM, ASPE and as required and outlined in these specifications. In particular note the testing requirements of NFPA-20 fire pumps, and of the authorities having jurisdiction.

.11 Personnel involved in starting, testing, balancing and adjusting procedures shall be experienced in the design and operation of mechanical equipment and systems being checked and shall be able to interpret results of the readings and tests.

.12 Assume all liabilities associated with starting, testing and balancing procedures.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 Starting and Adjusting

.2	HVAC Performance Requirements	
.3	Commissioning	Section 01 91 13
.4	Documentation for HVAC Systems	Section 23 05 05
.5	Demonstration and Owner's Instruction for HVAC Systems	Section 23 05 06
.6	Commissioning	Section 01 91 13

2. Products

Not Applicable.

3. Execution

3.1 GENERAL

.1 Conduct performance tests to demonstrate equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct tests as soon as conditions permit. Make changes, repairs, and adjustments required prior to operating tests.

.2 Meet with Division 26 manufacturers, suppliers, and other specialists as required to ensure all phases of work are properly coordinated prior to commencement of each particular testing procedure. Establish all necessary manpower requirements.

.3 Operate and test motors and speed switches for correct wiring and sequences and direction of rotation. Check and record overload heaters in motor starters.

.4 Confirm voltages and operating amperages at full load.

.5 Failure to follow instructions pertaining to correct starting procedures may result in re-evaluation of equipment by an Independent Testing Agency selected by Owner at Contractor's expense. Should results reveal equipment has not been properly started, equipment may be rejected, removed from site, and replaced. Replacement equipment shall also be subject to full starting procedures, using same procedures specified on the originally installed equipment.procedures

3.2 PROCEDURES

.1 Procedure shall be identified in the following five (5) distinct phases:

- .1 Pre-Starting: Visual inspection.
- .2 Starting: Actual starting procedure.
- .3 Post-Starting: Operational testing, adjusting or balancing, and equipment run-in phase.
- .4 Pre-Interim Acceptance of the Work: Final cleaning, re-testing, balancing and adjusting, and necessary maintenance.
- .5 Post-Interim Acceptance of the Work: Repeat tests and fine-tuning resulting from corrective action of deficiency clean-up.

.2 Check specified and shop drawing data against installed data.

.3 Check the installation is as defined by contract documents and as per manufacturer's recommendations including manufacturer's installation check sheets.

.4 Include for the costs of an independent testing agency, selected by the Owner, to take samples of all chemically treated hydronic systems, perform lab analysis of the chemical treatment levels, and submit a written report of their findings to the Owner. Should chemical treatment levels not meet the requirements of the specifications, the Contractor shall adjust treatment levels accordingly and cover the costs of the independent testing agency to take additional samples and tests.

3.3 CONTRACTOR TESTING RESPONSIBILITIES

.1 The contractor shall be required to provide the following tests as part of his construction contract. For each test, a test form is to be filled out, witnessed, kept on site for the consultant to verify at any time during construction and then they are to be included in the final submission of the contractor O&M manuals.

- .1 Air Systems
  - .1 Fans
    - .1 Check radiated and discharge sound power levels.
    - .2 Determine rpm, air flow rates, static pressure and record on the fan curves.
    - .3 Conduct fan performance test for total system volume on main air supply and exhaust units.
    - .4 Conduct smoke control test to meet occupancy requirements.
  - .2 Terminal Boxes
    - .1 Measure air flow and inlet static pressure.
    - .2 Verify box installation duct inlet.
    - .3 Measure discharge sound power level at 3 m downstream.
    - .4 Verify DDC box control volume read outs by traverse.
    - .5 Measure box temperature profile.
    - .6 Verify box access acceptability.
  - .3 Air Outlets
    - .1 Take sound readings at specified air flows at outlets.
    - .2 Test each damper to ensure proper blade movement and damper closure.
    - .3 Verify damper accessibility for changing of the fusible links.
  - .4 Ductwork
    - .1 Low pressure supply, return and exhaust ductwork is to be tested by sound and feel for leakage.
    - .2 Medium and High pressure supply, return and exhaust ductwork is to be pressure tested as per requirements of Sections 23 05 07 and 23 3113.
  - .5 Unit Heater, Fan Coil Units
    - .1 Inlet/outlet air flows and temp.
    - .2 Inlet/outlet water flows and temp.
    - .3 Air and water pressure drop across the unit.

.4 Fan speed setting.
.5 Check acoustic performance.

.2 Hydronic Heating System
.1 Boilers
.1 Start-up boilers as per manufacturers recommendations.
.2 Set up and adjust burner operation through all firing rates, and record efficiencies.
.2 Control Valves
.1 Record pressure drops across each valve.
.3 Pumps
.1 Run for 12 hours. (Ensure parallel pumps are equally balanced).
.2 Record motor power consumption.
.3 Calculate pump efficiency.
.4 Measure specific gravity of fluid.
.4 Tanks
.1 Verify expansion tank level at 20°C and 93°C.
.5 Piping
.1 Test to 1½ times the working pressure, minimum 1035 kPa, for eight (8) hours.
.6 Chemical Treatment System
.1 Acceptance tests by independent lab to provide performance guarantee.

.3 Cooling System
.1 Chillers
.1 Conduct chiller operational system test.
.2 Verify chiller installation requirements for venting of rupture discs.
.3 Verify piping for oil coolers.
.4 Prior to chiller operation verify that strainers are in place.
.2 Pumps & Piping
.1 All tests shall be the same as the hydronic heating system
.2 Verify glycol concentration levels.
.3 Chemical Treatment System
.1 Acceptance tests by independent lab to provide performance guarantee

.4 DDC Control System
.1 General
.1 Conduct system 7-day performance test to prove communication, loop tuning and control sequences

END OF SECTION

1. General

1.1 SCOPE

.1 Provide infinitely variable speed drive package equipment as specified.

.2 Submit complete service and maintenance manuals including wiring and connection diagrams for review and inclusion in Maintenance Manuals.

1.2 SUBMITTALS

.1 Submit shop drawing information including, but not limited to the following:

.1 CSA approval

.2 Unit tag number and equipment number it serves

.3 Voltage, horsepower

.4 Wiring schematic

.5 Physical dimensions

.6 Copy of start-up and commissioning report

.7 Operation procedures and maintenance

1.3 REFERENCES

.1 IEEE 519-1992, Recommended Practices and Requirements for Harmonic control in Electrical Power System.

.2 FCC Part 15, Class A.

.3 UL 508, ETL.

.4 NEC.

2. Products

2.1 GENERAL

.1 Furnish complete variable frequency drives as specified herein for the pumps designated on the drawing schedules to be variable speed. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. VFD enclosure shall be NEMA 1 with inlet air filters.

.2 The VFD shall convert three-phase, 60 Hz utility power to adjustable voltage and frequency, three phase power for step-less motor speed control from 10% to 100% of the motor’s 60 Hz speed. Input voltage shall be as specified on the drawing schedules.

.3 The VFD shall include a converter and an inverter section. The converter section shall convert fixed frequency and voltage AC utility power to DC voltage. All VFDs shall include input line reactors.

.4 The inverter section of the VFD shall invert the DC voltage into a quality output waveform, with adjustable voltage and frequency for step-less motor speed control. The VFD shall maintain a constant V/Hz ratio.

.5 The VFD and options shall be tested to ANSI/UL Standard 508. The complete drive, including all specified options, shall be listed by a nationally recognized testing agency such as UL, ETL or CSA.

.6 Power line noise shall be limited to a voltage distortion factor and line notch depth as defined in IEEE Standard 519-1981, Guide for Harmonic Control and Reactive Compensation of Static Power Converters. The total voltage distortion shall not exceed 5%.

.7 The VFD shall not emit radiated RFI in excess of the limitations set forth in the FCC Rules and Regulations, Part 15 for Class A computing devices. The VFD shall carry a FCC compliance label. PWM type drives shall include RFI filters.

.8 Motor noise as a result of the VFD shall be limited to three dB over across the line operation, measured at three feet from the motor's centre line.

.9 The VFD's full load amp rating shall meet or exceed NEC Table 430-150.

.10 Protective Features:

.1 Individual motor overload protection for each motor controlled.

.2 Protection against input power undervoltage, overvoltage, and phase loss.

.3 Protection against output current overload and instantaneous over current.

.4 Protection against over-temperature within the VFD enclosure.

.5 Protection against over-voltage on the DC bus.

.6 Protect VFD from sustained power or phase loss. Under-voltage trip activates automatically when line voltage drops more than 10% below rated input voltage.

.7 Automatically reset faults due to under-voltage, over-voltage, phase loss, or over temperature.

.8 Protection against output short circuit and motor winding shorting to case faults, as defined by UL508.

.9 Status lights or digital display for indication of individual fault conditions.

.10 Controller capable of operating without a motor or any other equipment connected to the drive output to facilitate start-up and troubleshooting.

.11 Input line reactors shall be provided to minimize harmonics introduced to the AC line, and to provide additional protection to AC line transients.

.11 Interface Features:

.1 Door mounted Hand/Off/Auto selector switch to start and stop the VFD. In the auto position, the VFD will start/stop from a remote contact closure.

In the HAND Position, the VFD will run regardless of the remote contact position.

.2 Manual speed control capability.

.3 Local/Remote selector switch. In the remote position, motor speed is determined by the follower signal. In the local position, motor speed is determined by the manual speed control.

.4 Power/on light to indicate that the VFD is receiving utility power.

.5 Fault light to indicate that the VFD has tripped on a fault condition.

.6 Digital meter with selector switch to indicate percent speed and percent load.

.7 A set of form-C, dry contacts to indicate when the VFD is in the run mode.

.8 A set of form-C, dry contacts to indicate when the VFD is in the fault mode.

.9 A 0 to 10Vdc output signal to vary in direct proportion to the controller's speed.

.10 VFD to have terminal strip to accept N.C. safety contacts such as freezestats, smoke alarms, etc. VFD to safely shut down in drive or bypass mode when contacts open.

.11 VFD to accept an additional N.C. contact to interface with the Hand-Off-Auto switch for remote Stop/Start control.

.12 VFD shall accept a4 to 20 mA, 0 to 5Vdc, 0 to 10Vdc or a 3 to 15 psi pneumatic signal (if required).

.12 Adjustments:

.1 Maximum speed, adjustable 50 to 100% base speed.

.2 Minimum speed, adjustable 0 to 50% base speed.

.3 Acceleration time, adjustable 3 to 60 seconds.

.4 Deceleration time, adjustable 3to 60 seconds with override circuit to prevent nuisance trips if decel time is set too short.

.5 Current limit, adjustable 0 to 105%.

.6 Overload trip setpoint.

.7 Offset and gain to condition the input speed signal.

.13 Service Conditions:

.1 Ambient temperature, 32° to 104°F (0 to 40°C).

.2 0 to 95% relative humidity, non-condensing.

.3 Elevation to 3,300 feet (1,000 metres) without de-rating.

.4 AC line voltage variation, -10 to +10% of nominal.

.14 Special Features:

.1 The following special features shall be included in the VFD enclosure. The unit shall maintain its UL, ETL Listing and CSA certification.

.2 Manual bypass shall provide all the circuitry necessary to transfer the motor from the VFD to the power line, or from the line to the controller. The bypass circuitry shall be mounted in a separate section of the VFD enclosure. Motor overload protection shall be provided in both drive and bypass modes.

.3 A door interlocked, pad lockable drive disconnect switch shall be provided to disconnect power from the VFD only.

.4 A second fused disconnect switch or circuit breaker shall be provided as a means of disconnecting all power to both the VFD and bypass circuits, as well as providing short circuit and locked rotor protection to the motor while in the bypass mode.

.5 The disconnect and bypass functions may be accomplished via disconnects, contactors and overloads, or with a four position drive/off/line/test switch with motor starter and bypass fuses.

.15 Quality Assurance:

.1 To ensure quality and minimize infantile failures at the jobsite, the complete VFD shall be tested by the manufacturer. The VFD shall operate a dynamometer at full load and the load and speed shall be cycled during the test.

.2 All optional features shall be functionally tested at the factory for proper operation.

.16 Submittals:

.1 Submit manufacturer's performance data including dimensional drawings, customer connection drawings, power circuit diagrams, installation and maintenance manuals, warranty description, VFD's FLA rating, certification agency file numbers and catalogue information.

.2 The specification lists the minimum VFD performance requirements for this project. Each supplier shall list any exceptions to the specification. If no departures from the specification are identified, the supplier shall be bound by the specification.

3. Execution

3.1 START-UP SERVICE

.1 The manufacturer shall provide start-up commissioning of the variable frequency drive and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. The commissioning personnel shall be the same personnel that will provide the factory service and warranty repairs at the customer's site. Sales personnel and other agents who are not factory certified technicians for drive field repair shall not be acceptable as commissioning agents.

.2 Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system. Included in this service shall be (as a minimum):

.1 Verification of contractor wire terminations to the VFD and its optional circuitry

.2 Installation verification for proper operation and reliability of the VFD, the motor being driven, and the building automation system

.3 Up to one hour of customer operator training on operation and service diagnostics at the time of the equipment commissioning

.4 Measurement for verification of proper operation on each of the following items:

.5 Motor voltage and frequency. Verification of proper motor operation

.6 Control input for proper building automation system interface and control calibration.

.7 Calibration check for the following set points (and adjustment as necessary):

.1 Minimum speed,

.2 Maximum speed,

.3 Acceleration and deceleration rates

3.2 WARRANTY

.1 The VFD shall be warranted by the manufacturer for a period of 36 or 18 months from date of shipment. The warranty shall include parts, labour, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service.

.2 The motor(s) which are directly connected to the VFD shall be warranted by the VFD manufacturer against insulation breakdown which is directly attributed to the VFD. The length of the motor insulation warranty shall be the same as the VFD warranty. The motor must never have been driven by another VFD.

3.3 EXAMINATION

.1 Contractor to verify that jobsite conditions for installation meet factory recommended and code required conditions for VFD installation prior to start-up. These shall include as a minimum:

.1 Clearance spacing

.2 Temperature, contamination, dust, and moisture of the environment

.3 Separate conduit installation of the motor wiring, power wiring, and control wiring

.4 Installation per the manufacturer's recommendations

.2 The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.

END OF SECTION

1. General

1.1 SCOPE

.1 Flexible pipe connections.

.2 Expansion joints and compensators.

.3 Pipe loops, offsets, and swing joints.

1.2 REFERENCE STANDARDS

.1 Conform to Standards of "Expansion Joint Manufacturers Association" and manufacturer's recommendations.

1.3 SHOP DRAWINGS

.1 Flexible pipe connector shop drawing data shall include maximum allowable temperature and pressure rating, overall face-to-face length, live length, hose wall thickness, hose convolutions per 300 mm and per assembly, fundamental frequency of assembly, braid structure and total number of wires in braid.

.2 Expansion joint shop drawings shall include maximum allowable temperature and pressure rating, and maximum expansion compensation.

1.4 INSPECTION

.1 Provide inspection services by flexible pipe manufacturer's representative for final installation and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1	Flexible pipe connections:	Mason, Flexonics, Minnesota Flexible, Corporation.
.2	Expansion joints and compensators:	Flexonics, Mason.

2.2 FLEXIBLE PIPE CONNECTORS

.1 Flexible Rubber Spools: Neoprene twin sphere connector of molded multiple plys of nylon tire cord fabric and neoprene, rated for 1035 kPa at 120°C. Union end connections for sizes 50 mm and under; floating galvanized ductile iron flanges for sizes over 50 mm.

.2 Spherical Rubber Spools: Neoprene single sphere elbow connector, construction and service rating same as 2.2.1 above.

.3 Braided Spools for Copper Piping: Stainless steel inner core and braid brazed to copper tube ends, suitable for 1035 kPa at 120°C.

.4 Braided Spools for Steel Piping: Stainless steel inner core and braid welded to steel pipe nipples, threaded for pipe up to 50 mm diameter, flanged for 65 mm diameter pipe and over. Suitable for service at 1035 kPa at 120°C.

2.3 EXPANSION JOINTS

.1 Copper piping: Laminated stainless steel bellows brazed to copper tube ends, internal guide, stainless steel external shroud. Suitable for 1035 kPa at 260°C.

.2 Steel piping up to 100 mm: Laminated stainless steel bellows welded to steel pipe nipples. Anti-torque device and threaded ends for sizes to 50 mm, flanged ends for sizes 65 mm and over. Internal guide and carbon steel shroud suitable for 1035 kPa at 260°C.

.3 Steel piping 100 mm and over: Guided externally pressurized laminated stainless steel bellows, flanged ends, internal guide tube and ring, external shroud and guide ring. Suitable for 1035 kPa at 260°C.

2.4 PIPE GUIDES

.1 4 finger "spider" inside a guiding sleeve formed of two halves suitable for clamping onto pipe.

.2 Guided sleeve formed of two parts, suitable to be bolted to supporting structure.

.3 Guide length to be minimum 300 mm.

3. Execution

3.1 APPLICATION

.1 Provide flexible pipe connectors on pipes connected to equipment supported by vibration isolation and where indicated on the drawing.

.2 Provide structural work and equipment required to control expansion and contraction of piping, loops, pipe offsets, and swing joints and provide expansion joints where indicated or required.

.3 Provide pipe guides as required to ensure correct pipe alignment for expansion joints. Minimum two guides on each side of expansion joints.

3.2 INSTALLATION

.1 Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end.

.2 Rigidly anchor pipe to building structure at points shown, and where necessary provide pipe guides so that movement takes place along axis of pipe only.

.3 Install flexible connectors and expansion joints in accordance with manufacturer's instructions.

.4 Do not compress or expand connector during installation.

END OF SECTION

1. General

1.1 SCOPE

.1 Expansion tanks.

.2 Glycol fill tanks.

.3 Accessories and connection to piping system.

.4 Saddles and structural supports.

1.2 STANDARDS

.1 Construct pressure tanks to ASME Code for Unfired Pressure Vessels.

.2 Comply with Provincial Government Regulations.

1.3 SUBMITTALS

.1 Submit shop drawings; comply with Section 01 33 00, Submittal Procedures.

1.4 INSPECTIONS

.1 Obtain inspection certificates for pressure vessels from Provincial Authorities

2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1	Expansion Tanks:	Westeel Rosco, Clemmer
.2	Expansion Tanks Diaphragm Type:	Bell & Gossett, Armstrong

2.2 EXPANSION TANKS

.1 Tank shall be closed type, welded steel rated for working pressure, cleaned, prime coated and supplied with steel support saddles.

.2 Construct tank with necessary tappings for installation of accessories.

.3 Provide gauge glass set consisting of brass compression stops and guard. Glass shall be long enough to cover the tank from 50 mm above the bottom to 50 mm below the top. Maximum length of each glass shall be 600 mm.

.4 Provide quick connect air inlet of automotive tire valve type, pipe from top of tank to accessible location on wall, and tank drain hose bibb on bottom of tank.

.5 Provide pressure relief valve.

.6 Provide pressure relief valve, and automatic cold water fill assembly complete with positive displacement meter, pressure reducing valve, reduced pressure back flow preventer valve with test cocks, strainer, pressure gauge, and valved bypass around reducing valve only, as shown on drawings, for chilled water and heating water expansion tanks.

2.3 EXPANSION TANKS, DIAPHRAGM TYPE

.1 Welded steel, rated for working pressure, supplied with steel support structure.

.2 Pre-charged air chamber, heavy duty butyl diaphragm bonded with polypropylene liner to steel shell separating air chamber from water.

.3 Provide with air side charge connection and water side inlet connection.

.4 Include items listed in 2.2.4, 2.2.5 and 2.2.6 above.

2.4 GLYCOL CHARGING TANKS

.1 Pressure Vessel Type

.1 Closed type ASME rated pressure vessel, welded steel.

.2 Red zinc rich primer coating, inside and out.

.3 Steel skirt for vertical floor support.

.4 Maximum 600 mm long gauge glass sections from top of tank to bottom, brass try cocks, ball check stops and guards.

.5 Accessories:

.1 Pressure gauge
.2 Funnel with valve on top of tank
.3 Pressure reducing valve with bypass
.4 Gauge glass assembly
.5 Pressure relief valve

.6 Inlet, discharge, drain, gauge glass, pressure relief valve tappings.

3. Execution

3.1 INSTALLATION

3.2 Support tanks inside building from building structure as indicated on drawings. Provide 100 mm high housekeeping bases on floor mounted tanks.

3.3 Provide 12 mm compressed air line with flexible coiled hose at each expansion tank and charging tank complete with fitting compatible with quick connect on the tank. Extend line and hose down to 1200 mm above floor level.

3.4 PERFORMANCE

.1 Provide tanks of dimensions and capacities indicated on the drawings and/or tank schedule.

END OF SECTION

1. General

1.1 SCOPE

.1 Provide meters and gauges and taps where shown on drawings and/or specified herein.

.2 Submit shop drawings of proposed products to the engineer for review.

.3 Submit data sheets on thermometers and pressure gauges indicating service, and temperature or pressure ranges, to the engineer for review.

.4 Submit list of all meters, including location, service, flow and corresponding reading for flow.

2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1	Thermometers:	Marsh, Weksler, Trerice, Ashcroft, Wika.
.2	Pressure gauges:	Marsh, Trerice, Ashcroft, Wika, Weksler.
.3	Static pressure gauges:	Dwyer, Magnehelic.
.4	Positive displacement meters:	Neptune, Rockwell, Badger.
.5	Venturi Flow Meters:	Gerand, Preso.
.6	Digital Turbine Flow Meters:	Unicon.

2.2 THERMOMETERS

.1 Dial Thermometers: 80 mm diameter dial in drawn steel case, bimetallic helix actuated, brass separable socket or flange and bushing, glass cover, adjustable pointer.

.2 Mercury Thermometer: Red reading mercury filled, 2° graduations, plastic or aluminum case, 230 mm scale, straight shank, separable socket, adjustable angle.

2.3 PRESSURE/TEMPERATURE TAPS (PETE'S PLUGS)

.1 Fitting to allow a 3 mm O.D. plug-in gauge to measure temperature or pressure.

- .1 Maximum pressure: 3450 kPa.
- .2 Maximum temperature: 135°C.

.2 Fitting constructed of:

- .1 6 mm NPT brass body with hex head screw cap and gasket.
- .2 Protective screw cap to have retaining strap.
- .3 Two self-closing valves constructed of nordel.

.3 Test kit including the following:

- .1 One 65 mm diameter pressure gauge with 3 mm O.D. plug-in stem.
- .2 Two 45 mm diameter temperature gauges with 3 mm O.D. x 125 mm plug-in stem, range 0 to 110°C.

.3 All above in protective carrying case with operating instructions.

.4 Installation:

.1 Install pressure/temperature taps into threaded pipe nipples welded to wall of pipe. Locate fittings in accessible spaces.

.2 Provide one pressure/temperature taps test kit.

2.4 PRESSURE GAUGES

.1 100 mm diameter, drawn steel case, phosphor bronze bourdon tube, brass movement, extruded brass socket, 1% midscale accuracy, front calibration adjustment, black figures on white background. Pressure gauges shall be liquid filled with ½% accuracy in locations subject to vibration (on pumps, air handling units, and chillers), and 1% accuracy in all other locations. Provide needle valve and syphon for steam service, pulsating damper and ball valve for water service.

2.5 STATIC PRESSURE GAUGES

.1 Dial Gauge: 100 mm dial, diaphragm actuated, suitable for positive, negative, or differential pressure measurement. Accuracy within ±2% of full scale, complete with static pressure tips and mounting accessories.

.2 Inclined Vertical Manometer: molded plastic manometer, accuracy within ±3% of full scale, suitable for positive, negative or differential pressure measurement, complete with static pressure tips, and mounting accessories.

2.6 POSITIVE DISPLACEMENT METERS

.1 Nutating disc measuring chamber, disc material to suit fluid encountered, odometer-type direct reading totalizer counter with 6 numerical wheels for cumulative readings

2.7 VENTURI FLOW METERS

.1 Provide calibrated venturi flow meter elements where shown on drawings.

.2 Each venturi element shall be complete with safety shut-off valves and quick coupling connections. A permanent metal tag shall be attached with a chain showing designed flow rates, meter readings for designed flow rates, metered fluid, line size and tag number.

.3 Supplier to select flow meters to provide mid-range reading on portable meter specified below. Flow meters selected with readings less than 25% of full scale will not be accepted.

.4 Liquid Service:

.1 Venturis 50 mm and smaller to be brass threaded.

.2 Venturis 65 mm and larger to be steel for butt weld installation.

.3 Rating: 1750 kPa, 120°C.

.5 Accuracy of flow measuring elements shall be ±1%. Permanent head loss not to exceed

.6 10% of differential pressure reading.

.7 Venturis are required to be selected to provide a pressure differential of not less than 381 mm W.G. and not more than 1143 mm W.G.

.8 Provide a portable meter set of dry diaphragm type with a round 150 mm diameter dial. Meter range shall be 0 - 1524 mm W.G with a 270° dial. All wetted parts shall be of copper construction. Meter shall include pulsation damper, equalizing valve, 2-bleed valves, master chart for direct conversion of meter readings to metric engineering units, rust proof carrying case, two 3-m each rubber test hoses with brass quick connect valves to venturi element.

3. Execution

3.1 INSTALLATION

.1 Install positive displacement meters with isolating valves. Provide valved bypass for liquid service meters.

.2 Install flow meters in uninterrupted straight pipe, minimum 2 pipe diameters downstream and 5 pipe diameters upstream, or according to manufacturer's recommendations.

.3 Provide one pressure gauge per pump installing taps before strainers and on suction and discharge of pump. Pipe to gauge.

.4 Select gauges so that normal operating point is approximately mid-point of instrument range.

.5 On pipes 65 mm and smaller, place well in tee used in lieu of an elbow to accommodate well.

3.2 METERS AND GAUGES INSTALLATION SCHEDULE

.1 Positive Displacement Meter:

- .1 Heating System Make-up.
- .2 Chilled Glycol System Make-up.
- .3 And where shown on drawings.

.2 Flow Meters:

- .1 Heating Water System.
- .2 Chilled Glycol System.
- .3 And where shown on drawings.

.3 Pressure Gauges:

- .1 Chiller, (inlets and outlets).
- .2 Boilers, (inlets and outlets).
- .3 Heat exchangers, (inlets and outlets).
- .4 Pumps.
- .5 Expansion Tanks.
- .6 Pressure Tanks.
- .7 Heat Recovery, inlets and outlets.
- .8 Leaving side of automatic make-up valves.
- .9 Leaving side of pressure reducing valves.

.10 And where shown on drawings.

.4 Pressure/Temperature Taps - Pete's Plugs:

.1 All control sensor tappings.

.2 All lines to three-way control valves.

.3 Heating and cooling coils: at common inlet and outlet of each fan coil

.5 Thermometers:

.1 Chiller, (inlet and outlet).

.2 Boiler, (inlet and outlet).

.3 Supply and return headers of central equipment.

.4 Heat exchangers, inlet and outlet tube and shell side.

.5 Heating water zone supply and return mains.

.6 Chilled water zone supply and return mains.

.7 And where shown on drawings.

.6 Static Pressure Gauges:

.1 Across built-up filter banks

.2 Across unitary filter sections

.3 Across supply and return fans

.4 And where shown on drawings.

.7 Static Pressure Taps:

.1 Across all major dampers

.2 Across heating and cooling coils

.3 Across evaporative humidifiers

.4 On each side of balance valves

.5 Across heat recovery sections

.6 And where shown on drawings.

END OF SECTION

1. General

1.1 SCOPE

.1 Gate valves.

.2 Globe or angle valves.

.3 Check valves.

.4 Plug cocks.

.5 Eccentric plug valves.

.6 Butterfly valves.

.7 Drain valves.

.8 Hose bibbs.

.9 Strainers.

.10 Suction guides with strainers

1.2 MANUFACTURERS

.1 Provide valves of the same type by the same manufacturer throughout.

.2 Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.

.3 All valves shall meet the requirements of the Manufacturers Standardization Society, Standard Practice standards, latest edition. SP-67 Butterfly Valves, SP-70 Cast Iron Gate Valves, SP-71 Cast Iron Check Valves, SP-80 Bronze Gate, Globe, Angle and Check Valves and SP-82 for pressure testing.

.4 Ball valves to be ULC listed, SP. 110 Standard.

1.3 SHOP DRAWINGS

.1 Submit copies of valves "ordering schedule" for review before ordering valves.

.2 Submit detailed shop drawings clearly indicating make, model, size, pressure rating, materials of construction and intended service.

2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1	Gate Valves:	Jenkins, Crane, Toyo, Kitz.
.2	Globe Valves:	Jenkins, Crane, Toyo, Kitz.
.3	Angle Valves:	Jenkins, Crane, Toyo, Kitz.
.4	Swing Check Valves:	Jenkins, Crane, Toyo, Kitz, Mueller SPX, Moygro.
.5	Silent Check Valves:	Val-Matic, APCO, Stream Flo, Duo-Check II, Mueller SPX.

.6	Ball Valves:	Jenkins, Crane, Toyo, Kitz, MAS.
.7	Plug Cocks:	Newman-Milliken, DeZurik.
.8	Eccentric Plug and Ball-centric Valves:	DeZurik, Homestead.
.9	Butterfly Valves:	Keystone, DeZurik, Crane, Jenkins, ITT, Grinnell, Bray, Lunkenheimer, Toyo, Mueller SPX, Apollo, Kitz.
.10	Drain Valves:	Dahl, Crane, Jenkins, Toyo, Kitz, Hammond.
.11	Hose Bibbs:	Dahl, Crane, Jenkins, Toyo, Hammond Kitz.
.12	Radiator Valves:	Dahl, Crane, Jenkins, Toyo, Kitz.
.13	Circuit Balancing Valves:	Tour and Anderson, Armstrong.
.14	Strainers:	Jenkins, Crane, Toyo, Kitz, Mueller SPX.
.15	Suction Guides:	Armstrong, Bell & Gossett.

2.2 HOT WATER HEATING, GLYCOL, AND CHILLED WATER SYSTEMS

.1 Ball Valves up to 50 mm: Two piece bronze body, full standard port, chrome plated, solid bronze ball, threaded ends or solder ends, TFE seat and packing, lever handle, rating 4134 kPa non-shock W.O.G. rating. Jenkins Figure 910J, Toyo #5044A, Toyo #5049A, Kitz #58, Kitz #59.

.2 Swing Check Valves up to 50 mm: Bronze body and disc, regrinding swing check, screw-in cap, threaded ends, rating 860 kPa steam. Jenkins Figure 4092J, Toyo #236, Kitz #22.

.3 Swing Check Valves 65 mm and Over: Cast iron body, regrind-renew swing check, bolted cover, flanged ends, bronze disc and seat ring, rating 860 kPa steam. Jenkins Figure 587J, Toyo #435, Kitz #76, Moyes & Groves W12A-I6V, Centerline Series 800.

.4 Silent Check Valve for Pump Discharge:

.1 Up to 50 mm:

.1 Bronze body, SS stem, 316 SS spring, Teflon disc and seat ring, 430 SS seat screw, threaded ends. 1380 kPa water. Val Matic Series VM-S1400.

.2 50 mm and Over:

.1 Wafer style, cast iron body, 316 SS seat, plug, spring and bushing. ANSI Class 125. Val Matic Series 1400, Moyes Groves W12A-I6A, Centerline Series 800.

.5 Eccentric Plug Valves:

.1 Cast iron body with resilient faced cast iron plug, bolted bonnet, stainless steel bearings, nickel seat. Multiple packing ring, stem seal and resilient plug facing materials suitable for hot water/glycol service to 121°C. Valve ends threaded up to 50 mm, flanged 65 mm and over. Lever operator with adjustable open position memory stop up to 100 mm valves, heavy duty gear reducer handwheel operator with adjustable open position memory stop for valves 150 mm and over. Rating 1210 kPa water at 121°C. DeZurik Series 100.

.6 Butterfly Valves:

.1 Cast iron wafer full-lug body, Stainless steel shaft, NDI, replaceable EPDM seat, lever lock handle operator with multiple position lock plate for valve sizes 65 mm to 100 mm, heavy duty gear handwheel operator with position indicator for valve sizes 150 mm and over. Minimum rating 1200 kPa, 121°C. Full rating for end of line or isolation shut off service. DeZurik Fig. 632 R.S., Jenkins Fig 2232ELJ, Apollo #143 CBE, Kitz #6122 EL.

.7 Terminal Heat Transfer Unit Valves up to 30 mm:

.1 Heavy pattern brass body radiator valve, wheel handle, rising stem, inside screw, renewable composition swivel disc, straight or angle globe, threaded or union ends, positive back seating. Dahl Series 11040, Hammond #100, #200, #8421-9, Toyo #252/253.

.8 Terminal Heat Transfer Unit Valves 40 mm and Over:

.1 Bronze gate valves, threaded ends up to 50 mm, cast iron gate valves, flanged ends, valve sizes 65 mm and over. Jenkins Figure 810J, Figure 454J, Toyo #293, Kitz #24.

.9 Terminal Heat Transfer Unit Balancing Valves up to 30 mm:

.1 Removable cap key, screw set memory bonnet for balancing, brass body, rising stem, inside screw, renewable composition swivel disc, straight or angle globe, threaded or union ends, positive back seating. Dahl Series 13000-M, Toyo #250/#251.

.10 Terminal Heat Transfer Unit Balancing Valves 40 mm and Over:

.1 Eccentric plug valve, as described above.

.11 Drain Valves up to 50 mm:

.1 Forged brass body, brass cap, stem, and ball. Teflon stem seals and Teflon seat. Hose thread end. Working pressure 1725 kPa at 121°C. Dahl 50.430, Jenkins Fig 901CJ, Toyo #5046, Kitz #68AC.

.12 Drain Valves 65 mm and Over:

.1 Bronze body, bronze ball, threaded ends, twin seal Teflon seats and Viton seals, "O" ring, lever handle, rating 2070 kPa at 121°C water. Jenkins Figure 32BJ.

.13 Terminal unit brass T-body drain valve;

.1 Wheel handle, ground body-bonnet joint, renewable disc, brass chain, forged brass gasketed cap. Working pressure 1725 kPa at 121°C. Dahl 21.616.

.14 Circuit Balancing Valves:

.1 Suitable for throttling. All metal parts non-ferrous, die cast non porous copper alloy. Flow measuring accuracy ±2%. Positive shut-off, drain connection with cap. Memory balancing feature. Fittings for connection of portable differential pressure meter. Tour and Anderson, Bell & Gossett circuit setter.

2.3 NATURAL GAS SYSTEMS

.1 Plug Cocks:

.1 Class 125 non-lubricated parallel-plug valve, cast iron body and plug, short pattern, regular port, full bore, threaded or flanged ends, CGA approved. Valves installed outdoors shall be rated for operation down to -40°C-.

.2 Ball Valves:

.1 CGA approved, -40°C/F, full bore, 50 mm and smaller Toyo #5044A, Kitz #58, MAS B3.

2.4 VALVE OPERATORS

.1 Provide suitable hand wheels for gate, globe or angle, radiation and drain valves, and inside hose bibbs.

.2 Provide one plug cock wrench for every ten plug cocks sized 50 mm and smaller, minimum of one. Provide each plug cock sized 65 mm and larger with a wrench, with set screw.

2.5 STRAINERS

.1 Size 50 mm and under:

.1 Screwed brass or iron body, Y pattern with 0.75 mm stainless steel perforated screen. R-W/Toyo 380 Kitz #15.

.2 Size 65 mm to 100 mm:

.1 Flanged iron body, Y pattern with 1 mm stainless steel perforated screen. R-W/Toyo #381, Kitz #80

.3 Size 125 mm and larger:

.1 Flanged iron body, Y pattern with 3 mm stainless steel perforated screen.

.4 Screen free area shall be minimum three times area of inlet pipe.

2.6 PUMP SECTION GUIDE AND STRAINER

.1 Pump Suction Guides and Strainer:

.1 Angle pattern with combination diffuser-strainer, flow straightening vanes, adjustable support foot. Strainer shall have minimum 5 times pipe cross section free area. Body to be of cast iron construction with Class 150 flanged, NPT connections as required to match valve connections. Suction diffuser body rated for 1200 kPa at 121°C. Strainer to be designed to withstand full pump differential head.

3. Execution

3.1 INSTALLATION AND APPLICATION

.1 Install valves with stem upright or horizontal, not inverted.

.2 Install valves for shut-off and isolating service, to isolate all equipment, parts of systems, or vertical risers.

.3 Where butterfly valves are installed, provide threaded lug type valves on flanged systems.

.4 Install globe or angle valves for throttling service and control device or meter by-pass.

.5 Use eccentric plug valves in hydronic systems for throttling service where shown. Provide circuit balancing valves on branches from mains on hydronic heating and cooling systems where plug valves are shown.

.6 Use memory radiator balancing valves in hydronic systems terminal heat transfer unit balancing service.

.7 Provide drain valves at main shut-off valves, low points of piping and apparatus and terminal units.

.8 Size drain lines and drain valves equal to size of apparatus drain connection.

.9 For pipe sizes 20 mm and over, minimum drain size to be 20 mm.

.10 Provide hose thread connection with cap and chain for 20 mm drain valves located in ceiling and public areas.

.11 Provide male NPT nipples with threaded pipe cap for drain sizes over 20 mm where not piped directly to floor drains.

.12 Provide valved drain and hose connection off the bottom of all strainers.

.13 Provide to the owner at project completion, one pressure differential flow meter where circuit balancing valves are specified and installed.

.14 Install strainers on the inlet to all pumps. Use temporary strainers during construction and system cleaning. Remove temporary and install permanent strainers prior to system balancing. Refer to Section 23 05 92, Coordination with Balancing Agency.

.15 Install suction guides on the inlet to all heating water, heating glycol, chilled water, chilled glycol, and snow melt. Refer to Section 23 21 23, Hydronic Pumps.

.16 Install combination suction guides with strainers on the inlet to all heating water, heating glycol, chilled water, chilled glycol, and snow melt. Refer to Section 23 21 23, Hydronic Pumps.

.17 Mount all strainers that are installed on horizontal piping on steam systems, with the centerline of the basket/screen at the same elevation as the centerline of the attached pipe.

END OF SECTION

1. General

1.1 SCOPE

.1 Pipe hangers and supports

.2 Duct hangers and supports

.3 Flashing for mechanical equipment

.4 Sleeving for mechanical equipment

.5 Pipe anchors

.6 Access Doors

1.2 REFERENCE STANDARDS

.1 Pipe supports shall meet the requirements of ANSI B31.1 Power Piping.

.2 Duct hangers shall conform to SMACNA Duct Manuals.

1.3 GENERAL REQUIREMENTS

.1 Provide hangers and supports to secure equipment in place, prevent vibration, maintain grade, provide for expansion and contraction.

.2 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.

.3 Select hangers and supports for the service and in accordance with manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.

.4 Fasten hangers and supports to building structure or inserts in concrete construction.

.5 Provide and set sleeves or block-outs required for equipment, including openings required for placing equipment.

.6 Provide sleeves for all piping through rated assemblies. In non-rated assemblies, provide sleeves for all heating, cooling, steam, condensate, domestic hot, domestic cold, and domestic recirculation piping. Sleeves to be sized to allow insulation to pass through and to project through both sides of wall.

.7 Provide sleeves for all piping through ceilings, floors and footings.

.8 Provide sleeves for duct penetrations through walls, ceilings, floors and footings. Provide locations and dimensions for block-outs imbedded material if provided by others.

.9 Do not weld piping, ductwork or equipment supports to building metal decking or building structural steel supports unless prior written approval has been obtained from the structural engineer.

.10 Obtain approval prior to drilling for inserts and supports for piping system. Discuss and obtain approval for hanging systems and methods with Structural Engineer.

.11 Obtain approval prior to using percussion type fastenings.

.12 Use of piping or equipment for hanger supports and use of perforated band iron, wire or chain as hangers is not permitted.

1.4 SUBMITTALS

.1 Submit shop drawings of each factory fabricated component.

2. Products

2.1 INSERTS

.1 Inserts shall be galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.

.2 Size inserts to suit threaded hanger rods.

2.2 PIPE HANGERS AND SUPPORTS

.1 Hangers, Pipe Sizes 15 mm to 40 mm: Adjustable wrought steel ring.

.2 Hangers, Pipe Sizes 50 mm and Over: Adjustable wrought steel clevis.

.3 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods. Cast iron roll and stand for hot pipe sizes 150 mm and over. Cup washers for hot piping below 150 mm.

.4 Wall Support, Pipe Sizes to 80 mm: Cast iron hook.

.5 Wall Support, Pipe Sizes 100 mm and Over: Welded steel bracket and wrought steel clamp, adjustable steel yoke and cast iron roll for hot pipe sizes 150 mm and over.

.6 Vertical Support: Steel riser clamp.

.7 Floor Support, Pipe Sizes to 100 mm and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier or steel support.

.8 Floor Support, Hot Pipe Sizes 125 mm and Over: Adjustable cast iron roll and stand, steel screws and concrete pier to steel support.

.9 Design hangers so they cannot become disengaged by movements of supported pipe.

.10 Provide copper plated hangers and supports for copper piping.

.11 Provide galvanized hangers and supports for galvanized piping.

.12 Support all piping below grade and under floor slabs in 3.2 mm10 gauge" continuous cadmium plated channel. Support channel with cadmium plated clevis hangers and rods. Install supports on centers as specified in 3.2. Extend cadmium plated hanger rods 450 mm18" above slab rebar and bend back over rebar so as to provide a minimum of 450 mm18" of support in slab. Do not stress rod when bending.

2.3 HANGER RODS

.1 Provide cadmium coated rods, threaded both ends, threaded one end, or continuous threaded.

2.4 DUCT HANGERS AND SUPPORTS

.1 Conform to SMACNA manuals.

2.5 FLASHING

.1 Steel Flashing: 0.5 mm galvanized steel.

.2 Lead Flashing: 24.4 kg/m² sheet lead for waterproofing, 4.88 kg/m² sheet lead for soundproofing.

.3 Safes: 24.4 kg/m² sheet lead or 0.5 mm neoprene.

.4 Caps: Steel, 0.8 mm minimum, 1.6 mm at fire resistance structures.

2.6 SLEEVES

.1 Pipes through Floors: Form with steel pipe or approved PVC sleeves.

.2 Pipes through Beams, Walls, Fire Proofing, Footings, Potentially Wet Floor: Form with steel pipe.

.3 Ducts: Form with galvanized steel.

.4 Size large enough to allow for movement due to expansion and to provide for continuous insulation.

2.7 SEALS

.1 Provide modular mechanical type seals between pipes and sleeves where passing through perimeter walls below grade (basement). These to consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve when linking bolts are tightened in sequence. Equal to "Link-seal" by Thunderline.

2.8 ACCESS DOORS

.1 Steel frame access panel with stainless steel piano-type hinge, channel reinforced steel door panel, three "Symmons" fasteners per door. Door panel recessed to receive ceiling or wall material to give finished appearance showing only hinge and fasteners. Provide acoustic gasket between door panel perimeter and steel frame. Rated access doors shall be UL-listed. All access doors in public areas to be lockable type (pin torx secure fasteners).

3. Execution

3.1 INSERTS

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over 100 mm or ducts over 1500 mm wide.

.3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed 100 mm minimum square steel plate and nut above slab.

3.2 PIPE HANGERS AND SUPPORTS

.1 Support horizontal steel and copper piping as follows:

Nominal Pipe Size (mm)	Distance Between Supports (mm)	Hanger Rod Diameter (mm)

	Steel	Copper	
15 to 20	1800	1500	10
25 to 40	2100	1800	10
50 to 65	3000	2400	10
80 to 100	3600	3000	16
150 to 300	4200	4000	22
350 to 450	6000		25

.2 Install hangers to provide minimum 15 mm clear space between finished covering and adjacent work.

.3 Use oversize hangers to accommodate pipe insulation thickness. For pipes up to 50 mm use high density rigid pipe insulation at hanger location, with an insulation protection shield. For pipes 65 mm and over use insulation protection saddle.

.4 Place a hanger within 300 mm of each horizontal elbow.

.5 Use hangers which are vertically adjustable 40 mm minimum after piping is erected.

.6 Support cast iron horizontal drainage pipe near each hub and on each side of gasket and clamp joints, with 1500 mm maximum spacing between hangers.

.7 Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.

.8 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.9 Where practical, support riser piping independently of connected horizontal piping.

3.3 DUCT HANGERS AND SUPPORTS

.1 Support duct work in accordance with SMACNA, and as a minimum as follows:

.1 Low pressure duct hangers and supports:

.1 <u>Hanger Minimum Sizes:</u>

.1 Up to 750 mm wide: 25 mm x 1.6 mm at 3.0 m spacing;

.2 775 mm to 1200 mm wide: 40 mm x 1.6 mm at 3.0 m spacing;

.3 Over 1200 mm wide: 40 mm x 1.6 mm at 3.4 m spacing.

.2 <u>Horizontal Duct on Wall Supports Minimum Sizes:</u>

.1 Up to 450 mm wide: 40 mm x 1.6 mm or 25 mm x 3 mm at 2.4 m spacing;

.2 475 mm to 1000 mm wide: 40 mm x 40 mm x 3 mm at 1.2 m spacing.

.3 <u>Vertical Duct on Wall Supports Minimum Sizes:</u>

.1 At 3.6 mm spacing;

.2 Up to 600 mm wide: 40 mm x 1.6 mm;

.3 625 mm to 900 mm wide: 25 mm x 25 mm x 3 mm;

.4 925 mm to 1200 mm wide: 30 mm x 30 mm x 3 mm.

.4 <u>Vertical Duct Floor Supports Minimum Sizes:</u>

.1 Riveted or screwed to duct;

.2 Up to 1500 mm wide: 40 mm x 40 mm x 3 mm;

.3 Over 1500 mm wide: 50 mm x 50 mm x 3 mm.

3.4 MEDIUM AND HIGH PRESSURE DUCT HANGERS AND SUPPORTS

.1 Rectangular Duct Hangers Minimum Sizes:

- .1 Up to 900 mm wide: 2 at 25 mm x 1.6 mm at 3.0 m spacing;
- .2 925 mm to 1500 mm wide: 2 at 25 mm x 1.6 mm at 2.4 m spacing and 50 mm x 50 mm x 6 mm trapeze;
- .3 1525 mm to 3000 mm wide: 2 at 40 mm x 2.7 mm at 2.4 m spacing and 50 mm x 50 mm x 6 mm trapeze;
- .4 3200 mm to 6000 mm wide: 3 at 10 mm diameter at 1.2 m spacing and 65 mm x 65 mm x 6 mm trapeze.

.2 Round Duct Hangers Minimum Sizes:

- .1 At 3 m spacings;
- .2 Up to 450 mm diameter: 25 mm x 1.6 mm;
- .3 475 mm to 900 mm diameter: 25 mm x 2.7 mm;
- .4 925 mm to 1250 mm diameter: 40 mm x 2.7 mm;
- .5 1300 mm to 2000 mm diameter: 2 at 40 mm x 2.7 mm from girth reinforcing angle.

.3 Vertical Duct Floor Supports Minimum Sizes:

- .1 Rivet to duct and tie angles together with rod, angles or "band iron".
- .2 Up to 1200 mm wide: 40 mm x 40 mm x 3 mm;
- .3 Over 1200 mm wide: 50 mm x 50 mm x 5 mm.
- .4 Angle reinforcing may be used for support omitting trapeze.

3.5 EQUIPMENT BASES AND SUPPORTS

.1 Provide reinforced concrete housekeeping bases poured directly on structural floor slab

.2 100 mm thick minimum, extended 100 mm minimum beyond machinery bedplates for equipment. Provide templates, anchor bolts and accessories required for mounting and anchoring equipment.

.3 Construct supports of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

.4 Provide rigid anchors for ducts and pipes immediately after vibration isolation connections to equipment unless spring hangers are specified.

3.6 FLASHINGS

.1 Flash and counterflash where mechanical equipment passes through weather or waterproofed walls, floors and roofs.

.2 Flash vent and soil pipes projecting 80 mm minimum above finished roof surface with lead worked 25 mm minimum into hub, 200 mm minimum clear on sides with minimum

.3 600 mm x 600 mm sheet size. For pipes through outside walls, turn flange back into wall and caulk.

.4 Flash floor drains over finished areas with lead 250 mm clear on sides with minimum

.5 900 mm x 900 mm sheet size. Fasten flashing to drain clamp device.

.6 Provide curbs for mechanical roof installations 200 mm minimum high. Flash and counterflash with galvanized steel, soldered and made waterproof.

.7 Provide lead acoustic flashing around duct and pipes passing from equipment rooms, installed according to manufacturer's data for sound control.

3.7 SLEEVES

.1 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeve.

.1 Extend sleeves through potentially wet floors 25 mm above finished floor level. Caulk sleeves full depth and provide floor plate.

.2 Piping and duct work passing through floor, ceiling or wall, close off space between duct and sleeve with non-combustible insulation. Caulk both sides.

.3 Piping passing through perimeter walls below grade, mechanical room floor, roof or wall, close off space between pipe and sleeve with synthetic rubber compound mechanical type seals.

.4 Sleeves provided through walls or floors where liquids could potentially pass from one side to the other, provide sleeves with a 25 mm 'flange' welded to the external face of the sleeve at the mid-point of the thickness of the structure to provide a water stop.

.5 Install chrome plated escutcheons where piping passes through finished surfaces.

3.8 ACCESS DOORS

.1 Provide access doors for maintenance or adjustment purposes for all mechanical system components including:

.1 Valves.

.2 Volume and splitter dampers.

.3 Fire Dampers.

.4 Coils and terminal units.

.5 Expansion joints.

.6 Control components.

.2 Mark removable ceiling tiles used for access with color coded pins. See Painting and Identification.

.3 Sizes to be 600 mm x 600 mm minimum.

.4 Provide UL-listed fire rated access doors installed in rated walls and ceilings.

END OF SECTION

1. General

1.1 SCOPE

.1 Supply all labour, materials, and equipment required and necessary to isolate and restrain the equipment as indicated on the drawings and specified herein and guarantee the function of the materials and equipment supplied.

.2 Install 300 mm long flex connection on all duct work connected to isolated equipment.

1.2 QUALIFICATIONS

.1 All vibration isolators and bases shall be supplied by an approved supplier with the exception of isolators which are factory installed and are standard equipment with the machinery.

.2 Provide shop and placement drawings for all vibration isolation elements for review, before materials are ordered. The drawings shall bear the stamp and signature of the responsible supplier's technical representative.

.3 The work shall be carried out in accordance with the specification and, where applicable, in accordance with the manufacturer's instructions and only by workmen experienced in this type of work.

1.3 INSPECTION

.1 A qualified representative of the isolator manufacturer shall inspect the isolated equipment after installation and submit a concise report stating any deficiencies in the installation.

2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Vibro Acoustic, Vibron, IAC, Mason, Korfund, Vibro Acoustics Western.

2.2 ISOLATORS

.1 Spring isolators located out of doors or in humid areas shall have Rustoleum Painted housing and neoprene coated springs, unless otherwise indicated on drawings.

.2 Isolation mounts for equipment with operating weights substantially different from the installed weights, such as chillers, or boilers, shall have adjustable limit stops.

2.3 OPEN SPRING ISOLATORS

.1 Springs shall be "Iso-Stiff" having equal stiffness in the horizontal and vertical planes with a working deflection between 0.3 and 0.6 of solid deflection.

.2 Spring mounts shall be complete with levelling devices, minimum 6 mm thick neoprene sound pads, and zinc chromate plated hardware.

.3 Sound pads shall be sized for a minimum deflection of 1.2 mm and shall meet the requirements for neoprene isolators.

2.4 CLOSED SPRING ISOLATORS

.1 Compression springs shall be used both for hangers and floor mount isolators.

.2 Springs shall be stable under operating conditions.

.3 Housings shall incorporate a minimum 6 mm thick sound pad sized for a minimum static deflection of 1.2 mm meeting the requirements for neoprene isolators.

.4 Floor mount units shall incorporate neoprene side stabilizers with a minimum 6 mm clearance.

2.5 NEOPRENE ISOLATORS

.1 All neoprene isolators shall be tested to ASTM specifications.

.2 Where a ribbed pad is used, the height of the ribs shall not exceed 0.7 times the width of the rib. A steel layer shall be used to distribute the load in a multi-layered unit.

.3 Neoprene pads or elements shall be selected at the manufacturer's optimum recommended loading and shall not be loaded beyond the limit specified in the neoprene manufacturer's literature.

2.6 INERTIA BASES

.1 Concrete inertia bases shall be a minimum of 1.5 times the weight of the isolation equipment and shall be constructed using a channel iron perimeter and adequate reinforcing. The concrete shall be rated at 20 mPa. Design shall be by the isolation suppliers.

.2 Concrete inertia bases shall meet the requirements of the isolation supplier's shop drawings.

.3 Structural steel bases shall be sufficiently rigid to prevent misalignment or undue stress on the machine, and to transmit design loads to the isolators.

2.7 SPRING HANGERS

.1 Hangers capable of a 10° misalignment shall be provided unless otherwise specified.

3. Execution

3.1 APPLICATION

.1 Provide vibration isolation for mechanical motor driven equipment throughout, unless specifically noted otherwise.

.2 Set steel bases for 25 mm clearance between housekeeping pad and base. Set concrete inertia bases for 50 mm clearance. Adjust equipment level.

.3 Deflections 12 mm and over shall use steel spring isolators.

.4 Deflections 5 mm and under shall use neoprene isolators.

.5 Horizontal limit springs shall be provided on fans operating in excess of 1.5 kPa static pressure, except vertical discharge fans, and on hanger supported, horizontally mounted axial fans where thrust due to static pressure exceeds 300 N.

.6 All equipment mounted on vibration isolators shall have a minimum clearance of 50 mm to other structures, piping, equipment, etc. All isolators shall be adjusted to make equipment level.

.7 Prior to making piping connections to equipment with operating weights substantially different from installed weights, the equipment shall be blocked up with temporary shims to the final heights. When full load is applied, the isolators shall be adjusted to take up the load just enough to allow shim removal.

.8 Adjustable, horizontal stabilizers on close spring isolators shall be adjusted so that the side stabilizers are clear under normal operating conditions.

.9 All piping connections to isolated equipment shall be supported resiliently for the following distances or to the nearest flexible pipe connector:

Pipe Size	Distance, m
15 - 40 mm	3.0
50 - 65 mm	4.5
75 - 100 mm	7.0
125 - 200 mm	9.0
225 - 275 mm	13.5
300 - 350 mm	15.0

The three closest hangers to the vibration source shall be selected for the lesser of a 25 mm static deflection or the static deflection of the isolated equipment. The remaining isolators shall be selected for the lesser of the 25 mm static deflection or 1/2 the static deflection of the isolated equipment.

.10 Spring hangers shall be installed without binding.

.11 Adjust isolators as required and ensure springs are not compressed.

.12 Provide neoprene side snubbers or retaining springs where side torque or thrust may develop.

.13 Where movement limiting restraints are provided, they shall be set in a position with minimum 6 mm air gap. Restraints, isolator equipment and attachment points shall be designed to withstand the impact of the isolated equipment subjected to an acceleration not exceeding 3 g without permanent distortion or damage.

.14 Wiring connections to isolated equipment shall be flexible

3.2 PERFORMANCE

.1 Install inertia bases of type and thickness as indicated on Isolation Schedule.

.2 Install isolators of type and deflection as indicated on the Isolation Schedule or according to the following table, whichever provides the greater deflection.

.3 The required static deflection of isolators for equipment exceeding 0.35 kW is indicated below. Spring isolators shall be "open spring". Closed spring isolators shall only be used where specified.

Machine Speed r/min	**Slab on Ground Under 15 kW**	**Structural Slab Over 15 kW**	**Normal**	**Critical**
Under 400	Special*	Special*	Special*	Special*
400 - 600	25 mm	50 mm	90 mm	Special*
600 - 800	12 mm	25 mm	50 mm	90 mm
800 - 1100	5 mm	12 mm	25 mm	50 mm
1100 - 1500	3 mm	4 mm	5 mm	12 mm

*"Special" indicates as directed by the acoustical consultant.

3.3 ISOLATION SCHEDULE

Isolated Equipment		Base		Type of Isolation	Static Deflection	Remarks
No.	Description	Type	Thickness			

END OF SECTION

1. General

1.1 SCOPE

.1 Painting and identification for heating, ventilation, air conditioning and refrigeration systems

1.2 RELATED REQUIREMENTS

.1 Submittals Division 01

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 Painting of Mechanical Work

1.4 QUALITY CONTROL

.1 Coordinate colour coding of piping and equipment.

.2 Colour code mechanical equipment, piping and exposed ductwork. Refer to colour schedule at end of this section.

.3 Legend and direction of flow arrows shall consist of adhesive backed labels, yellow colour, with minimum 20 mm high black lettering equal to Brady System B-500, vinyl cloth labels for non-insulated surfaces; and Brady B946 for insulated surfaces.

1.5 EQUIPMENT PROTECTION AND CLEAN-UP

.1 Ensure that new and existing equipment and surfaces are carefully covered with tarping, or heavy duty plastic. Ensure that spills and splatter on finishes and equipment are cleaned up totally and promptly.

2. Products

.1 Not Applicable.

3. Execution

3.1 GENERAL

.1 Identify piping with labels, colour bands, and flow arrows. Provide identification at 15 m maximum intervals, before and after pipes passing through walls, at all sides of tees, behind access doors and in equipment rooms as required.

.2 Apply colour bands at both ends of the label with primary colour bands used to secure both ends of individual labels. Refer to colour schedule at end of this section.

.3 Provide 20 mm diameter brass, lamacoid or metal photo black numbers, secured to valve stem with key chain.

.4 Provide neat, typewritten directories, giving valve number, services and location. Frame one copy under glass for wall mounting as directed, second copy to be forwarded to Owner. Include copies in O & M Manuals.

.5 Identify all equipment excluding pipe and duct with screwed down lamacoid plates having 6 mm minimum letter size. Identification to match as built drawings equipment name and number.

.6 Identify electric starting switches, thermostats controlling motors, remote push button stations, and controls equipment supplies under this division with lamacoid plates having 6 mm minimum letter size. Identification to state equipment controlled and match to control shop drawing identification numbers.

.7 Identify the purpose of duct access panels with self-adhesive Brady stick-on coloured labels. Apply labels conforming to the following schedule:

	Color	Letters
Cleaning and service access	yellow	C.A.
Controls, including heat sensors	black	C
Dampers (backdraft, balance and control)	blue	D
Fire dampers	red	F.D.
Smoke dampers and detectors	red	S.D.

Note: Provide black lettering in all cases.

.8 Identify the location of the following items of equipment which are concealed above a ceiling with Avery "Data Dots". The colours shall conform to the following schedule:

Concealed equipment and cleaning access	yellow
Control equipment, including control	
Dampers and valves, and head sensors	black
Pipe mounted equipment with the exception of	
Fire, smoke, sprinkler and control equipment	green

.9 When T-bar ceilings are installed, adhere "Data Dots" on T-bar framing adjacent to panel to be removed.

3.2 COLOUR CODE SCHEDULE

.1 Colour numbers are called for in Canadian Government Specification No. 5-GP-1a. Colours assigned from CGSB 1-GP-12c for colour code identification.

.1 Mechanical Primary Colours for Pipe Lines/Equipment

Yellow:	505-102
Light Blue:	502-106
Green:	503-107
Orange:	508-102
Brown:	504-103
Red:	509-102
White:	513-101
Aluminum:	515-101
Purple:	501-101
Grey:	501-107

Secondary Colours for Bands

Red:	509-102
Orange:	508-102
Blue:	502-106

Banding

Red:	to indicate extremely hazardous material
Orange:	to indicate mildly hazardous material
Blue:	to indicate non-hazardous material

.2 Identification Symbols and Colours for Piping

	Pipe Colour	Stripe Colour	Symbol
Heating Hot Water Supply	Yellow	Red (Under 120°C)	90°C Heat Wat.
Heating Hot Water Return	Yellow	Orange (Under 120°C)	90°C Heat Wat.
Glycol Supply	Green	Orange	90°C Glycol
Glycol Return	Green	Orange	90°C Glycol R.
Chilled Water	Green	Orange	Ch. Water
Chilled Water Return	Green	Orange	Ch. Water R.
Engine Exhaust	Aluminum	Orange	Exh.
Boilers	Green	Red 1’ Length	Nil
Heat Exchangers	Green	Orange	Nil
Pumps (Regular)	Aluminum	Nil	Nil
Supports	Black	Nil	Nil
Uninsulated Valves		High Heat Aluminum	
Handles		Black Machinery Enamel	
Fan Guards – Motor Guards		Red Machinery Enamel	
Hangers, Brackets, Hanger Rods		Black Machinery Enamel	

.3 Mechanical Control Systems

.1 Conduit banding, pull boxes, terminal boxes and junction boxes - GREY Covers - GREY with black 'C'.

.2 Main and secondary control panels, factory finish acceptable - control contractor to install company label to identify.

.4 Duct Work

.1 All duct work to be identified as follows, complete with directional arrows:

Return Air	R.A.
Supply Air	S.A.
Mixed Air	M.A.
Combustion Air	Comb. Air
Relief Air	Relief Air
Exhaust Air	Exh. Air

.5 Equipment Bases / Housekeeping Pads

.1 Grey, with 100 mm yellow and black angled bands around edges.

END OF SECTION

1. General

1.1 SCOPE

.1 Prepare the facility for balancing.

1.2 RELATED REQUIREMENTS

.1 Starting and Adjusting

.2 Commissioning Section 01 91 13

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 Documentation for HVAC Systems Section 23 05 05

.2 Testing, Adjusting and Balancing for HVAC Systems Section 23 05 93

.3 Commissioning Section 01 91 13

2. Products

Not Applicable

3. Execution

3.1 INSTALLATION

.1 Bring the work to an operating state and ready for balancing, including:

- .1 Clean equipment and ductwork.
- .2 Install air terminal devices.
- .3 Provide temporary filters in air handling equipment and carry out a rough air balance to ensure all equipment performs required function.
- .4 Replace filters with specified filters prior to final balancing.
- .5 Verify lubrication of equipment.
- .6 Install permanent instrumentation.
- .7 Clean piping systems, clean systems as per Section, HVAC Water Treatment, drain and fill with clean treated heat exchange fluid.
- .8 Complete the "start-up" of equipment.
- .9 Review packing and seals on all pumps and valves.
- .10 Ensure all strainers are clean and complete prior to fluid system balancing (Refer to Section 23 05 23, General Duty Valves and Strainers for HVAC Piping).
- .11 Check rotation and alignment of rotating equipment and tension of belted drives.
- .12 Set control points of automatic apparatus, check-out sequence of operation.
- .13 Make available control diagrams and sequence of operation.
- .14 Clean work, remove temporary tags, stickers, and coverings.
- .15 Make available one (1) copy of Maintenance Manuals especially for use in balancing.

.16 Provide Balancing Agency a complete set of mechanical drawings and specifications.

.2 Cooperate with the Balancing Agency as follows:

.1 Make corrections as required by Balancing Agency.

.2 Allow Balancing Agency free access to site during construction phase. Inform Balancing Agency of any major changes made to systems during construction and provide a complete set of record drawings for their use.

.3 Provide and install any additional balancing valves, dampers, and other materials requested by the balancing agency and/or necessary to properly adjust or correct the systems to design flows.

.4 Provide and install revised pulleys and sheaves for rotating equipment and shave pump impellers, as required to properly balance the systems to design flows. Obtain requirements from balancing agency (Refer to Section 25 05 93, Testing, Adjusting and Balancing for HVAC Systems).

.5 Operate automatic control system and verify set points during Balancing.

END OF SECTION

1. General

1.1 SCOPE

.1 Balance, adjust, and test air and liquid systems and equipment and submit reports using identical units to those shown on contract documents.

.2 Obtain sound level readings and submit reports for no less than 5% of the rooms within the building. Rooms where readings to be taken to be selected by the Engineer.

1.2 QUALITY ASSURANCE

.1 Work specified in this section shall be performed by an Independent Agency specializing in this type of work.

.2 Balancing (of both air and liquid systems) and sound level readings shall be performed by the same agency.

.3 Balancing procedures shall be in accordance with SMACNA and ASHRAE Standards.

.4 During the one year warranty period, the owner may request re-check or re-setting of outlets or fans as listed in test report. Provide technicians and equipment required during visits for seasonal adjustments.

1.3 RELATED REQUIREMENTS

.1 Starting and Adjusting

.2 Commissioning — Section 01 91 13

1.4 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 Documentation for HVAC Systems — Section 23 05 05

.2 HVAC Equipment Testing and Start-Up — Section 23 05 08

.3 Plumbing Equipment Testing and Startup — Section 22 05 08

.4 Fire Suppression Equipment Testing and Startup — Section 21 05 08

1.5 SITE VISITS

.1 Total of six (6) site visits shall be made to correspond with the general monthly site meetings held by the Contractor. After each site visit, a written report shall be submitted to the Contractor and Engineer. Site visits shall commence after the start of air and liquid distribution work and be spread over the construction period to the start of the balancing work.

.2 A review of the installation and access to all valves, dampers, and equipment shall be made at the specified site visits and any additional dampers or valves required for proper balancing shall be forwarded in writing to be reviewed by the Engineer.

.3 Allow for three (3) visits of one (1) day to site to adjust systems for seasonal changes during warranty. Coordinate time of visits with the Owner. Submit reports to Engineer.

.4 Begin balancing after equipment start-up and testing and after systems have been completed and are in full working order. Place systems and equipment into full operation and continue operation during each working day of balancing.

1.6 BALANCING AGENDA

.1 General:

.1 Submit balancing agenda to the Engineer and commissioning contractor for review at least sixty (60) days prior to the start of balancing work. Start balancing work only after agenda has been approved. Include descriptive data, procedure data, and sample forms in agenda.

.2 Descriptive Data:

.1 General description of each system including associated equipment and different operation cycles, listing of flow and terminal measurements to be performed and selection points for proposed sound measurements.

.3 Procedure Data:

.1 Procedures for converting test measurements to establish compliance with requirements, specify type of instrument to be used, method of instrument application (by sketch) and correction factors.

.4 Sample Forms:

.1 Form showing application of procedures to typical systems.

.5 Prior to commencement of work on site, the balancing agent shall arrange with the Engineer, a pre-determined test area on site. This is to determine the accuracy of test equipment and to review the balancing methods outlined in the written, pre-approved balancing procedures.

.6 At the completion of balancing the first major air system or pre-arranged milestone, the balancing agent shall notify the Engineer to re-visit the site to evaluate work completed to this time. Provide the Engineer with seven (7) days written notice, prior to request for site visit.

1.7 BALANCE REPORT

.1 Submit (2) copies of rough balancing reports to the Engineer for review, prior to on-site verification and acceptance of Project.

.2 Provide four (4) copies of final reports to contractor for inserting in Owner's Operating and Maintenance Manuals as described in Section 23 05 05, Documentation for HVAC Systems.

.3 Include types, serial number, and dates of calibration of instruments in the reports.

1.8 SYSTEM DATA

.1 Air Handling Equipment

Design Data:
Total air flow rate;
Fan total static pressure; System static pressure;

Motor kW, r/min, amps, Volts, Phase; Outside air flow rate L/s;
Products
Fan r/min; Fan/kW;
Inlet and outlet, dry and wet bulb temperatures.

Installation Data:
Manufacturer and model;
Size;
Arrangement discharge and class;
Motor type, kW, r/min, voltage, phase, cycles, and load amperage; Location and local identification data.

Recorded Data:
Supply Air Fan

Fan @ 100% Outside Air
Air flow rate;
Fan total static pressure;
System static pressure;

Fan @ Full Return/Min O/A Air flow rate;
Fan total static pressure; System static pressure;
Return Air Fan

Fan @ 100% Exhaust Air
Air flow rate;
Fan total static pressure; System static pressure;

Fan @ Full Return
Air flow rate;
Fan total static pressure; System static pressure;

Fan r/min;
For Axial Fans, note blade pitch angle
Motor operating amperage;
Inlet and outlet, dry and wet bulb temperatures.

.2 Duct Air Quantities - All mains supplying more than 10% of Volume, outside air and exhaust (maximum and minimum) major return air openings back to duct shafts.

Duct sizes;
Number of pressure readings; Sum of velocity measurements; Average velocity;
Duct recorded air flow rate; Duct design air flow rate.

.3 Air Inlet and Outlets:

Outlet identification location and designation; Manufacturers catalogue identification and type;
*Application factors;
Design and recorded velocities; Design and recorded air flow rates; Deflector vane or diffuser cone settings.
* (Refer to 3.1.3 for supporting information)

.4 Pumps Design

Data Fluid flow rate;
Total Head;
r/min;
kW, r/min, amps, volts, phase.

Installation Data
Manufacturer and model; Size;
Type drive;
Motor type, kW, r/m, voltage, phase, and full load amperage.

Recorded Data:
Discharge and suction pressures with secondary systems on both bypass and full circulation (full flow and no flow);
Operating head;
Operating water flow rate (from pump curves if metering not provided); Motor operating amps (full flow and no flow);
r/min.

.5 Expansion Tank

Design Data: Size;
Capacity; Pressure rating; Installation Data:
Manufacturer, size, capacity; Pressure reducing valve setting; Pressure relief valve setting.

.6 Heating Equipment (Baseboard, Boilers, Unit heaters, etc.)

Design Data:
Heat transfer rate; Fluid flow rate;
Entering and leaving fluid temperatures; Fluid pressure drop.

Installation Data:
Manufacturer, Model, Type;
Entering and leaving fluid temperatures; Capacity;
Pressure drops; Flow rates.

Recorded Data:
Element type and identification (location and designation);
Entering and leaving fluid temperature (for varying outdoor temperatures); Fluid pressure drop;
Fluid flow rate;
Pressure relief valve setting.

.7 Heat Exchanger

Design Data:
Fluid flow rates (heated media, heating media); Fluid type;
Inlet and outlet temperatures.

Installation Data:
Manufacturer, model, type;
Fluid flow rates (heated media and heating media); Inlet and outlet temperatures;
Pressure relief valve setting.

Recorded Data

Heating media entering flow rate; Heated media leaving flow rate;

Entering and leaving temperatures (for varying outdoor temperatures) and pressures.

.8 Air Heating and Cooling Equipment

Design Data:
Heat transfer rate;
Liquid and air flow rates; Liquid pressure drop;
Air static pressure drop;
Entering and leaving liquid temperatures;
Entering and leaving air dry and wet bulb temperatures.

Installation Data:
Manufacturer, model, type;
Entering and leaving fluid flow and temperatures; Entering and leaving air flow and temperatures;
Fluid and air side pressure drops.

Recorded Data:
Element type and identification (location and designation);
Entering and leaving air dry and wet bulb temperatures;
Entering and leaving water temperatures; Liquid pressure drop;
Air static pressure drop; Air and Liquid flow rates;
Adjusted temperature rise or drop.

.9 Chiller

Design Data:
Cooling capacity;
Evaporator and condenser flow rates and pressure drops; Motor kW, voltage, phase, full load amps.

Installation Data:
Manufacturer and model;
Motor type, kW, r/min, voltage, phase, and full load amperage; Liquid flow rates;
Liquid pressure drops;
Entering and leaving liquid temperatures.

Recorded Data:
Liquid flow rates; Liquid pressure drops;
Entering and leaving liquid temperatures.

.10 Sound Level Data
Diagram or description of relationship of sound source and measuring instrument;
scale reading;
Graph readings at each octave band frequency; Calculate room N.C. levels.

2. Products

2.1 INSTRUMENTS

.1 Provide calibration histories for each instrument. Recalibration or use of instruments may be requested when accuracy of readings is questionable.

3. Execution

3.1 GENERAL PROCEDURE

.1 Permanently mark, by stick-on labels and/or fluorescent paint, settings on valves, splitters, dampers, and other adjustment devices.

.2 Subsequent to correctional work, take measurements to verify balance has not been disrupted or that any such disruption has been rectified.

.3 Where vane anemometer is used to measure supply, return or exhaust air grilles, AK factors shall be determined as follows:

.1 Determine and tabulate similar sized grilles being balanced for AK schedule.

.2 Traverse all ducts serving grilles (outlined in AK schedule) to verify AK factors.

.3 AK factor from schedule, must be approved by Engineer during initial review with balancer on site. (Balancer shall include written procedure for determination of AK factors).

.4 No flow hoods are to be used for measurement of exhaust or return air grilles.

.4 Balancing shall be performed to the following accuracies:

.1 Air - terminal outlets ±10% (outlets less than 200 L/s)

.2 Air - terminal outlets ±5% (outlets greater than 200 L/s)

.3 Air - central equipment ±5%

.4 Hydronic - terminal outlets ±10%

.5 Hydronic - pumps and central ±5%

.5 Balancing contractor is responsible for the required pulleys and sheaves to allow proper balancing of systems (Refer to Coordination with Balancing Agency). Where axial fans require blade pitch changes, this shall be the responsibility of the balancing contractor.

.6 Where pump impellers require shaving, this shall be the responsibility of the mechanical contractor. All adjustments shall be by qualified millwright. All changes shall be documented and included as part of the balancing report.

3.2 AIR SYSTEM PROCEDURE

.1 Perform balancing, adjusting, and testing with building doors and windows in their normal operation position.

.2 The following procedure shall be adopted for central systems:

.1 Ensure dampers or volume control devices are in fully open position.

.2 Balance central apparatus to ±5% air flow.

.3 Balance branches and mains in accordance with 3.1.4.

.4 Recheck central apparatus.

.5 Balance all terminal air outlets in accordance with 3.1.4.

.6 Re-balance central apparatus to ±5%.

.7 Recheck all air outlets.

.8 Perform acoustical measurements.

.3 When balancing air outlets:

.1 Rough balance furthest outlets and then balance sequentially back to source.

.2 Fine balance furthest outlet back to source.

.4 Take static pressure readings and air supply temperature readings at 20 points on the system.

.5 Make air quantity measurements in ducts by "Pitot Tube" traverse of entire cross sectional area. Take minimum of 16 for rectangular ducts, and 10 on each vertical and horizontal axis for round ducts, traverse readings. If readings are inconsistent across duct, try to obtain straight run of six (6) diameters widths upstream and re-do traverse.

.6 Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control only by duct internal devices such as dampers and splitters.

.7 Vary total system air quantities by adjustment of fan speeds. Vary branch air quantities by damper regulation.

.8 Where modulating dampers are provided, take measurements and balance at extreme conditions. (Balance variable volume systems at maximum air flow rate - full cooling, and at minimum air flow rate - full heating).

.9 Verify all terminal unit factory settings for maximum air flow (and minimum if applicable). Adjust terminal unit controller if required. Record adjusted units.

.10 The final balanced condition of each area shall include testing and adjusting of pressure conditions. Test and record building pressurization levels in variable volume systems throughout full range of fan delivery rates, under both heating and cooling conditions. For multi-storey building test pressure conditions at ground, intermediate and upper levels. Front doors, exits, elevator shafts, should be checked for air flow so that exterior conditions do not cause excessive or abnormal pressure conditions. Document abnormal building leakage conditions noted.

.11 Complete balancing to achieve positive building pressure unless otherwise instructed. A positive pressure relative to outside of 10 Pa minimum and 20 Pa maximum shall be achieved, measured with negligible outside wind velocity.

3.3 FIRE DAMPER/FIRE STOP FLAP VERIFICATION

.1 Visually inspect all fire dampers and fire stop flaps:

.1 Installation is straight.

.2 Wall angles properly installed.

.3 Duct has break-away connection.

.4 Fire stopping material where used is properly installed.

.5 Adequate access.

.6 Clearance between sleeve and wall.

.2 Inspect all fire damper blades and tracks prior to test firing. Sheet metal trade to clean all dirty dampers and tracks to satisfaction of balancer.

.3 Manually remove each fusible link to ensure damper blade drops properly, then reset damper. Mark dropped fire damper with black felt marker.

.4 Testing of 10% of the fusible links shall be performed with a suitable heat source capable of generating sufficient heat to detonate fusible link without burning or generating carbon deposits on the blades, frame or adjacent ductwork. Selection of links to be test dropped to be as directed by Engineer. Retesting and resetting shall be witnessed by Engineer.

.5 If fire damper does not close properly, sheet metal trade to repair installation and balancing agency to retest.

.6 All fire damper tests shall be witnessed by two parties, certified by Contractor and endorsed by the testing personnel.

3.4 ACOUSTICAL MEASUREMENTS

.1 Provide full spectrum acoustical measurements for each major area as follows:

.1 Offices.

.2 General access areas - reception area and atriums.

.3 Main building entrance and lobby.

.4 Assembly areas.

.5 Major equipment or service rooms.

.6 Outside air intakes or exhausts.

.2 Separate acoustic measurements shall be taken as follows:

a)	Rooms with single air outlet and not exceeding 10m²	=	1 central reading
b)	Rooms with multiple air outlets with an area less than 40 m².	=	2 @ 1/3 point readings
c)	Rooms with multiple air outlets with an area exceeding 40 m²	=	One reading in the center, and then readings at one-fifth and four-fifths points on each exceeding 40 m² diagonal.

.3 Provide additional or repeat acoustical measurements as necessitated by final balancing of each space, system, or piece of equipment.

.4 Take measurements at maximum air volume conditions.

.5 Note room reflective conditions at time of readings. (i.e. furnishings, window coverings, rugs).

3.5 BALANCING OF HYDRONIC SYSTEMS

.1 Open all (excepting pressure bypass must be closed) valves to fully open position including balancing valves, isolation valves, and control valves.

.2 Execute air balance prior to initiating hydronic balance (if coils are provided).

.3 Remove temporary strainers and install permanent sheaves prior to commencing balancing of hydronic systems (Refer to Section 23 05 92, Coordination With Balancing Agency).

.4 Set pumps to deliver 10% excess flow if possible.

.5 Adjust flows through each boiler or chiller to ensure equal flow.

.6 Check and adjust flows and temperatures at inlet side of coils.

.7 Position and mark all automatic valves, hand valves and balancing cocks for design flow through all coils, connectors, and all items in system requiring circulation of liquid.

.8 Upon completion of flow readings and coil adjustments, mark setting and record data.

.9 Coordinate with the mechanical contractor shaving of impeller to operating condition on pumps larger than 1.5 kW.

.10 Ensure all bypass valves are tightly closed.

.11 After making all terminal unit adjustments, re-check settings at pumps. Re-adjust as required.

.12 Calibrate all pressure and temperatures gauges.

.13 For all parallel pumping systems, check all flows through boilers, chillers, heat exchangers, and pumps under the following situations:

.1 With two pumps operating.

.2 With one pump operating - repeat for each pump.

.3 With controls demanding no heating or cooling.

.14 For each pump, plot maximum and minimum flows on curve.

.15 Verify pressure drops and flows through 3-way pressure control bypass valves at full operating range.

3.6 BALANCING AND ADJUSTING OF DOMESTIC WATER SYSTEMS

.1 Adjust PRV on main line to 570 kPa maximum.

.2 Balance domestic hot water recirculating system piping to ensure flow from all points in the system. Ensure all hot and cold supply shut off valves are fully open.

3.7 BALANCING AND ADJUSTING OF EMERGENCY GENERATOR SYSTEMS (AIR SIDE)

.1 Verify sequence of operation.

.2 Measure air flows on full exhaust and recirculation, static pressure drops. (Include explanation of equipment used and procedure.)

.3 Measure discharge air temperature.

3.8 BALANCING REPORT

.1 Submit draft copies of rough balancing reports prior to final acceptance of project.

.2 Include types, serial number and dates of calibration of instruments.

.3 Record test data on a sepia made from the latest available revised set of mechanical drawings and submit three (3) copies upon completion of the balancing contract for inclusion in equipment and maintenance manuals.

.4 Submit with report, fan and pump curves with operating conditions plotted. Submit grille and diffuser shop drawings and diffusion factors.

.5 Report shall be indexed as follows:

Air

Summary Procedure Instrumentation Drawings
Equipment Summary
Fan Sheets
Fan Curves
Fan Profile Data
Static Data
Air Monitoring Station Data Traverse Data and Schedule Terminal Unit Summary
Outlet Data Summary and Schematics (per system) Building Schematic
Building Pressurization Data Weather Conditions at Time of Test Diagnostic
Millwright Reports

Liquid

Summary Procedure Instrumentation Drawings
Pump Data
Pump Curves
Flow Stations
Coils
Equipment Data
Element Data Summary and Schematics (per system)
Diagnostic
Millwright Reports

Acoustics

Summary Procedure Instrumentation Drawings
Profile
Scale Readings

END OF SECTION

1. General

1.1 SCOPE

.1 Duct thermal insulation.

.2 Duct acoustic insulation.

.3 Breeching/Chimneys/flues insulation

.4 Adhesives, tie wires, tapes.

.5 Recovery.

.6 All outdoor mounted ductwork.

1.2 QUALITY ASSURANCE

.1 Insulation shall be installed by skilled workmen regularly engaged in this type of work.

.2 Materials shall meet fire and smoke hazard ratings as stated in this section and defined in applicable building codes.

1.3 SUBMITTALS

.1 Submit shop drawings which indicate complete material data, "K" value temperature rating, density, finish, recovery jacket of materials proposed for this project and indicate thickness of material for individual services.

.2 Submit samples of proposed insulating materials and recovering.

1.4 JOB CONDITIONS

.1 Deliver material to job site in original non-broken factory packaging, labelled with manufacturer's density and thickness.

.2 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement, poor workmanship or material defects.

1.5 ALTERNATIVES

.1 Alternative insulations are subject to approval. Alternatives shall provide the same thermal resistance within 5% at normal conditions as material specified.

2. Products

2.1 GENERAL

.1 Insulation Material, Recovery Jackets, Vapour Barrier Facings, Tapes and Adhesives: Composite fire and smoke hazard ratings shall not exceed 25 from flame spread and 50 for smoke developed.

.2 Insulating materials and accessories shall withstand service temperatures without smoldering, glowing, smoking or flaming.

.3 Recovery Jackets:

.4 All insulation materials shall meet Building Code Standards, and packages or containers of such materials shall be appropriately labelled.

2.2 MATERIALS

.1 Exposed Rectangular Ducts:

.2 Round Ducts and Concealed Rectangular Ducts:

.3 Acoustic Lining:

.4 Pool Acoustic Installation

.5 Breeching/Chimneys/Flues Insulation

3. Execution

3.1 PREPARATION

.1 Do not install covering before ductwork and equipment has been tested and approved.

.2 Ensure surface is clean and dry prior to installation. Ensure insulation is dry before and during application. Finish with systems at operating conditions where possible.

3.2 INSTALLATION

.1 Ensure insulation is continuous through inside walls. Pack around ducts with fireproof self-supporting insulation materials, properly sealed.

.2 Finish insulation neatly at hangers, supports and other protrusions.

.3 Do not insulate ductwork with external thermal insulation where acoustic duct insulation is specified.

.4 Locate insulation or cover seams in least visible locations. Locate seams on ductwork in ceiling spaces on the underside of the duct.

.5 Provide recovering jackets on exposed insulation throughout, including equipment rooms. Insulation located in crawl spaces, shafts and suspended ceiling spaces is not considered exposed. Make smooth any uneven insulated surface before recovering.

.6 Cover insulation exposed to outdoors with aluminum jacket secured with aluminum bands on 200 mm centres or screws on 150 mm. centres. Lap joints 75 mm. minimum and seal with compatible waterproof lap cement.

.7 Exposed Rectangular Ducts:

.8 Round Ducts and Concealed Rectangular Ducts:

.9 Acoustic Lining:

.1 ULC labelled thermo-canvas.

.2 0.5 mm. embossed aluminum sheet

.3 0.9 mm embossed aluminum sheet for breaching.

.4 Rigid fibrous glass or mineral fibreboard insulation, "K" value maximum 0.035 W/m.°Cat 24°C.

.5 Factory applied reinforced aluminum foil vapour barrier for cold ducts.

.6 Hot duct service temperature 20°C to 65°C.

.7 Cold ducts service temperature -40°C to 65°C.

.8 Flexible fibrous glass or mineral fibre insulation, "K" value maximum 0.035 W/m.°C at 24°C.

.9 Factory applied reinforced aluminum foil vapour barrier for cold ducts. Hot duct service temperature 20°C to 65°C.

.10 Cold duct service temperature -40°C to 65°C.

.11 Fibrous glass or mineral fibreboard insulation with "K" value maximum 0.035 W/m.°C at 24°C.

.12 Absolute roughness of exposed surface not to exceed 0.58 mm., coated to prevent fibre erosion at air velocities up to 25.4 m/s, 24 kg/m³ minimum density for ductwork and 75 kg/m³ for plenums.

.13 Substrate must not be dark in colour. Service temperature -40°C to 65°C.

.14 Pool Acoustic Duct Insulation: Open cell melamine-based foam, standard 1" thickness, 0.5-0.7 lbs./cubic ft. (ASTM D3574-77) density, air erosion evaluation shall comply with UL-181, Section 18, flame spread rating of 25 as per ASTM-E-84, smoke density rating of 65 as per ASTM-E-84, fungus resistance rating #0 per ASTM-G21, mould growth shall pass UL-181 section 11, "K" value maximum 0.035 W/m.°C at 10°C. Insulation shall be coated with "Hypalon Coating" with a grey finish.

.15 Semi-rigid mineral fibre insulation with glass mat "K" value 0.035 W/m.°C maximum at 24°C.

.16 Service temperature 65°C to 450°C.

.17 Secure rigid insulation with galvanized anchors or welded pins on 400 mm. centres. Secure in place with retaining pins.

.18 Seal all insulation joints and breaks with joint tape. Seal adhesive; cover joints with 100 mm. strips of open mesh cloth imbedded between two coats of lap seal adhesive.

.19 Use vapour barrier tape for insulation joints or breaks on cold ducts.

.20 Adhere flexible insulation to ductwork with adhesive applied in 150 mm. wide strips on 400 mm. centres.

.21 Provide annealed tie wire tied at 400 mm. centres for securing duct insulation.

.22 Butt insulation and seal joints and breaks with lap seal adhesive; cover joints with joint tape.

.23 Use vapour barrier tape for cold ducts.

.24 Apply to interior of ducts where shown.

.25 Secure to ductwork with adhesive using 50% coverage and anchors or weld pins on 400 mm centres.

.26 Secure in place with retaining clips.

.27 Cut off excess fastener length and cover with brush coat of mastic over protrusions and all raw edges.

.28 Use 25 mm. thick insulation unless otherwise noted.

.29 Provide vapour barrier located on the warm side for outside air intakes.

.30 Bevel corners at joints and butt together.

.31 Install acoustic gauze over all cut corners and joints and brush coat with lap seal adhesive.

.32 Face breeching with 9.5 mm rib lath turn out to provide 12 mm. space between insulation and hot surface and 12.5 mm. mesh expanded lath on the outside.

.33 Butt blankets firmly together and secure with 1.6 mm. galvanized wire.

.34 Lace metal mesh together.

.35 Coat with 12 mm thick insulating cement.

.36 Finish with a final 12 mm. coat of insulating cement.

.37 Trowel to a smooth hard finish.

.38 Recover with aluminum jacket.

.10 Where duct velocities exceed 15 m/s, cover internal duct insulation with 0.8 mm perforated galvanized steel with 24% free area.

.11 Breeching/Chimneys/Flues Insulation:

.12 Fasten aluminum recovery jacket in place with aluminum banding on 200 mm. centers or screws or rivets on 150 mm. centers.

.13 Duct insulation is not required where the ductwork is exposed the space which the duct is supplying.

3.3 INSULATION INSTALLATION THICKNESS SCHEDULE

Ducts and Equipment	Insulation Thickness *(mm)(in)*	Recovery Jacket
Combustion Air & Relief Duct	*50*	Canvas
Exhaust Ducts within *3000 mm.* of Exterior Walls or Openings	*25*	Canvas
Outside Air Intake Ducts	*50*	Canvas
Supply Ducts Heating System	*25*	Canvas
Supply Ducts Heating/Cooling System	*25*	Canvas
Supply Ducts Ventilation Systems	*25*	Canvas
Ducts Exposed to Outdoors	*50*	Aluminum
Ventilation Equipment Casings	*25*	Canvas
Acoustic Lining (Interior ductwork where indicated)	*25*	
Boiler Breeching/Chimney/Flues	*50*	Aluminum
Domestic Hot Water Breeching/Chimney/Flues (Forced Air Burners)	*50*	Aluminum
Ventilation Equipment	*50*	Canvas

END OF SECTION

1. General

1.1 SCOPE

.1 Equipment insulation.
.2 Adhesives, tie wires, tapes.
.3 Recovering.

1.2 QUALITY ASSURANCE

.1 Insulation shall be installed by skilled workmen regularly engaged in this type of work.

.2 Materials shall meet or exceed fire and smoke hazard ratings as stated in this section and defined in applicable building codes.

1.3 SUBMITTALS

.1 Submit shop drawings which indicate complete material data, "K" value, temperature rating, density, finish, recovery jacket of materials proposed for this project and indicate thickness of material for individual services.

1.4 JOB CONDITIONS

.1 Deliver material to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness.

.2 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

1.5 ALTERNATIVES

.1 Alternative insulations are subject to approval. Alternatives shall provide the same thermal resistance within 5%, at normal conditions as material specified.

2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Owen's Corning/Fiberglas Canada Inc., Manson, Knauf Fiberglass.

2.2 GENERAL

.1 Insulation Materials, Recovery Jackets, Vapour Barrier Facings, Tapes and Adhesives: Composite fire and smoke hazard ratings shall not exceed 25 for flame spread and 50 for smoke developed.

.2 All insulation materials shall meet Building Code Standards, and packages or containers of such materials shall be appropriately labeled.

.3 Insulate fittings and valve bodies with preformed insulated fittings.

2.3 MATERIALS

.1 Hot Equipment: Rigid fibrous glass, or mineral fibre insulation, "K" value 0.035 W/m. °C, at 24°C. Service temperature -14°C to 200°C.

.2 Cold Equipment: Rigid fibrous glass, or mineral fibre insulation, with factory applied reinforced aluminum foil vapour barrier, "K" value maximum 0.035 W/m. °C, at 24°C. Service temperature -10°C to 100°C.

.3 Recovery Jackets : ULC listed canvas: 220 g/m^2 plain weave cotton fabric with

ULC listed dilute fire retardant lagging adhesive.

2.4 HEAT EXCHANGERS

.1 Heat Exchangers Box Type Jacket (Plate & Frame):

.1 High-temperature insulation blanket formed of silica Aerogel and reinforced with a non-woven, glass-fiber batting.

.2 Insulation must be hydrophobic.

.3 Estimation of Maximum Use Temperature 1200°F (650°C).

.4 Recovery Jacket Hot & Cold Side: Silicone Fiberglass Composite Jacketing, 17 oz/sq. yd. minimum. Estimation of Maximum Use Temperature 450°F (232°C).

.5 Thread: Kevlar. Begins to decompose at 800 degrees (426 C). Does not melt. Diameter – 0.0114".

.6 Construction:

.1 Sewn with lock stitch at a minimum of 4 to 6 stitches per inch. Jackets shall be sewn using specified thread in section 1.3D. The thread must be able to withstand the skin temperatures without degradation.

.2 Hog rings, staples and wire are not an acceptable methods of closure.

.3 No raw cut jacket edges shall be exposed after install.

.4 Jackets shall be fastened using hook and loop (Velcro) straps and D-rings.

.5 Provide a permanently attached Laser Etched Anodized Aluminum nameplate (2" x 3.5") on each jacket to identify its location and item number. Each nameplate must have a Laser Etched QR code linking to a website that contains the following information about that particular jacket:

.1 Item Number

.2 Location Information

.3 Application Type

.4 Operating Pressure

.5 Component Type

.6 Component Size

.7 Jacket Min Max Temp
.8 Insulation Thickness
.9 Jacket material Hot Side
.10 Jacket material Cold Side
.11 Pre Photo & Post Photos
.12 Pattern

.7 An iPod or IOS App must be submitted, and training provided, upon project completion to display the website and items listed in section 5 above.

.8 The insulation shall be designed to minimize the convection current in the space between the hot metal surface and the inner layer of insulation.

.9 All jacket pieces which match mating seams must include an extended 50mm flap constructed from the exterior fabric (or equivalent) and shall be secured using hook & loop closure (i.e. Velcro®) parallel to the seam.

.10 Insulation must be sewn as integral part of the jacket to prevent shifting of the insulation. Insulation pins are NOT an allowable method of preventing the insulation from shifting and shall NOT be used.

3. Execution

3.1 PREPARATION

.1 Do not install covering before piping and equipment has been tested and approved.

.2 Ensure surface is clean and dry prior to installation. Ensure insulation is dry before and during application. Finish with systems at operating conditions.

3.2 INSTALLATION

.1 Finish insulation neatly at supports and other protrusions.

.2 Locate insulation or cover seams in least visible locations.

.3 Provide recovering jackets on exposed insulation throughout, including equipment rooms.

.4 Flare out staples may be used to secure jacket laps on hot systems. Staples are to be applied on 100 mm centres.

.5 Equipment: Apply insulation with edges tightly butted, joints staggered and secured in place by metal bands. Where necessary, weld on suitable anchors. Provide sufficient clearance around openings for normal operation of equipment. Finish surface of cold equipment insulation with vapour barrier jacket sealed with vapour barrier adhesive. Make uneven surfaces smooth with insulating cement.

.6 Install 25 mm thick aluminum foil-back fibrous glass or mineral fibre insulation onto the back of all radiant panels, with foil backing face up.

3.3 INSULATION INSTALLATION THICKNESS SCHEDULE

	Piping or Equipment	Pipe Sizes mm	Insulation Thickness mm	Recovery Jacket
.1	Chilled Water Pumps		50	Canvas
.2	Chillers		50	Aluminum
.3	Plate & Frame Heat Exchangers		50	Aluminum
.4	Expansion Tank		25	Aluminum
.5	Air Separators		25	Aluminum
.6	Radiation Panels (Backside)		25	Foil Face Up

END OF SECTION

1. General

1.1 SCOPE

.1 Piping insulation.
.2 Adhesives, tie wires, tapes.
.3 Recovering.

1.2 QUALITY ASSURANCE

.1 Insulation shall be installed by skilled workmen regularly engaged in this type of work.

.2 Materials shall meet or exceed fire and smoke hazard ratings as stated in this section and defined in applicable building codes.

1.3 SUBMITTALS

.1 Submit shop drawings which indicate complete material data, "K" value, temperature rating, density, finish, recovery jacket of materials proposed for this project and indicate thickness of material for individual services.

1.4 JOB CONDITIONS

.1 Deliver material to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness.

.2 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

1.5 ALTERNATIVES

.1 Alternative insulations are subject to approval. Alternatives shall provide the same thermal resistance within 5%, at normal conditions as material specified.

2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Owen's Corning/Fiberglas Canada Inc., Manson, Knauf Fiberglass.

2.2 GENERAL

.1 Insulation Materials, Recovery Jackets, Vapour Barrier Facings, Tapes and Adhesives: Composite fire and smoke hazard ratings shall not exceed 25 for flame spread and 50 for smoke developed.

.2 All insulation materials shall meet Building Code Standards, and packages or containers of such materials shall be appropriately labeled.

.3 Insulate fittings and valve bodies with preformed insulated fittings.

2.3 MATERIALS

.1 Cold Piping: Formed fine fibrous glass or formed mineral fibre pipe insulation, with factory applied vapour barrier jacket, factory moulded to conform to piping, “K" value maximum 0.035 W/m. °C at 24°C. Service temperature: 4°C to 100°C.

.2 Hot Piping: Formed fine fibrous glass or mineral fibre pipe insulation, with factory applied general purpose jacket, factory moulded to conform maximum 0.035 W/m. °C, at 24°C. Service temperature up to 150°C. to piping, "K" value

.3 Recovery Jackets: ULC listed canvas: 220 g/m^2 plain weave cotton fabric with ULC listed dilute fire retardant lagging adhesive.

3. Execution

3.1 PREPARATION

.1 Do not install covering before piping and equipment has been tested and approved.

.2 Ensure surface is clean and dry prior to installation. Ensure insulation is dry before and during application. Finish with systems at operating conditions.

3.2 INSTALLATION

.1 Ensure insulation is continuous through inside walls. Pack around pipes with fire proof self-supporting insulation material, properly sealed.

.2 Insulate complete system including piping, fittings, valves, unions, flanges, strainers. Do not insulate flexible connections and expansion joints. Terminate insulation neatly with plastic material trowelled on a bevel.

.3 Finish insulation neatly at hangers, supports and other protrusions.

.4 Locate insulation or cover seams in least visible locations. Locate seams on piping in ceiling spaces on the underside of the pipe.

.5 Provide recovering jackets on exposed insulation throughout, including equipment rooms. Insulation located in crawl spaces, pipe shafts and suspended ceiling spaces is not considered exposed. Make smooth uneven insulated surfaces before recovering.

.6 Cover insulation exposed to outdoors with aluminum jacket secured with aluminum bands on 200 mm centres. Lap circumferential joints 75 mm minimum and seal with compatible waterproof lap cement. Lock form longitudinal joints and seal.

.7 Cold Piping: Seal lap joints with 100% coverage of vapour barrier adhesive. Seal butt joints with 50 mm wide strips of vapour barrier sealed with vapour barrier adhesive. For fittings and valves, apply hydraulic insulating cement; or apply factory fabricated insulation half shells, seal all laps and joints.

.8 Flare out staples may be used to secure jacket laps on hot systems. Staples are to be applied on 100 mm centres.

.9 Hot Piping: For fittings and valves, apply hydraulic insulating cement; or apply factory fabricated insulation half shells.

3.3 INSULATION INSTALLATION THICKNESS SCHEDULE

	Piping	Pipe Sizes mm	Insulation Thickness mm	Recovery Jacket
.1	Chilled Glycol Piping	15 to 65	25	Canvas
		75 to 150	40	
		200 & over	50	
.2	Heating Water Piping	15 to 40	25	Canvas
		50 to 75	25	
		100 to 150	40	
		200 and Over	50	
		15 to 40	25	Canvas
		50 to 75	25	
		100 to 150	40	
		200 and Over	50	

NOTE: Pipe insulation for piping installed in 38 x 92 mm wall cavity can be reduced to 15 mm, for pipe sizes 40 mm to 65 mm. Install insulation to thickness specified for piping outside the wall cavity.

END OF SECTION

1. General

1.1 SCOPE

.1 All pumps except where integral with a manufactured piece of equipment.
.2 Pumps controls where self contained.

1.2 SUBMITTALS

.1 Submit with shop drawings certified pump curves showing pump characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

1.3 QUALITY ASSURANCE

.1 Base mounted pumps shall be aligned by qualified millwright and alignment certified.

.2 Ensure pumps operate at specified system fluid operating temperatures and pressures without vapour binding and cavitation, are non-overloading in parallel or individual operation, operate within 25% of midpoint of published maximum efficiency curve. Motor capacity shall be adequately sized to prevent overloading throughout entire range of performance curve.

.3 Comply with Section on, Electric Motors.

2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1 End Suction Centrifugal Pumps : Bell & Gossett, Armstrong, Leitch, Taco,
.2 Vertical Centrifugal Pumps : Bell & Gossett, Armstrong, Leitch.

2.2 GENERAL

.1 Statically and dynamically balance rotating parts.

.2 Construction shall permit complete servicing without breaking piping or motor connections.

.3 Pumps shall operate at 1750 rpm unless specified otherwise.

.4 Pump connections shall be flanged.

.5 All pump flanges to be complete with pressure gauge tappings.

2.3 BASE MOUNTED CENTRIFUGAL PUMPS

.1 Type: Centrifugal, single stage.

.2 Casing: Cast iron volute, rated for 1200 kPa, single end suction or split suction casing, renewable bronze wearing rings, air vent, drain plug, suction and discharge gauge ports.

.3 Impeller: Bronze, fully enclosed, keyed to shaft.

.4 Shaft: Stainless steel.

.5 Bearings: Ball bearings, regreaseable.

.6 Drive: Flexible coupling with coupling safety guard.

.7 Seals: Spring loaded carbon rotating against a stationary ceramic seat. Integral seal flush with micron filter on condenser water service.

.8 Baseplate: Fabricated steel with drip rim and drain connector.

.9 Motor: Open drip proof, unless noted otherwise in pump schedule.

2.4 VERTICAL CENTRIFUGAL PUMPS

.1 Type: Centrifugal, single stage, close coupled, in-line, suitable for vertical operation.

.2 Casing: Cast iron, rated for 1200 kPa, suction and discharge gauge ports, air vent, wear rings, seal flushing connection, drain plug.

.3 Impeller: Bronze, fully enclosed, keyed to shaft.

.4 Shaft: Stainless steel.

.5 Bearings: Ball bearings, regreaseable.

.6 Seals: Spring loaded carbon rotating against a stationary floating stellite seat and seat ring. Integral seal flush with micron filter on condenser water service.

.7 Motor: Open drip proof unless noted otherwise in pump schedule.

3. Execution

3.1 INSTALLATION

.1 Provide drains for bases piped to and discharging into floor drains.

.2 Provide air cock and drain connection on horizontal pump casings.

.3 Provide suction guides complete with strainer on inlet to all pumps. Refer to Section 23 05 23, General Duty Valves and Strainers for HVAC Piping, for requirements for strainers and combination suction guides with strainers.

.4 Decrease from suction line size with eccentric reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Support suction guide and discharge elbow from a floor stand with rubber and shear sandwich pad isolators or from above with hangers and spring isolators.

.5 Provide 100 mm high housekeeping pads for pumps. Grout base mounted pumps to inertia and/or housekeeping pads.

.6 Check and align base mounted pumps prior to start-up by qualified millwright.

3.2 PERFORMANCE

.1 Refer to pump schedule on drawings.

END OF SECTION

1. General

1.1 SCOPE

.1 Manual and automatic air vents.
.2 Air separators.
.3 Relief valves and fittings.
.4 Radiation valves.
.5 Pressure Reducing Valves.
.6 Quantity Meters.

2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1	Air Separators	:	Bell and Gossett, Taco, Armstrong.
.2	Relief Valves	:	Bell and Gossett, Armstrong, Taco.
.3	Pressure Reducing Valves	:	Bell and Gossett, Armstrong, Taco.

2.2 MANUAL AIR VENTS

.1 Provide manual air vents with 25 mm or line diameter pipe which ever is the greater, to form air collection chamber. Collection chambers to be a minimum of 150 mm high.

2.3 AIR SEPARATORS

.1 Provide centrifugal type with 861 kPa WSP steel tank, galvanized steel 5 mm perforated strainer, perforated stainless steel air collector tube and drain connection.

2.4 RELIEF VALVES

.1 Provide ASME rated direct spring loaded type, lever operated non-adjustable factory set. Relief pressure as indicated.

2.5 HANDWHEEL RADIATOR VALVES

.1 Refer to Section 23 05 23, General Duty Valves and Strainers for HVAC Piping.

2.6 RADIATOR BALANCING VALVES

.1 Refer to Section 23 05 23, General Duty Valves and Strainers for HVAC Piping.

2.7 QUANTITY METERS

.1 Refer to Section 23 05 19, Meters and Gauges for HVAC Systems.

2.8 PRESSURE REDUCING VALVES

.1 20 mm pressure reducing valve complete with low inlet pressure check valve, removable strainer, Brass body and adjustable pressure of 175 kPa to 415 kPa. Bell & Gossett Model 7.

3. Execution

3.1 AIR VENTS

.1 Provide manual type at system high points and convection type heating units. Pipe air vent to servicable location.

.2 Where large air quantities can accumulate, provide enlarged air collection standpipe.

3.2 AIR SEPARATOR

.1 Provide on suction side of system circulation pump and connect to expansion tank.

3.3 RELIEF VALVES

.1 Provide relief valves on pressure tanks, low pressure side of reducing valves, heating convertors, expansion tanks and where indicated.

.2 Pipe relief valve to nearest floor drain.

.3 System relief valve capacity shall equal make-up pressure reducing valve capacity. Equipment relief valve capacity shall exceed input rating of connected equipment.

.4 Where one line vents several relief valves, cross sectional area shall exceed sum of individual vent areas.

3.4 QUANTITY METERS

.1 Install where indicated on drawings complete with isolation valves and line size bypass.

3.5 SYSTEM CAPACITY RECORDING

.1 Contractor shall record quantity of water in system. Data to be recorded in Operating and Maintenance Manuals.

3.6 HANDWHEEL RADIATOR VALVES

.1 Provide on water inlet to terminal heating units such as radiation, unit heaters and fan coil units.

3.7 RADIATOR BALANCING VALVES

.1 Provide on water outlet from terminal heating units.

END OF SECTION

1. General

1.1 SCOPE

.1 Manual and automatic air vents.
.2 Air separators.
.3 Relief valves and fittings.
.4 Centrifugal filters.
.5 Centrifugal filter purge filter.
.6 Quantity Meters.

2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1	Air Separators	:	Bell and Gossett, Taco, Armstrong.
.2	Centrifugal Filters	:	Lakos.
.3	Centrifugal Filter Purge Filter	:	Lakos.

2.2 MANUAL AIR VENTS

.1 Provide manual air vents with 25 mm or line diameter pipe which ever is the greater, to form air collection chamber. Collection chambers to be a minimum of 150 mm high.

2.3 AIR SEPARATORS

.1 Provide centrifugal type with 861 kPa WSP steel tank, galvanized steel 5 mm perforated strainer, perforated stainless steel air collector tube and drain connection.

2.4 RELIEF VALVES

.1 Provide ASME rated direct spring loaded type, lever operated non-adjustable factory set. Relief pressure as indicated.

2.5 RADIATOR BALANCING VALVES

.1 Refer to Section 23 05 23, Valves and Strainers.

2.6 QUANTITY METERS

.1 Refer to Section 23 05 19.

2.7 CENTRIFUGAL FILTERS

.1 Centrifugal Action Vortex Separator

.1 Separation efficiency 98% for particles 74 microns and larger, 75% for particles 5 microns and larger based on particle specific gravity of 2.6 and water at 1.0.

.2 Fluid to Enter Separator

.1 Tangentially at the top of the vessel. Fluid passes through slots into a

tubular separation chamber. Separated particles are collected at the bottom of the chamber and system fluid exits the separator out the top.

.3 Solids Recovery Vessel

.1 Separated solids to be continually purged under controlled flow to a vessel with 25 micron fiberfelt solids collection bag(s). Excess fluid to pass through the bag and return to system flow at suction side of system pump. System to include air/pressure relief valve, manual isolation vlaves, sight glasses, bag cleaning/service annunciator, flow control orifice, clamps tubing and specialty piping for complete package.

.4 Refer to schedule on the drawings.

3. Execution

3.1 AIR VENTS

.1 Provide manual type at system high points and convection type heating units. Pipe air vent to servicable location.

.2 Where large air quantities can accumulate, provide enlarged air collection standpipe.

3.2 AIR SEPARATOR

.1 Provide on suction side of system circulation pump and connect to expansion tank.

3.3 RELIEF VALVES

.1 Provide relief valves on pressure tanks, low pressure side of reducing valves, heating convertors, expansion tanks and where indicated.

.2 Pipe relief valve to nearest floor drain.

.3 System relief valve capacity shall equal make-up pressure reducing valve capacity. Equipment relief valve capacity shall exceed input rating of connected equipment.

.4 Where one line vents several relief valves, cross sectional area shall exceed sum of individual vent areas.

3.4 QUANTITY METERS

.1 Install where indicated on drawings complete with isolation valves and line size bypass.

3.5 SYSTEM CAPACITY RECORDING

.1 Contractor shall record quantity of water in system. Data to be recorded in Operating and Maintenance Manuals.

3.6 CENTRIFUGAL FILTERS

.1 Follow manufacturer's installation instructions and system schematic drawings.

END OF SECTION

1. General

1.1 SCOPE

.1 Provide for cleaning and degreasing of hot water heating, glycol and chilled water systems.

.2 Provide all necessary equipment and chemicals to treat hot water heating, glycol and chilled water systems.

.3 Isolate and bypass equipment listed in Clause 3.1.

.4 Do NOT use permanent building system pumps for cleaning and piping. Provide temporary recirculating pumps.

.5 Provide bypass for heat exchangers during cleaning of systems.

1.2 ACCEPTABLE AGENCY

.1 Chemical treatment agency shall provide equipment, chemicals and site supervision so as to fully comply with all requirements and their intent contained within this specification section.

.2 Acceptable Agency: Keytech Water Management, SAI Engineering, Guardian Chemicals Inc., Technical Sales.

1.3 QUALITY ASSURANCE

.1 Perform the cleaning and degreasing operation on site in conjunction mechanical contractor and submit written reports on all situations found, actions taken and final results. Reports shall be signed by the contractor, chemical treatment agency, and commissioning agency. Inform the engineer and commissioning agency 15 working days prior to commencing of work.

.2 Provide chemical treatment as specified herein and provide written reports. Reports shall be signed by the chemical treatment agency, mechanical contractor and commissioning agency.

.3 Chemical treatment agency shall provide directive and assistance to the mechanical contractor in the degreasing, cleaning and chemical treatment of all piping systems. Use of the permanent mechanical systems for pumping or heating of cleaning and dilution solutions is not permitted. Permanent systems shall be isolated and portable pumps and boilers utilized for the duration of the cleaning process. Permanent equipment shall be flushed, degreased and chemically treated independent of the piping systems.

.4 Include for the costs of an independent testing agency, selected by the Owner, to take samples of all chemically treated hydronic systems, perform lab analysis of the chemical treatment levels, and submit a written report of their findings to the Owner. Should chemical treatment levels not meet the requirements of the specifications, the Contractor shall adjust treatment levels accordingly and cover the costs of the independent testing agency to take additional samples and tests.

1.4 SUBMITTALS

.1 Submit shop drawings with complete description of proposed chemicals, calculations, procedures, test kits and equipment to be supplied. Along with product shop drawings, provide copies of data sheets, procedure instructions and analysis reports to be used on this project. Shop drawings shall be submitted within 10 workings days of the award of contract.

.2 Provide written reports containing procedure of system cleaning and degreasing, giving times, dates, conditions of water and problems and actions encountered.

.3 Submit written reports to the mechanical contractor and engineer containing results of tests taken seven days after completion of chemical treatment. Reports shall be done every seven days for a minimum time period of 35 days.

.4 Provide monthly site visits (12 minimum) within the warranty year to check the treatment, take samples, analyze and recommend proper addition of treatment. Provide written reports to the owner after each visit with a copy to the engineer.

2. Products

2.1 MATERIALS

.1 Provide sufficient chemicals to treat and test the systems from the time of activation and acceptance of the building for the first year of operation by the owner.

.2 Materials which may contact finished areas shall be colorless and non-staining. Chemicals used must comply with environmental and health standards applicable to the usage on this project.

.3 System Cleaner: Alkaline compound which in solution removes grease and petroleum products.

.4 Closed System Treatment: Sequestering agent to reduce deposits and adjust PH, and a corrosion inhibitor.

2.2 EQUIPMENT

.1 Solution Pumps: Provide positive displacement diaphragm type metering pumps for adding chemicals. Pumps shall have an adjustable flow rate and be suitable for chemicals to be pumped. Pumps shall be self flushing. Provide pumps with plastic solution tanks complete with agitator, pump mounting, cover, provision for fill line and pump strainer. Size the pumps and tanks to permit operation for three days at 50% pump capacity without refill of tanks. Provide agitator motor with terminals and junction box for electric wiring.

.2 Provide chemical pot feeder with a minimum of 10 L capacity, semi-sphere top and bottom, one pot feeder per system, located as shown on system schematics and floor plans. If location is in question obtain clarification from the engineer prior to installation.

2.3 BYPASS FILTER

.1 Unit to consist of cartridge filter, flow indicator, flow control valves and filter Cartridge filter; stainless steel shell of single centre bolt construction with cast nickel- plated brass head, drain plug and air vent. Flow indicator - cast bronze body with two sight glasses of high temper, thermo shock-resistant glass and nylon rotor on stainless steel pin..

.2 Flow control valves shall be automatic regulating type.

.3 Spare filter cartridges to be turned over to the Owner: 10 each of 5 micron retention, and 25 micron retention.

2.4 CHEMICAL POT FEEDER

.1 150 mm diameter x 550 mm long feeder, suitable for 861 kPa operating pressure complete with isolation valves on 20 mm inlet and outlet lines. 20 mm drain valve 40 mm fill complete with filling funnel.

2.5 TEST KITS

.1 Test methods shall be titration type utilizing automatic burettes capable of determining 0.1 ppm, where this type of method may be used.

.2 All test kits shall be provided with adequate chemicals and reagents for one year of testing.

.3 Provide test kits as required to determine proper system treatment consisting of but not limited to the following:

.1 heating water test kit to determine proper treatment.

.2 chilled water treatment test kits to determine proper treatment.

.3 glycol systems treatment test kits to determine proper concentration and glycol inhibitor, this shall include a hydrometer type tester.

.4 Provide test kits for hardness and chlorides in addition to those listed above.

.5 Provide a PH meter complete with three different calibration standard solutions.

3. Execution

3.1 SYSTEM CLEANING

.1 Ensure reasonable care is exercised to prevent debris, dirt and other foreign material from entering the pipe during construction. This is to include proper protection of piping on site prior to installation, temporary caps on partial systems, and complete evacuation of moisture within systems being hydrostatically pressure tested.

.2 Chemical treatment agency shall, in conjunction with the mechanical contractor, review connections for complete draining and venting of the systems. The mechanical contractor shall provide adequate drain connections to completely drain the systems within one hour. Utilize water meter to record capacity within each system systems.

.3 Protect and/or remove control devices from systems during cleaning. All terminal control valves shall be in open position during cleaning. Particular attention is to be made to control valves which have a normally closed position. Isolate and bypass the following equipment during flushing and chemical treating: Cooling towers, plate and frame heat exchangers.

.4 Make systems completely operational, totally filled, thoroughly vented, and completely started.

.5 Add system cleaner and degreasant to flow systems at concentration of 1 kg per 1000 L of water contained in systems for hot systems, 1 kg per 500 L of water for cold systems.

.6 For hot water heating systems apply heat while circulating, raise temperature to 71°C slowly and maintain at 71°C for a minimum of 12 hours. Remove heat and circulate systems to 38°C or less. Drain system, entirely at one time, including all low points and coils. Intermittent start/stop of drainage is not approved. The mechanical contractor to provide additional temporary pipe, pumps as necessary and drainage location for complete drainage. Refill the entire system with clean water, circulate for six hours at design temperature, provide complete venting and deairation, repeat the draining procedure. Refill complete system with clean water and retest.

.7 For chilled water systems utilize the same procedures specified above for hot water heating systems; however, circulate at ambient temperature for a minimum of 48 hours.

.8 For glycol systems utilize the same procedure for hot water heating systems specified above.

.9 Inspect, clean of sludge and flush all low points with clean water after cleaning and degreasing process is completed. Include disassembly of components as required. All cleaning and flushing of low points, coils, boilers, etc., shall be done prior to final fill and chemical treatment.

3.2 HEATING WATER, CHILLED WATER AND GLYCOL SYSTEMS

.1 Provide and install one pot feeder for each individual system. Install complete with isolating and drain valves and necessary piping. Install as indicated on schematics.

.2 Treat closed systems with closed systems treatment introduced through pot feeder when required or indicated by test.

.3 Provide and install one side stream micron filter (between pump suction and discharge) per system, complete with isolation valves, drain valve, union, site glass, and flow regulating valve to limit flow thru filter to manufacturers recommendations.

END OF SECTION

1. General

1.1 SCOPE

.1 Ductwork and plenums.

.2 Fasteners.

.3 Sealants.

.4 Duct cleaning.

1.2 DEFINITIONS

.1 Low Pressure: Static pressure in duct less than *500 Pa* and velocities less than *10 m/s*.

.2 Medium Pressure: Static pressure in duct less than *1500 Pa* and velocities greater than *10 m/s*.

.3 High Pressure: Static pressure over *1500 Pa* and less than *2500 Pa.* and velocities greater than *10 m/s* **.**

.4 Duct sizes shown on plans are inside clear dimensions. For acoustically lined or internally insulated ducts, maintain sizes inside ducts.

1.3 QUALITY ASSURANCE

.1 Ductwork shall meet the requirements of NFPA No. 90A - Air Conditioning and Ventilating Systems; NFPA No. 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

.2 Fabricate in accordance with SMACNA duct manuals and ASHRAE handbooks.

.3 Flexible air duct shall conform to NFPA 90A and UL181 standard for factory made air duct materials and air duct connectors.

1.4 SUBMITTALS

.1 Submit shop drawings and samples of duct fittings for approval, including particulars such as gauge sizes, welds, and configurations prior to start of work.

1.5 ALTERNATIVES

.1 Obtain written permission from the Engineer prior to making variations in duct configuration or sizes. Size alternatives using ASHRAE table for circular equivalents of rectangular ducts.

2. Products

2.1 MATERIALS

.1 Ducts: Galvanized steel lock forming quality, having galvanized coating of *380 g/m²* for both sides.

.2 Fasteners: Use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts. Weld kitchen exhaust ducts.

.3 Sealant: Water resistant, fire resistive, compatible with mating materials.

.4 Flexible Duct - Low Pressure: Flexible air duct shall be used where shown on drawings. Length of flexible duct shall not exceed *900 mm* Flexible duct shall be polymetric liner banded to a steel wire helix, wrapped with fiberglass insulation and outer fiberglass reinforced metalized vapour barrier jacket. Flexible duct rated for *12 m/s* velocity and pressure rated for *500 pascal* positive and *500 pascal.* negative.

.5 Standard Acceptance: Thermaflex M-KE.

.6 Flexible Duct - Medium and High Pressure: Flexible air duct may be used to connect terminal units to metal duct. Length of flexible duct shall not exceed *300 mm.*. Flexible duct shall be woven and vinyl coated fiberglass liner bonded to a steel wire helix. Where flexible air duct is attached to metal insulated duct, furnish flexible air duct with fiberglass insulation and outer fiberglass reinforced metalized vapour barrier jacket. Flexible duct rated for *30 m/s* velocity and pressure rated for *4.0 kPa* positive and *500 pascal.* negative.

.7 Standards of Acceptance: Uninsulated - Thermaflex S-TL; Insulated - Thermaflex M-KC.

3. Execution

3.1 INSTALLATION

.1 Fabricate ductwork from field measurements and not from plans and shop drawings exclusively. Failure to do so will not constitute an extra to the Contract.

.2 Complete metal ducts within themselves with no single partition between ducts. Where width of duct exceeds *450 mm* crossbrace for rigidity. Open corners are not acceptable.

.3 Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.

.4 Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of cut on centre line. Where not possible and where rectangular elbows are specified, provide double wall air foil type turning vanes. Where acoustical lining is provided, provide turning vanes of perforated metal type with fibreglass inside.

.5 Increase duct sizes gradually, not exceeding 15° divergence wherever possible. Maximum divergence upstream of equipment to be 30° and 45° convergence downstream.

.6 Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breathe, rattle, vibrate, or sag. Caulk duct joints and connections with sealant as ducts are being assembled. Seal seams on fresh air and exhaust ducts watertight with mastic or low velocity duct sealant.

.7 Weld all stainless steel ductwork and ensure a smooth finish on all interiors.

.8 Provide floor drains in fresh air and humidifier sections with deep seal traps.

.9 Set plenum doors *150 mm* above floor. Arrange door swings so that fan static holds door in closed position.

3.2 PLENUM GAUGES

.1 Fabricate fan plenums and plenums downstream of fan in accordance with SMACNA manual.

.2 Fabricate plenums between fan and upstream apparatus of *1.6 mm* thick material.

.3 Fabricate plenums between filters and upstream apparatus of *1.3 mm* thick material.

3.3 DUCT SEALING

.1 All supply, return, and exhaust duct joints, longitudinal as well as transverse, should be sealed using:

.1 Low Pressure Ductwork:

.1 Slip Joints: Apply heavy brush-on high pressure duct sealant. Apply second application after the first application has completely dried out. Where metal clearance exceeds *1.5 mm***.** use heavy mastic type sealant.

.2 Flanged Joints: Soft elastomer butyl or extruded form of sealant between flanges followed by an application of heavy brush-on high pressure duct sealant.

.3 Other Joints: Heavy mastic type sealant.

.2 Medium and High Pressure Ductwork: Combination of woven fabrics and sealing compound followed by an application of high pressure duct sealant.

.2 Duct tapes as sealing method are not permitted.

.3 Surfaces to receive sealant should be free from oil, dust, dirt, moisture, rust and other substances that inhibit or prevent bonding.

.4 Prior to sealing all ductwork, demonstrate sealing of a section of each type of duct and obtain approval from the Engineer.

.5 Do not insulate any section of the ductwork until it has been inspected and approved of duct sealant application.

3.4 INSTALLATION

.1 Locate ducts with sufficient space around equipment to allow normal operation and maintenance activities.

.2 Coordinate the location of duct access doors. Refer to specifications for Duct Accessories and Ductwork Cleaning.

.3 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

.4 Interrupt duct linings at fire, balancing backdraft and smoke dampers so as not to interfere with operation of devices. Provide sheet metal edge protection over linings on both sides of damper device.

.5 Shield ductwork from dust and construction material during construction. Clean any ductwork found to be dirty at no extra cost to the Contract.

.6 Protect carbon steel ductwork exposed to weather by painting or coating with suitable weather resistant material.

.7 Install ducts associated with fans subject to forced vibration with flexible connections immediately adjacent to equipment. Refer to specifications for Duct Accessories.

.8 Do not use flexible duct to change direction. Provide a minimum of three duct diameters of straight metal duct between box inlet and flexible connector.

.9 Connect diffusers or troffer boots to low pressure ducts with *300 mm.* maximum length of flexible duct. Hold in place with caulking compound and strap or clamp.

.10 Prove that ductwork is substantially air tight before covering or concealing.

.11 Clean systems with power vacuum machines. Refer to Specifications for Ductwork Cleaning.

END OF SECTION

1. General

1.1 QUALITY ASSURANCE

.1 Firms shall be specialists in this field.

.2 Cleaning Equipment: 5.0 kPa suction capacity and 12,000 L/s minimum capacity.

.3 Submit list of five (5) past projects undertaken of same magnitude as this project.

.4 Submit a letter certifying that all systems have been completely cleaned and are ready for inspection.

.5 Acceptable contractors: Don's Pow-R Vac, Carson Pow-R-Vac, Modern Power Vac.

2. Products

2.1 MATERIALS

.1 Access Doors: Minimum 450 mm x 350 mm door, hinge and frame type, positive latching/locking mechanism. Refer to Section 23 33 13, Air Duct Accessories.

3. Execution

3.1 PREPARATION

.1 Isolate items to be cleaned so as not to contaminate unprotected work.

.2 Equip vacuum equipment with filters.

3.2 INSTALLING ACCESS DOORS

.1 Locate access doors and install as follows:

.1 At 12.0 m intervals in vertical ducts.
.2 Horizontal ducts at intervals of 6 m.
.3 At the base of all duct risers.
.4 Both sides of turning vanes in all ducts.
.5 At each fire damper location.
.6 At each side of all coils except where an access is provided.
.7 At all locations of internally duct mounted equipment or devices including balancing dampers, automatic dampers, damper motors, duct mounted smoke detectors and heat detectors, and controls, except where access is provided.

3.3 CLEANING

.1 When the duct systems are completely installed and before any systems are operated, clean all ductwork, plenums, coils, unit heaters, fan coil units and air handling equipment by compressed air and suction equipment.

.2 Cleaning is not required for exhaust ductwork systems that convey air directly to the outside exclusively without recirculation.

.3 Seal all ductwork outlets after ductwork has been cleaned.

.4 Seal all plenums after cleaning.

3.4 INSPECTION

.1 Ductwork cleanliness will be inspected using a periscope built of 75 mm diameter tube, mirrors and flashlight.

.2 Ductwork found to be dirty shall be re-cleaned at contractor's expense.

END OF SECTION

1. General

1.1 SCOPE

.1 Access doors.
.2 Fire dampers.
.3 Combination fire/smoke dampers.
.4 Fire stop flaps.
.5 Balancing dampers.
.6 Flexible connections.
.7 Backdraft dampers.

1.2 QUALITY ASSURANCE

.1 Fire dampers shall be ULC listed and constructed in accordance with ULC Standard S 112 "Fire Dampers".

.2 Fusible links on fire dampers shall be constructed to ULC Standard S 505.

.3 Demonstrate re-setting of fire dampers to authorities having jurisdiction and Owner's representative.

.4 Access doors shall be ULC labeled.

.5 Accessories shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems. Fabricate in accordance with ASHRAE Handbooks and SMACNA Duct Manuals.

.6 Prove all dampers to inspector at job completion.

1.3 SUBMITTALS

.1 Submit shop drawings of factory fabricated assemblies.

.2 Submit samples of shop fabricated assemblies as requested by the Engineer.

.3 Comply with requirements of Section Shop Drawings, Product Data and Samples.

2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Access Doors: Controlled Air, Nailor, Air-O-Metal, Titus.

.2 Fire Dampers: Controlled Air, Ruskin.

2.2 DUCT ACCESS DOORS

.1 Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and suitable quick fastening locking devices. Duct access panels with screws acceptable. Install minimum 25 mm thick insulation with suitable sheet metal cover frame for insulated ductwork.

.2 Fabricated with two butt hinges and two sash locks for sizes up to 450 mm, two hinges and two compression latches with outside and inside handles for sizes up to 600 mm x1200 mm and an additional hinge for larger sizes.

2.3 FIRE DAMPERS

.1 Fabricate of galvanized steel or prime coated black steel weighted to close and lock in closed position when released by fusible link.

.2 Fire dampers shall be curtain type with damper blades retained out of air stream in a recess so free area of connecting ductwork is not reduced.

.3 Fusible links shall be set for 71°C.

2.4 COMBINATION FIRE/SMOKE DAMPERS

.1 Combination Fire/Smoke dampers, rated as a unit by ULC, shall be provided c/w actuators by the Mechanical Contractor. Mechanical Contractor shall install in locations noted.

.2 Fire/smoke dampers shall be wired by the electrical contractor.

.3 Coordinate correct size of smoke/fire damper with Control Contractor.

.4 Fabricate combination fire and smoke dampers of multiple blades readily adjustable in open position. Dampers shall be ULC rated.

.5 Fire and smoke damper free area opening shall not be less than internal duct size indicated on plans. If a multiple of blade sizes does not equal opening size, oversize damper and increase and decrease ductwork accordingly.

2.5 FIRE STOP FLAPS

.1 Fabricate of heat retardant fabric in galvanized or prime coated black steel frame, spring loaded action to close and lock in closed position when released by fusible link.

.2 Blanket shall be retained in a recess so free area of connecting ductwork is not reduced.

.3 Fusible links shall be set for 71°C.

2.6 SPLITTER DAMPERS

.1 Fabricate splitter dampers of double thickness sheet metal to streamline shape, properly stiffened to avoid vibration.

.2 Fabricate galvanized steel, minimum 1.6 mm, and provide with adjustable rod and locking screw.

.3 On externally insulated ductwork, install operating mechanisms on a steel bridge type mounting base to permit continuity of insulation under the mechanism.

2.7 BALANCING DAMPERS

.1 Fabricate of galvanized steel, minimum 1.6 mm. Full blade-length shafts of hollow square construction with blades rigidly fastened along entire blade length.

.2 Lockable quadrant type operating mechanism with end bearings on accessible rectangular ducts up to 400 mm deep and on accessible round ducts.

.3 Wide pitch screw operating mechanism with crank operator and end bearings on accessible rectangular ducts 425 mm and over in depth and on all inaccessible rectangular and round ducts.

.4 On rectangular ducts up to 275 mm deep construct of single blade (butterfly) type.

.5 On rectangular ducts 300 mm to 400 mm deep construct of two opposed blades mechanically interlocked with pivots at quarter points.

.6 On rectangular ducts over 425 mm deep construct of multiple opposed blades, mechanically interlocked with blades no greater than 200 mm deep and pivots equally spaced.

.7 On round ducts construct of single blade (butterfly) type. On 500 Pa class and on all dampers over 300 mm diameter fabricate with full blade-length shaft.

.8 Construct damper blades for medium and high pressure systems to block air passage 70% maximum. Provide complete with locking type handles.

.9 Provide over-ride limiting stops on all operating mechanisms.

.10 Identify the air flow direction and blade rotation and open and close positions on operating mechanism.

.11 On round ductwork, install operating mechanism on a steel mounted base firmly secured to the ductwork.

.12 On externally insulated ductwork, install operating mechanisms on a steel bridge type mounting base to permit continuity of insulation under the mechanism.

2.8 FLEXIBLE CONNECTIONS

.1 Fabricate of ULC approved neoprene coated flameproof glass fabric approximately 150 mm wide tightly crimped into metal edging strip and attached to ducting and equipment by screws or bolts at 150 mm intervals. Flexible connection airtight at 500 Pa.

2.9 BACKDRAFT DAMPERS

.1 Construct of minimum 1.3 mm galvanized steel channel frame.

.2 Construct of minimum 0.6 mm aluminum blades, complete with stiffeners along trailing edge. Fabricate single blade dampers for duct sizes to 240 mm, multiblade dampers for ducts greater than 240 mm.

.3 Provide full blade-length shafts complete with brass or nylon bearings.

.4 Provide neoprene anti-clatter blade strips on pivot side of blades.

.5 Construct blade connecting linkage of minimum 2.0 mm aluminum rod with eyelet, pin bearings, and adjustable counter weight to assist blade opening action.

.6 Maximum blade length of 750 mm.

.7 Backdraft damper suitable for 10 m/s face velocity.

3. Execution

3.1 APPLICATION

.1 Provide access door minimum 450 mm x 350 mm or 50 mm smaller than duct dimension for cleaning and inspection at positions indicated by drawings and as follows:

.1 At 6.0 m intervals on all horizontal ducts.
.2 At 12.0 m intervals in all vertical duct systems.
.3 At the base of all duct risers.
.4 Both sides of turning vanes in all ducts.
.5 At each fire damper location.
.6 At each side of all heating or cooling coils.
.7 At all locations of internally duct mounted devices including automatic dampers, damper motors, duct mounted smoke detectors and heat detectors, and control sensors and devices.

.2 Provide fire dampers at locations shown, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Fire dampers shall be complete with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

.3 Coordinate with the General Contractor for correct size openings and proper fire guard sleeving for fire damper penetration.

.4 At each point where ducts pass through partitions, the opening around the duct shall be sealed with non-combustible material.

.5 Provide balancing dampers at points on low pressure supply, return and exhaust systems where branches are taken from larger ducts.

.6 Provide balancing dampers on medium and high pressure systems where indicated. Splitter dampers shall not be used on medium and high pressure system.

.7 Install ducts associated with fans and equipment subject to forced vibration with flexible connections, immediately adjacent to equipment and/or where indicated on drawing.

.8 For connections to medium and high pressure fans, install 15 mm thick neoprene pad over fabric and hold in place with additional metal straps.

.9 All fire dampers and fire stop flaps are to be left in the closed position for balancing contractor to fix open.

.10 Support ceiling fire stops from the structure above the fire stop and not from air outlets on associated ductwork.

END OF SECTION

1. General

1.1 SCOPE

.1 Flexible ducts.

1.2 DEFINITIONS

.1 Low Pressure: Static pressure in duct less than 500 Pa and velocities less than 10 m/s.

.2 Medium Pressure: Static pressure in duct less than 1500 Pa and velocities greater than 10 m/s.

.3 High Pressure: Static pressure over 1500 Pa and less than 2500 Pa and velocities greater than 10 m/s.

.4 Duct sizes shown on plans are inside clear dimensions. For acoustically lined or internally insulated ducts, maintain sizes inside ducts.

1.3 QUALITY ASSURANCE

.1 Ductwork shall meet the requirements of NFPA No. 90A - Air Conditioning and Ventilating Systems.

.2 Flexible air duct shall conform to NFPA90A and UL181 standard for factory made air duct materials and air duct connectors. Flexible duct shall have a Fire Rating of at least ½ hour as measured by UL Standard.

2. Products

2.1 MATERIALS

.1 Fasteners: Use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts.

.2 Sealant: Water resistant, fire resistive, compatible with mating materials.

.3 Flexible Duct - Low Pressure: Flexible air duct shall be used where shown on drawings.

.4 Length of flexible duct shall be a minimum of 1500 mm. Flexible duct shall have a perforated core with an open area 20% to 25%. The core is to be enclosed in a glass fibre insulating wool having a minimum density of ¾ lb. and held in compression of 25% min. The outer skin shall be factory tested to 1kPa static pressure without leakage.

.5 Standard of Acceptance: Flexmaster T/L-A acoustic.

.6 Flexible Duct - Medium and High Pressure: Flexible air duct may be used to connect terminal units to metal duct. Length of flexible duct shall not exceed 300 mm. Flexible duct shall be woven and vinyl coated fiberglass liner bonded to a steel wire helix. Where flexible air duct is attached to metal insulated duct, furnish flexible air duct with fiberglass insulation and outer fiberglass reinforced metalized vapour barrier jacket. Flexible duct rated for 30 m/s velocity and pressure rated for 4.0 kPa positive and 500 Pa negative.

.7 Standards of Acceptance: Un-insulated: - Thermaflex S-TL
Insulated: Thermaflex M-KC

3. Execution

3.1 DUCT SEALING

.1 All supply, return and exhaust duct joints, longitudinal as well as transverse, shall be sealed using,

.1 Low Pressure Ductwork:

.1 Joints: Heavy mastic type sealant.

.2 Medium and High Pressure Ductwork: Combination of woven fabrics and sealing compound followed by an application of high pressure duct sealant.

.2 Duct tapes as sealing method are not permitted.

.3 Surfaces to receive sealant should be free from oil, dust, dirt, moisture, rust and other substances that inhibit or prevent bonding.

.4 Prior to sealing all joints to ductwork, demonstrate sealing and obtain approval from the engineer.

3.2 INSTALLATION

.1 Do not use flexible duct to change direction. Provide a minimum of three (3) duct diameters of straight metal duct between box inlet and flexible connector.

.2 Connect diffusers or troffer boots to low pressure ducts with 300 mm maximum stretched length of flexible duct. Hold in place with caulking compound and strap or clamp.

END OF SECTION

1. General

1.1 SCOPE

.1 Centrifugal Fans.

.2 In-line Centrifugal Duct Fans.

.3 Fan Accessories.

.4 Roof Curbs.

1.2 QUALITY ASSURANCE

.1 Conform to AMCA Bulletins regarding construction and testing. Fans shall bear AMCA certified rating seal for performance and sound ratings.

.2 Fans shall bear CSA label.

1.3 SUBMITTALS

.1 Submit with shop drawings acoustical data and fan curves showing fan performance with fan and system operating point plotted on curves.

.2 Comply with requirements of Section on, Shop Drawings, Product Data and Samples.

1.4 JOB CONDITIONS

.1 Do not operate fans for any purpose, temporary or permanent until ductwork is clean, filters are in place and bearings are lubricated.

.2 Refer to Section on, Temporary Heating, Cooling and Ventilating.

1.5 ALTERNATES

.1 Equivalent fan selections shall not increase motor kilowatts, increase rpm, increase noise level, increase tip speed by more than 10%, or increase inlet air velocity by more than 20%, from that of the specified fan.

1.6 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 Motors

.2 Documentation for HVAC Systems Section 23 05 05

.3 HVAC Equipment Testing and Startup Section 23 05 08

2. Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Centrifugal Fans: Trane, Chicago, Twin City, Barry Blower, Northern Blower, ACME.

.2 In Line Centrifugal Duct Fans: Greenheck, Ammerman, Loren Cook, ACME, Penn.

2.2 GENERAL

.1 Statically and dynamically balance fans so no objectionable vibration or noise is transmitted to occupied areas of the building.

.2 Provide balanced variable sheaves for motors 11.2 kW and under and fixed sheave for15 kW and over.

.3 Fans are to be capable of accommodating static pressure variations of ±10% with no objectionable operating characteristics.

.4 Supply replacement pulleys and sheaves for fans as required to properly balance the systems to design flows at actual job site static pressure conditions. Obtain requirements from balancing agency (Refer to Section 23 05 93, Balancing).

.5 Provide cross linkage for inlet vanes on double inlet fan.

.6 Size motors for parallel operating fans for non-overloading operation with only one fan operating.

.7 Provide belt guards with tachometer holes.

.8 External static pressure means external to the fan cabinet and all accessories such as backdraft dampers, mixing boxes, filters and coils, etc. These accessories if supplied as part of the unit are considered as internal losses for fan.

.9 Two speed motors shall have separate winding for each speed.

2.3 CENTRIFUGAL FANS

.1 Fabricate with multi-blade wheels in heavy gauge steel housing reinforced for service encountered.

.2 Provide V-belt drives with fan and motor mounted on reinforced, rigid steel base with adjustable motor mount.

.3 Provide heavy duty, self-aligning, anti-friction bearings with external lubrication.

.4 Provide access door and drain connection to scroll.

.5 Unless noted otherwise, centrifugal fans over 425 mm diameter shall have die formed air foil blades welded to side and back plate.

.6 Provide fan cabinets lined with minimum 25 mm acoustic insulation, unless noted otherwise elsewhere in the specifications.

3. Execution

3.1 INSTALLATION

.1 Where inlet or outlet is exposed, provide safety screen.

.2 Provide belt guards on belt driven fans complete with tachometer access.

.3 Supply and install sheaves as necessary for final air balancing.

.4 Set roof-mounted fans on curbs 200 mm minimum above roof. Provide acoustic insulation on duct to below roof line and on fan inlet plenum, and drip pan for collecting condensation with drain line to nearest drain.

.5 Provide 100 mm high housekeeping base for floor mounted units.

3.2 PRIMING

.1 Prime coat fan wheels and housing factory inside and outside. Prime coating on aluminum parts is not required.

.2 Provide two additional coats of paint on fans handling air downstream of humidifiers.

3.3 PERFORMANCE

.1 Refer to schedules on drawings.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Roof Mounted Fans.
.2 Fan Accessories.
.3 Roof Curbs.

1.2 QUALITY ASSURANCE

.1 Conform to AMCA Bulletins regarding construction and testing. Fans shall bear AMCA certified rating seal for performance and sound ratings.

.2 Fans shall bear CSA label.

1.3 SUBMITTALS

.1 Submit with shop drawings acoustical data and fan curves showing fan performance with fan and system operating point plotted on curves.

.2 Comply with requirements of Section on, Shop Drawings, Product Data and Samples.

1.4 JOB CONDITIONS

.1 Do not operate fans for any purpose, temporary or permanent until ductwork is clean, filters are in place and bearings are lubricated.

1.5 ALTERNATES

.1 Equivalent fan selections shall not increase motor kilowatts, increase rpm, increase noise level, increase tip speed by more than 10%, or increase inlet air velocity by more than 20%, from that of the specified fan.

1.6 WORK SPECIFIED IN OTHER SECTIONS

.1 Motors

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Roof Mounted Fans : Ammerman, Greenheck, Powerline, Acme, Loren Cook, Penn.
.2 Kitchen Range Hoods : Nutone, Lau, Broan.

2.2 GENERAL

.1 Statically and dynamically balance fans so no objectionable vibration or noise is transmitted to occupied areas of the building.

.2 Provide balanced variable sheaves for motors 11.2 kW and under and fixed sheave for 15 kW and over.

.3 Fans are to be capable of accommodating static pressure variations of ±10% with no objectionable operating characteristics.

.4 Supply replacement pulleys and sheaves for fans as required to properly balance the systems to design flows at actual job site static pressure conditions. Obtain requirements from balancing agency. (Refer to Section 23 05 93, Testing, Adjusting and Balancing for HVAC Systems.)

.5 Size motors for parallel operating fans for non overloading operation with only one fan operating.

.6 Provide belt guards with tachometer holes.

.7 External static pressure means external to the fan cabinet and all accessories such as backdraft dampers, mixing boxes, filters and coils, etc. These accessories if supplied as part of the unit are considered as internal losses for fan.

.8 Two speed motors shall have separate winding for each speed.

2.3 ROOF MOUNTED FANS

.1 Provide V-belt drives with fan and motor mounted to main housing through neoprene anti-vibration pads.

.2 All roof mounted fan motors shall be a minimum of 0.25 kW.

.3 Heavy aluminum dome type housings shall be reinforced as necessary.

.4 Provide with multi-blade, rattle free, backdraft damper with felt lined blade edges, birdscreen, disconnect switch and pre-manufactured roof curb.

.5 Unit shall be complete with electrical disconnect switch.

.6 For fume hood exhaust exhaust fans, finish exterior steel fan parts with baked enamel primer and enamel final paint coat. Finish fan interior, including blades and other parts in contact with the air stream with two coats of acid resistant paint.

2.4 KITCHEN RANGE HOODS

.1 Resiliently mount multi-blade direct driven fan and motor. Motor shall be two-speed plug- in type with permanently lubricated bearings.

.2 Finish hood in colour selected by Architect, baked on enamel, with rocker type switches for light and two speed fan. Provide washable type filter of aluminum mesh.

Part 3 Execution

3.1 INSTALLATION

.1 Where inlet or outlet is exposed, provide safety screen.

.2 Provide belt guards on belt driven fans complete with tachometer access.

.3 Supply and install sheaves as necessary for final air balancing.

.4 Set roof mounted fans on curbs 200 mm minimum above roof. Provide acoustic insulation on duct to below roof line and on fan inlet plenum, and drip pan for collecting condensation with drain line to nearest drain.

.5 Provide 100 mm high housekeeping base for floor mounted units.

3.2 PRIMING

.1 Prime coat fan wheels and housing factory inside and outside. Prime coating on aluminum parts is not required.

.2 Provide two additional coats of paint on fans handling air downstream of humidifiers.

3.3 PERFORMANCE

.1 Refer to schedules on drawings.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Basic terminal units.
.2 Pressure independent variable volume regulators complete with damper motor operator.
.3 Sound attenuator.
.4 Heating coils.

1.2 QUALITY ASSURANCE

.1 The terminal units shall be tested and certified in accordance with applicable ARI equipment test codes.

.2 Insulation materials, coatings, vapour barrier facings, tapes and adhesives: Composite fire and smoke hazard rating shall not exceed 25 for flame spread and 50 for smoke developed.

1.3 LABELLING

.1 Label units with capacities as factory adjusted including minimum maximum ratings of volume regulators.

1.4 SUBMITTALS

.1 Include discharge and radiated sound power level schedules with shop drawings, for each of second through sixth octave bands and inlet pressures of 250 Pa to 1000 Pa.

.2 Provide for inclusion in maintenance manuals, instructions for resetting constant volume regulators.

.3 Comply with Section 01 33 23, Shop Drawings, Product Data and Samples.

1.5 DAMPER OPERATORS

.1 Terminal unit damper operators shall be provided by the controls trade and factory installed by the terminal unit manufacturer.

Part 2 Products

2.1 APPROVED EQUALS

.1 E.H. Price, Kruger, Titus, Airvector, Nailor, Trane

2.2 FABRICATION

.1 Fabricate casing from 0.73 mm galvanized steel. Line casing with 25 mm thick 0.7 kg density minimum, neoprene or vinyl coated fibrous glass insulation and provide interior sound attenuator baffle. Casing leakage shall not exceed 2% design flow at rated internal pressure.

.2 Fabricate variable volume regulator sub-assembly of extruded aluminum and coated steel frame with extruded aluminum blades and stainless steel springs. Factory set regulator for specified maximum and minimum air volume.

3. Reset volume with damper operator attached to assembly allowing flow range modulation from maximum to minimum specified.

4. Provide water coils mounted integral with casing as indicated.

5. Provide unit complete with sound attenuator at discharge of unit where indicated.

6. Provide access doors integral with casing suitable for providing access to regulators proportioning valves, operators and coils.

Part 3 Execution

3.1 INSTALLATION

.1 Arrange for suitable ceiling access to units. Provide access doors or locate above easily removable ceiling components.

.2 Install units individually from the structure. Do not support from adjacent ductwork.

.3 Provide a minimum of four inlet diameters of straight duct at inlet of units.

3.2 PERFORMANCE

.1 Noise Criteria: The maximum discharge sound power levels measured immediately after the unit with attenuator shall not exceed the values noted below. These values are based on a 125 Pa pressure drop through the unit. Sound power levels are in db re 10-12 W.

Active Band Center Frequencies (#2)

250 500 1000 2000

.2 The differential static pressure of the unit shall not exceed 30 Pa with inlet velocities of 10 m/s or less. With an attenuator but with no other accessories, the static pressure across the assembly with a 10 m/s or less inlet velocity shall not exceed 110 Pa.

.3 Unit operation shall be independent of inlet static pressure. Flow, (within the adjustable range) shall not vary by more than 5% for inlet static pressures between minimum specified and 1500 Pa.

.4 Volume regulators shall be capable of maintaining minimum set flows within 5% at inlet velocities down to 3 m/s.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Diffusers.
.2 Grilles and Registers.
.3 Outside Louvers.
.4 Diffuser Boots.
.5 Roof Hoods.
.6 Goosenecks.

1.2 QUALITY ASSURANCE

.1 Air flow tests and sound level measurement shall be made in accordance with applicable ADC equipment test codes, ASHRAE Standards and AMCA Standards.

.2 Unit rating shall be approved by ADC and AMCA.

.3 Manufacturer shall certify catalogued performance and ensure correct application of air outlet types.

.4 Outside louvers shall bear AMCA seal for free area and water penetration.

1.3 JOB CONDITIONS

.1 Review requirements of outlets as to size, finish and type of mounting prior to submitting shop drawings and schedules of outlets.

.2 Positions indicated are approximate only. Check locations of outlets and make necessary adjustments in position to conform with Architectural features, symmetry and lighting arrangement.

1.4 SUBMITTALS

.1 Submit shop drawings with complete catalogue information, materials of construction, dimensions and accessories.

.2 Submit colour selection charts of finishes, for approval prior to fabrication.

.3 Comply with requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples.

Part 2 Products

2.1 ACCEPTABLEMANUFACTURES

.1 Diffusers: : Titus, Price, Nailor.
.2 Grilles and Registers : Titus, Price, Nailor.

.3	Security Grilles	:	Virtucom SCO, Chubb OP-20V, Simpson V-2, Eneround Security
.4	Outside Louvres	:	Aerolite, Westvent, Ruskin.
.5	Roof Hoods	:	Greenheck, Penn, Acme, Carnes, Jenn Air, Airolite, Loren Cook, Vent Air.
.6	Access Floor Diffuser	:	Trox (do not use plastic)

2.2 GENERAL

.1 Base air outlet application on space noise level of NC 30 maximum.

.2 Provide supply outlets with sponge rubber seal around the edge.

.3 Provide baffles to direct air away from walls, columns or other obstructions within the radius of diffuser operation.

.4 Provide plaster frame for diffusers located in plaster surfaces.

.5 Provide anti-smudge frames or plaques on diffusers located in rough textured surfaces such as acoustical plaster.

.6 Refer to Air Outlet Schedule for specifications of air outlets.

2.3 OUTSIDE LOUVERS

.1 Louvers 150 mm deep with blades on 40° slope with double drainable blade and drainable heavy channel frame, birdscreen with 15 mm square mesh. Equivalent to Ruskin ELF375DD.

.2 Fabricate of 2.0 mm extruded aluminum blades and frame.Where openings exceed 1800 mm in height, jamb frames shall be 2.0 mm. Provide welded assembly.

.3 Finish in factory prime coat finish. Colour shall be selected by the Architect.

.4 Fabricate louvered penthouses with mitered corners and sheet roof reinforced with structural angles.

2.4 ROOF HOODS

.1 Air inlet or exhaust hoods shall have removable hood, curb flange and birdscreen with 15 mm square mesh.

.2 Fabricate of aluminum minimum 1.6 mm base and 1.3 mm hood. Provide suitable reinforcing to hood. Louvers shall be storm proof.

.3 Mount unit on minimum 300 mm high curb base with insulation between duct and curb.

.4 Finish in factory prime coat finish.

.5 Hood outlet area shall be minimum twice throat area.

2.5 GOOSENECKS

.1 Fabricate goosenecks of minimum 1.3 mm galvanized steel.

.2 Mount on minimum 300 mm high curb base where size exceeds 225 mm x 225 mm.

Part 3 Execution

3.1 PRIMING

.1 Paint ductwork visible behind air outlets matte black.

3.2 SIZING

.1 Size outside air louvers as indicated on drawings.

.2 Size air outlets as indicated on drawings.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Panel filters.

1.2 QUALITY ASSURANCE

.1 Filters shall be product of and supplied by one manufacturer.

.2 Filter media shall be UL listed, Class I or Class II.

.3 Filter components assembled to form filter banks shall be products of same manufacturer.

.4 Filters shall be in accordance with ASHRAE Standard 52-76.

.5 Filters containing asbestos, urea formaldehyde or fibreglass shall not be acceptable.

1.3 ALTERNATIVES

.1 Size, media face area, material, test efficiency, initial and final air resistance of alternative manufacturers shall be as specified.

1.4 SUBMITTALS

.1 Comply with requirements of Section Shop Drawings, Product Data, and Samples.

2 Products

2.1 APPROVED EQUALS

.1 Panel Filters : Pacific, Cambridge, AAF, Viledon.

2.2 FRAMES

.1 Fabricate filter frames and supporting structures of galvanized steel or extruded aluminum with necessary gasketing between frames and walls. Provide holding frames 1.6 mm, "T" section construction, locking clips and provision for front mounted filters.

.2 Provide standard size frames to provide interchangeability of filter media of other manufacturers.

2.3 PANEL FILTERS

.1 Media: The air filter shall consist of a 3 ply panel filter element in a uniform non-woven structure. The filter shall be fabricated from variable denier fibres offering a graduated media with minimum loft of 40 mm and shall be progressively bonded with a fire retardant latex binder.

.2 The filter shall contain a non-migrating tackifier impregnated between the second and third ply to prevent unloading of the tackifier downstream.

.3 Holding Frames: 1.3 mm minimum galvanized frame with expanded metal grid on leaving air side and steel rod grid on air entering side, hinged with pull and retaining handles.

.4 The filter shall be Class II listed UL.

.5 The filter shall have an average dust spot efficiency of 45% (ASHRAE 52-76) at 2.54 m/s maximum face velocity at a final resistance of 125 Pa.

3 Execution

3.1 INSTALLATION

.1 Construct and install filters to prevent passage of unfiltered air. Provide felt, rubber or neoprene gaskets.

.2 Do not operate fan system connected to filter banks until filters (temporary or permanent) are in place. Provide new filters at take-over by the Owner. Replace filters used during construction.

.3 Provide filter banks in arrangement shown with removal and access indicated.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Site fabricated breeching.

.2 Manufactured vents and chimney for atmospheric gas fired equipment.

.3 Manufactured chimneys for forced draft natural gas fired equipment.

1.2 QUALITY ASSURANCE

.1 Vents and Chimneys: Labelled by Underwriters' Laboratory of Canada.

1.3 DEFINITIONS

.1 Vent: enclosed passageway for conveying flue gases from the appliances to outdoors.

.2 Breeching: portion of vent from the appliance to the chimney.

.3 Chimney: primary vertical portion of vent.

.4 Draft: flow of air or combustion products or both, through an appliance and its venting system.

.5 Mechanical Draft: draft produced by a mechanical device such as a fan, blower, or aspirator which may supplement natural draft.

.6 Forced Draft: a mechanical draft produced by a device upstream of the combustion zone of an appliance.

.7 Induced Draft: a mechanical draft produced by a device downstream from the combustion zone of an appliance.

.8 Natural Draft: a draft other than mechanical draft.

1.4 QUALITY ASSURANCE

.1 Vents and accessories forming part of the venting system shall be ULC labelled.

1.5 SHOP DRAWINGS

.1 Comply with requirements of Section Shop Drawings, Product Data and Samples.

Part 2 Products

2.1 VENTS

.1 Type A: to CAN4-S604.

.1 Application: gas and liquid fuel fired appliances.
.2 Service Temperature: maximum flue gas temperature of 540°C.

.2 Type A-2 Vent: to CAN4-S629.

.1 Application: gas, liquid and solid fuel fired appliances.
.2 Service Temperature: maximum flue gas temperature of 650°C.

.3 Type B Vent: to CAN4-S605.

.1 Application: gas fired appliances certified with draft hoods or diverters.
.2 Service Temperature: maximum flue gas temperature of 243°C.

2.2 BREECHING

.1 Breeching Type 1: for natural draft, gas burning appliances with draft hoods, use one of the following:

.1 Galvanized steel with thicknesses as follows:
.2

Vent Diameter	Min.
Smaller than 125 mm	0.4 mm
125 mm to 200 mm	0.5 mm
Larger than 200 mm	0.6 mm

.3 Breeching constructed of same vent components as chimney.

.2 Breeching Type 2: for forced, induced, or natural draft with dilution, gas or liquid fuel fired appliances, use one of the following:

.1 Mild steel, all welded construction with thicknesses as follows: Use Type 316 welded stainless steel or AL29-4C stainless steel for condensing boilers

Vent Diameter	Min. Thickness
300 mm and smaller	1.3 mm
325 mm to 600 mm	1.6 mm
625 mm to 900 mm	2.0 mm
925 mm and larger	3.0 mm

.2 Breeching constructed of same vent components as chimney.

2.3 ACCESSORIES

.1 Cleanouts: bolted, gasketted type, full size of breeching area.

.2 Barometric Damper: double acting sized to 70% of full size of breeching area.

.3 Breeching Damper: motor operated damper 3.5 mm thick steel, ball bearings on full length shaft, 80% maximum closure.

.4 Appurtenances: raincap, thimbles, support brackets and guys, flashing and counter flashings, fly ash screen, and other materials required to complete the assembly.

Part 3 Execution

3.1 VENT INSTALLATION

.1 Install vents, complete with accessories and appurtenances, in accordance with CAN1- B149.1 and manufacturer's instructions and as follows:

.1 Type A: to CAN4-S604.
.2 Type A-2: to CAN4-S629.
.3 Type B: to CAN4-S605.

.2 Do not penetrate flue gas chamber of vent with screws or mechanical fasteners.

.3 Install breeching with positive slope upward from appliance.

.4 Suspend breeching using trapeze hangers at 1500 mm centers.

.5 Install cleanout at base of chimney.

.6 Provide properly sized barometric damper as required.

.7 Provide breeching damper as indicated on drawings.

.8 Support chimney at bottom, roof and intermediate levels.

.9 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney.

.10 Install raincap on chimney outlet.

.11 Install counterflashing where chimneys pass through roof.

.12 Provide for expansion and contraction of chimney and breeching.

END OF SECTION

Part 1 GENERAL

1.1 Scope

.1 Boilers.
.2 Controls and boiler trim c/w control panel.
.3 Hot water connections.
.4 Fuel connection.
.5 Electrical hook-up.
.6 Combustion air intake and chimney connection.
.7 Condensate neutralization c/w tank and drainage.

1.2 QUALITY ASSURANCE

.1 Comply with Provincial Regulations and have CSA and CGA approval.

.2 Units shall be approved and labeled by Underwriters' Laboratories.

1.3 START-UP

.1 Provide start-up service and provide written report from the boiler manufacturers certified technician, make adjustments and efficiency tests, and instruct operators.

.2 Provide maintenance and operating instructions to Owner's designated representatives.

Part 2 Products

2.1 BOILER

.1 The hot water heating boilers shall be high-efficiency gas-fired condensing boilers. The energy savings from the flue gas condensation collection shall be extracted using a corrosion-resistant stainless steel heat exchanger. The non-fin heat exchanger surfaces shall be generously designed with wide water passageways in between plates, and a large water volume on the pressure vessel side to enhance heat transfer.
.

.2 Boiler shall utilize a modulating power burner, with a turn-down ratio of 1:10 and positive pressure discharge.

.3 Unit shall have ASME approved relief valve with a setting of 60 PSIG.

.4 The boiler shall be capable of operating without a flow switch and no additional safety devices shall be required to safeguard against low flow conditions.

2.2 BOILER DESIGN

.1 Boiler shall be a compact, single-pass, vertical down-fired Firetube type, with stainless steel tubes and tube sheets. The boiler pressure vessel shall be completely insulated with a minimum of 2" of insulation and shall be encased in an 18 gauge metal cabinet with powder coated finish. To prevent installation damage, the casing shall be packaged

separately and shall ship loose for field installation by the manufacturer's service representative.

.2 The tubes shall be 316Ti Stainless Steel and shall be fitted with Aluminum internal heat transfer fins creating no less than 10 square feet of fireside heating surface per boiler horsepower.

.3 The Vessel shall be mounted on a structural steel stand with exhaust gasses collected in a polymer drain collection box complete with drain fitting for draining condensation from the products of combustion. A condensate neutralizing box complete with limestone granules shall be shipped loose for field installation by contractor. Note: A condensate trap assembly shall be furnished if a condensate collection tray is not provided due to operating conditions.

.4 The top tubesheet shall be fully accessible by lifting the burner assembly which shall come complete with lifting hinges and pneumatic lifters. The boiler shall have a built in hinged platform allowing the operator to access the tubesheet, burner, ignition assembly and flame rod without the use of a ladder.

.5 The vessel shall be fully insulated with a minimum of 2" of insulation, guaranteeing external convection and radiation heat losses to the boiler room from the boiler shall be less than 0.5% of the rated input.

.6 The condensing capability shall allow the boiler to be operated without the use of a 3- way valve for the boiler supply water temperature reset. No minimum boiler return water temperature or secondary pump or minimum flow rate shall be required.

.7 Each boiler shall be constructed in accordance with the A.S.M.E. Section IV Code and bear the "H" stamp and shall be manufactured within an ISO 9001 Certified facility to ensure high quality standards.

.8 The boiler shall be designed for top rear water outlet and bottom rear water inlet; the water inlet [return] shall be equipped with internal baffling. The maximum pressure drop through the boiler shall not exceed 0.45 psi with a 20-degree differential and less than 0.05 psi with a 60-degree differential.

.9 A threaded air vent connection shall be furnished at the top rear of the boiler for field piping to an expansion tank or for the addition of an auto-vent valve when a bladder type expansion tank is utilized.

.10 To drain the boiler, a bottom-threaded connection shall be provided at the front of the boiler and field piped by the installing contractor with a manual full size shutoff valve to drain.

2.4 BURNER DESIGN

.1 General: Forced draft burner mounted in and integral with the boiler hinged top door so when the door is opened the burner head, furnace, tubesheet, and tubes are exposed. The burner door shall utilize easy removable threaded handles, and the burner shall swing upward on hydraulic piston arms, one on each side to provide open support of the burner assembly.

.2 A drop down hinged service platform shall be furnished to provide service personnel an easy means of accessing the burner and controls for service and maintenance. When out of use, this platform shall fold up beneath the front service boiler panel.

.3 The burner shall be of the Unitized Venturi, Gas Valve, Blower, and burner head design. This pre-mix design shall utilize a variable speed fan connected to a venturi to simultaneously modulate fuel and air for a minimum a 5:1 turndown ratio. The venturi design shall also act as a method for compensating for changes in barometric pressure, temperature and humidity so the excess air levels are not adversely affected by changes in atmospheric conditions. External linkages, damper motor drives and single speed fans shall not be acceptable.

.4 Burner head shall be constructed of a Fecralloy-metal fiber for solid body radiation of the burner flame. Combustion shall take place on the surface of the burner mantle, which shall be constructed of a woven fecralloy material creating a 360 degree low temperature radiant flame.

.5 Emissions: The boiler(s) burner shall be guaranteed to limit NOx emissions to 12 PPM or less (corrected to 3% oxygen), as certified by an independent testing lab. NOx emissions shall be at full operating conditions. Proof of such certification shall be made available to the engineer and purchaser. External flue gas recirculation shall not be accepted for emission control.

.6 Gas Train - As a minimum, the gas train shall meet the requirements of CSA and ASME CSD-1 and shall include:

.1 Low Gas Pressure Interlock, manual reset.
.2 High Gas Pressure Interlock, manual reset.
.3 Upstream and downstream manual test cocks.
.4 Ball Type manual shutoff valve upstream of the main gas valve.
.5 Unibody double safety gas valve assembly.
.6 Gas Pressure Regulator
.7 Union connection to permit burner servicing.

.7 Combustion Air Proving Switch shall be furnished to ensure sufficient combustion airflow is present for burner firing.

.8 To ensure that proper draft is not blocked in the stack, the burner shall include a High Air Pressure Switch sensing the outlet pressure connection relative to stack back draft.

2.5 BOILER TRIM

.1 Safety valve(s) shall be ASME Section IV approved side outlet type mounted on the boiler water outlet. Size shall be in accordance with code requirements and set to open at 60 psig.

.2 Temperature and pressure gauge shall be mounted on the water outlet.

.3 Solid State Low water cut-off probe with manual reset and test switch.

.4 Outlet water supply sensing probe for operating water limit setpoint.

.5 Return water-sensing probe for operating water limit setpoint.

2.6 BOILER CONTROLS

.1 The Boiler shall include a Computerized Boiler Burner control which shall be an integrated, solid state digital micro-processing modulating device, complete with sequence indication, fault reset, mode selection, and parameter set-point switches. It shall be mounted at the front of the boiler panel for easy access and viewing.

.2 Controller shall provide for both flame safeguard and boiler control and shall perform the following functions:

.1 Burner sequencing with safe start check, pre-purge, Electronic direct spark ignition, and post purge. Flame rod to prove combustion.

.2 Flame Supervision - the control shall provide pre-purge and post-purge and shall maintain a running history of operating hours, number of cycles, and the most recent faults. The control shall be connected to a touchscreen display module that will retrieve this information.

.3 Safety Shutdown with display of error.

.4 Modulating control of the variable speed fan for fuel/air input relative to load requirements.

.5 High Limit temperature control.

.6 Gas pressure supervision, high and low.

.7 Combustion Air Proving Supervision.

.8 High Air Pressure (back draft too high) Supervision.

.9 Display of supply temperature and set-point temperature shall be accessible via touchscreen. Output shall be continuous PID via 4 -20 mA current.

.10 Controller shall have an option for communication device to a laptop computer interface service and troubleshooting.

.3 All parameter input control set-points shall be factory downloaded with jobsite conditions programmed at the time of initial jobsite operation.

.4 All controls to be panel mounted and so located on the boiler as to provide ease of servicing the boiler without disturbing the controls and also located to prevent possible damage by water according to CSA requirements.

.5 Electrical power supply shall be 120 volts, 60 Hertz, single phase for the fan motor and 120 volts, 60 Hertz, single phase for the control circuit.

.6 Boiler is to be provided with a BACnet card. All controls points indicated in Points Schedule and Control Sequences to be available to EMCS via BACnet card. (Revised by Addendum M1)

2.7 BOILER FLUE VENTING

.1 The Boiler shall be CSA certified as an indirect or direct vent boiler. Venting shall be accomplished with a catagory IV vent piping installed in accordance with applicable national and local codes.

.2 For direct venting, the boiler shall have the combustion air intake supply ducted with PVC pipe from the outside. Vibration isolation components are not required.

2.8 MANUFACTURER'S FIELD SERVICES

.1 General: The boiler supplier's factory authorized service organization shall be responsible for performance of inspections, start up and testing of the package boiler, and accessory equipment and materials furnished under this Section. A detailed written record of the start up performance, including burner setting data over the entire load range shall be furnished to the engineer before final acceptance. All labor, equipment, and test apparatus shall be furnished by the authorized service organization. All equipment defects discovered by the tests shall be rectified either by the service organization or boiler manufacturer.

.2 Equipment inspection: Boiler representative to provide one (1) day of jobsite assistance to inspect boilers and other equipment upon arrival, verifying completeness of equipment supplied and potential damages. All shipped loose components, such as casing, to be mounted on boiler by boiler provider after contractor has set boiler in building.

.3 Pre start-up walk through: Boiler representative shall spend one (1) day at jobsite reviewing installation with mechanical contractor to be conducted approximately 1 week prior to startup.

.4 Start-up shall be conducted by experienced and factory authorized technician in the regular employment of the authorized service organization, and shall include:

.1 Demonstrate that boiler, burner, controls, and accessories comply with requirements of this Section as proposed by the boiler and accessories supplier. Pre-test all items prior to scheduling the final testing that will be witnessed by the test engineer.

.2 Readings at different firing rates (20, 50, 75 and 100%) of load for the modulating burner shall be taken with a written report of the tests submitted to the engineer. The reports shall include readings for each firing rate tested and include stack temperatures, O2, CO, NOx, and overall boiler efficiency.

.3 Auxiliary Equipment and Accessories: Observe and check all valves, draft fans, electric motors and other accessories and appurtenant equipment during the operational and capacity tests for leakage, malfunctioning, defects, and non compliance with referenced standards or overloading as applicable.

.4 Commissioning Requirements:

.1 Fireside inspection
.2 Set up fuel train and combustion air system
.3 Set up operating set points

.4 Check all safeties, including Flame safeguard, LWCO, Airflow, Fuel pressures, High limits.
.5 Set up and verify efficiencies at 20%, 50%, 75%, and 100%
.6 Set up and verify burner turndown.

.5 Training to include all safety procedures, maintenance procedures, control operations, and diagnostic procedures. Training to be provided in a single one (1) day continuous session to accommodate operator's availability on site.

2.9 WARRANTY DATA

.1 The pressure vessel shall be guaranteed against thermal shock for 20 years when utilized in a closed loop hydronic heating system with a temperature differential of 170 °F or less. The boiler pressure vessel shall be guaranteed accordingly without a minimum flow rate or return water temperature requirement. The boiler shall not require the use of flow switches or other devices to ensure minimum flow.

.2 The pressure vessel, tubes and tube sheets (heat exchanger) shall be guaranteed against flue gas corrosion and materials/ workmanship for a period of 10 years. The condensate collection box shall be guaranteed for 20 years.

.3 All parts not covered by the above warranties shall carry a 1 year warranty from startup, or 18 months from shipment, whichever occurs first. This shall include all electrical components and burner components.

Part 3 Execution

3.1 GENERAL

.1 Installation shall be provided by the contractor in accordance with the requirements of the codes specified hereinbefore. All of the contractor's work shall be performed by experienced personnel previously engaged in boiler plant construction and shall be under the supervision of a qualified installation supervisor.

3.2 INSTALLATION

.1 Install equipment in strict compliance with manufacturer's installation instructions.

.2 Install equipment in strict compliance with state and local codes and applicable NFPA standards.

.3 Maintain manufacturer's recommended clearances around sides and over top of equipment.

.4 Install components that were removed from equipment for shipping purposes.

.5 Install components that were furnished loose with equipment for field installation.

.6 Provide all interconnecting electrical control and power wiring.

.7 Provide all fuel gas vent and service piping.

.8 Provide all piping for boiler pipe connections.

3.3 FIELD TESTING

.1 The manufacturer's representative shall test all boiler and burner interlocks, actuators, valves, controllers, gauges, thermometers, pilot lights, switches, etc. Any malfunctioning component shall be replaced.

.2 All adjustments to boiler, burner, and boiler control system shall be performed by the manufacturer's representative.

3.4 START-UP, INSTRUCTION AND WARRANTY SERVICE

.1 The manufacturer's representative shall provide start-up and instruction of each new boiler, including burner and boiler control system as specified herein. Start-up and instruction shall cover all components assembled and furnished by the manufacturer whether or not of his own manufacture.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Indoor modular air-cooled scroll chillers.

1.2 REFERENCES

.1 Air-Conditioning and Refrigeration Institute (ARI)

.1 ARI 550/590, Standard for Water Chilling Packages Using the Vapor Compression Cycle.

.2 Canadian Standards Association (CSA International)

.1 CSA B52 Mechanical Refrigeration Code.

.3 Environment Canada, (EC)/Environmental Protection Services (EPS)

.1 EPS 1/RA/2, Environmental Code of Practice for Elimination of Fluorocarbons Emissions from Refrigeration and Air Conditioning Systems.

1.3 USE OF ENVIRONMENTALLY SAFE REFRIGERANTS

.1 Chiller shall use an environmentally safe refrigerant with an Ozone Depletion Factor (ODF) not exceeding 0.02. The reduction in cooling capacity shall not exceed 10%; and increase in energy consumption per unit of cooling shall not exceed 5%, when the chiller is filled with an environmentally safe refrigerant.

.2 The chiller manufacturer shall submit the following information with the tender:

.1 Name the refrigerant and its ODF value.

.2 Safety considerations for the use of the environmentally safe refrigerant.

.3 Name of substitute environmentally safe refrigerant and its ODF value.

.4 Expected decrease in cooling capacity and increase in energy consumption with the use of the proposed environmentally safe refrigerant.

.5 Compatibility information on the materials used in chiller construction with the environmentally safe refrigerant.

.6 Hardware changes required and the estimated cost of each change, at the time of refrigerant conversion. This cost shall include all necessary changes to make the chiller operational with the substitute refrigerant.

.7 Additional operational and maintenance requirements as a result of the use of substitute refrigerant.

1.4 SUBMITTALS

.1 Submit shop drawings for review.

.2 Shop drawings shall include the following product data:

.1 Manufacturer's printed product literature, datasheets, product characteristics, and performance criteria.

.2 Physical dimensions, weight, finish, required clearances, construction details, recommended installation and support, mounting bolt hole sizes and locations and point loads.

.3 Dimensioned plan and elevation view drawings and location of all field connections.

.4 Required equipment including but not limited to connections, piping and fittings, valves, strainers, control assemblies and ancillaries, identifying factory and field assembled.

.5 Summary of all auxiliary utility requirements, such as electricity, water, compressed air, etc. Summary shall indicate quality and quantity of each required utility.

.6 Single-line schematic drawing of the power field hookup requirements, indicating all items that are furnished.

.7 Schematic diagram of control system indicating points for field interface/connection.

.8 Diagram shall fully delineate field and factory wiring.

.9 Certification of factory-run test of chiller unit signed by company officer.

.10 Installation manuals.

.11 Type of refrigerant used.

.12 Part load power requirements performance data at 100%, 80%, 60%, 40%, 20% and 10% of the rated capacity.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in Division 1.

.2 Data to include:

.1 Description of equipment giving manufacturers name, model type and year, capacity and serial numbers.

.2 Details on operation, servicing and maintenance.

.3 Recommended spare parts list.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Provide spare parts as follows: NONE

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Division 1.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse and return of pallets, crates, and packaging materials in accordance with Division 1

.4 Chillers shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer.

.5 Comply with the manufacturer's instructions for rigging and handling equipment.

Part 2 Products

2.1 GENERAL

.1 Provide complete modular air-cooled scroll type chiller package including: scroll type compressors; evaporator; condenser, motor and motor starter; controls; control centre; piping; wiring; refrigeration and oil change; ready for connection to chilled water circuit, interlocks, and electric power source, installed in a powder coated heavy gauge steel enclosure with removable access panels finished to manufacturers standard.

.2 Modules are to connected together to form a modular chiller bank for connection to a single point power connection, chilled water return pipe, chilled water supply pipe, and controls connection.

.3 Chillers shall incorporate scroll type compressors and consist of multiple independent refrigerant circuits. Each refrigerant circuit shall consist of an individual compressor set, evaporator, thermal expansion valve, liquid line solenoid valve, filter drier, fin and tube condenser, insulated suction line, and control system. Each circuit shall be constructed to be independent of other circuits from a refrigeration and electrical stand-point. The multi-circuit chiller must be able to produce chilled water even in the event of a failure of one or more refrigerant circuits.

.4 Chiller manufacturer to supply 2 year parts and labour warranty from start-up date

.5 Chiller manufacturer to supply a minimum of two year service agreement including start-ups, season checks, and shutdowns from time of start-up

.6 Chiller Modules shall be ETL listed in accordance with UL Standard 1995, CSA certified per Standard C22.2#236, and bear the ASME UM stamp on all water-to-refrigerant heat exchangers.

.7 Modules shall ship wired and charged with refrigerant. All modules shall be factory run tested prior to shipment.

.8 Chilled Water Mains: Each module shall include supply and return mains for chilled water. Grooved or flanged end connections are provided for interconnection.

.9 Each refrigerant circuit shall include all refrigerant specialties including a properly sized refrigerant receiver to provide reliable operation down to 40°F Ambient.

.10 Modules shall have minimum 25mm flange connection on condenser fan outlet for ductwork connection.

.11 Modules shall be complete with internal chilled water isolation valves and a chilled control valve. The isolation valves shall be accessible from front panel to allow for isolation of an individual module. The control valve shall be controlled by the chiller controller to open when the chiller module is in operation and close when the chiller module is not in operation. Flow should bypass the chiller when dry-cooler units are in operation and chiller modules are not.

.12 Chiller modules to be factory painted to colour specified by architect.

2.2 CAPACITY

.1 Refer to product schedules.

2.3 COMPRESSORS

.1 Hermetic scroll design.

.2 Unloaded start with capacity modulation by continuous linear modulation of slide valve in response to load change.

.3 Compressor to include suction and discharge shut-off valves; oil sight glass; separate circuit crankcase heater; and cylinder unloading device.

.4 Provide nameplate to show capacity at design temperature, type of refrigerant used and total weight in system.

.5 Each refrigerant system to include high discharge pressure and low suction pressure safety cut-outs.

.6 Sound reduction as required to meet Product Schedule requirements.

2.4 COMPRESSOR MOTOR

.1 Hermetic type with overload protection and manual restart: 600 V.

.2 Mounted complete with vibration isolation within unit.

2.5 EVAPORATOR

.1 Brazed plate heat exchanger constructed of stainless steel.

.2 Designed, tested and stamped in accordance with ASME for 350 psig water side working pressure.

.3 The evaporator heat exchanger shall not be mounted above the compressor to prevent the effect of migration of refrigerant to the cold evaporator with consequent liquid slugging on start-up.

.4 Vent and drain connections shall be provide at the inlet and outlet chilled water piping by the installing contractor.

.5 The evaporator shall be insulated as per the chilled water piping insulation schedule.

2.6 CONDENSER

.1 Air cooled:

.1 Aluminum fins mechanically bonded to copper tube, pressure tested to 3.1 MPa.

.2 Condenser fans are to be direct drive, steel, aluminum, or plastic composite vane axial type fan, statically and dynamically balanced. Motor to be complete with overload protection, permanently lubricated ball bearings. Maximum RPM of 1150.

.3 Chiller modules are to be mounted indoors complete with ductwork connected to the condenser fan discharge. Fans to be rated for high static installation. Refer to product schedules.

.4 Condenser fan shall be pressure controlled based on compressor discharge pressure. The motors shall suitable for outdoor use and shall be capable of operating high static fans.

2.7 CONTROL CENTRE

.1 A centrally located weatherproof control panel shall contain the field power connection point, control interlock terminals, and control system (Master Controller). Power and starting components shall include factory circuit breaker of fan motors and control circuit, individual contactors for each fan motor, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and unit power terminal blocks for connection to remote disconnect switch.

.2 Scheduling of the various compressors shall be performed by a microprocessor based control system (Master Controller). A new lead compressor is selected every 24 hours to assure even distribution of compressor run time.

.3 The Master Controller shall monitor and report the following on each refrigeration system:

.1 Discharge Pressure Fault.

.2 Suction Pressure Fault.

.3 Compressor Winding Temperature.

.4 Suction Temperature.

.5 Evaporator Leaving Chilled Water Temp.

.4 The Master Controller shall monitor and report the following on each system:

.1 Entering Chiller Water Temperature.

.2 Leaving Chiller Water Temperature.

.3 Discharge Refrigerant Temperature.

.4 Chilled Water Flow.

.5 An out of tolerance indication from these controls or sensors shall cause a “fault” indication at the Master Controller and shutdown of that compressor with the transfer of load requirements to the next available compressor. In the case of a System Fault the entire chiller will be shut down. When a fault occurs, the Master Controller shall record conditions at the time of the fault and store the data for recall. This information shall be capable of being recalled through the keypad of the Master Controller and displayed on the Master Controller’s LCD. A history of faults shall be maintained including date and time of day of each fault (up to the last 20 occurrences).

.6 Individual monitoring of leaving chilled water temperatures from each refrigeration system shall be programmed to protect against freeze-up.

.7 The control system shall monitor entering and leaving chilled water temperatures to determine system load and select the number of compressor circuits required to operate.

Response times and set points shall be adjustable. The system shall provide for variable time between compressor sequencing and temperature sensing, so as to fine tune the chiller to different existing building conditions.

.8 The chiller master control system shall have external inputs and outputs to be compatible with the building automation system to include:

.1 Remote Start/Stop capability.

.2 Reset of Leaving Chilled Water Temperature.

.3 Cooling Alarm output.

.4 Evaporator pump minimum flow rate corresponding to the number of chiller modules in operation. A time delay between outputting to the building automation system the minimum flow and the start of an additional chiller module shall be in place to allow for the evaporator pump flow to ramp up.

.5 Flow switch.

.9 The building automation system BACnet protocol shall be supported by the chiller control system.

.10 The chiller safety controls shall be provided (minimum) as follows:

.1 Low evaporator refrigerant pressure.

.2 Loss of water flow through the evaporator.

.3 High condenser refrigerant pressure.

.4 High compressor motor temperature.

.5 Low suction gas temperature.

.6 Low leaving evaporator water temperature.

.7 Sensor failure.

.11 Failure of chiller to start or chiller shutdown due to any of the above safety cutouts shall be enunciated by display of the appropriate diagnostic description at the unit control panel. This annunciation will be in plain English. Alphanumeric codes shall be unacceptable. An alarm signal shall also be generated to the building automation system.

.12 The chiller shall be furnished with a Master Controller as an integral portion of the chiller control circuitry to provide the following functions:

.1 Provide automatic chiller shutdown during periods when the load level decreases below the normal operating requirements of the chiller. Upon an increase in load, the chiller shall automatically restart.

.2 Provisions for connection to automatically enable the chiller from a remote energy management system.

.3 The control panel shall provide alphanumeric display showing all system parameters in the English language with numeric data in English units.

.13 When chiller is enabled, the factory supplied Master Controller modulates the chiller capacity from minimum to maximum as required by building load. The Chiller control system shall respond to Entering Water Temperature and will have an integral reset

based on entering water temperature to provide for efficient operation at part-load conditions.

.14 The chiller control module shall be equipped with a BACNet communication card.

Part 3 Execution

3.1 INSTALLATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

.2 Coordinate electrical connections with electrical contractor.

.3 Coordinate controls with controls contractor.

.4 Install a field-supplied manufacturer approved strained in the chilled water return line at the evaporator inlet.

3.2 CLEANING

.1 Clean in accordance with Division 1.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Division 1.

.3 Prior to connecting the chiller to the building chilled water loop, the piping shall be flushed with a detergent and hot water (110-130° F) mixture to remove previously accumulated dirt and other organic residue. In old piping systems with heavy encrustation of inorganic materials consult a water treatment specialist for proper passivation and/or removal of these contaminants.

.4 During the flushing a manufacturer approved strainer shall be in place in the system piping and examined periodically as necessary to remove collected residue. The flushing process shall take no less than 6 hours or until the strainers, when examined after each flushing, are clean. Detergent and acid concentrations shall be used in strict accordance with the respective chemical manufacturers instructions. After flushing with the detergent and/or dilute acid concentrations the system loop shall be purged with clean water for at least one hour to ensure that all residual cleaning chemicals have been flushed out.

.5 Prior to operation, supply water for the chilled water circuit shall be analyzed and treated by a professional water treatment specialist who is familiar with the operating conditions and materials of construction specified for the chiller’s heat exchangers, headers and associated piping. Cycles of concentration shall be controlled such that recirculated water quality for modular chillers using 316 stainless steel brazed plate heat exchangers and carbon steel headers is maintained within the manufacturer parameters.

3.3 START-UP

.1 Provide appropriate protection apparatus.

.2 Ensure adequate clearances for servicing and maintenance.

.3 Manufacturer to approve installation, to supervise startup and to instruct operators. Include 2 days per unit.

.4 Confirm refrigerant charge supplied from factory.

.5 Contractor to install flow switch and temperature sensor (supplied by chiller manufacturer) in chilled water piping.

.6 Provide testing and starting of chillers and instruct Owner in its proper operation and maintenance.

.7 A leak test is to be conducted on the chiller prior to project completion. The owner shall provide a leak test tag which shall be completed by the contractor and affixed to the chiller.

3.4 EQUIPMENT SERVICE

.1 Manufacturer trained service technician and product representative to have field offices located in the Province of Alberta. Location of field offices to be indicated on product shop drawings.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Gas Association (AGA)

.2 American National Standards Institute/Air-Conditioning, Heating and Refrigeration Institute (ANSI/AHRI)

.1 ANSI/AHRI 210/240, Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

.2 ANSI/AHRI 270, Sound Rating of Outdoor Unitary Equipment.

.3 CSA Group

.1 CSA B52, Mechanical Refrigeration Code.

.2 CSA C22.1, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

.4 National Fire Protection Association (NFPA)

.1 NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.

.5 Underwriters Laboratories (UL)

.1 UL 1995, Standard for Heating and Cooling Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for outdoor HVAC equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Drawings to indicate project layout and dimensions; indicate:

.1 Equipment, piping, and connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware, and recommended ancillaries which are mounted, wired and piped ready for final connection to building system, its size and recommended bypass connections.

.2 Piping, valves, fitting shipped loose showing final location in assembly.

.3 Control equipment shipped loose, showing final location in assembly.

.4 Complete internal panel wiring and external wiring, both as schematics and as actually assembled.

.5 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads.

.6 Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices of ancillaries, accessories, controllers.

.7 Pump and fan performance curves.

.8 Details of vibration isolation.

.9 Estimate of sound levels to be expected across individual octave bands in dB referred to A rating.

.10 Type of refrigerant used.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.1 Submit manufacturer's field reports specified.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for [outdoor HVAC equipment] for incorporation into manual.

.1 Indicate: brief description of unit, indexed, with details of function, operation, control, and service for components.

.2 Provide for units, manufacturer's name, type, year, number of units, and capacity.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect outdoor HVAC equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: as specified in Construction Waste Management Plan.

1.5 WARRANTY

.1 For Work of this Section 23 74 00 - Packaged Outdoor HVAC Equipment, 12 months warranty period is extended to 60 months.

Part 2 Products

2.1 GENERAL

.1 Roof mounted, self-contained single zone unit with gas and bear label of CSA and ULC.

.2 Units to consist of cabinet and frame, supply fan, exhaust fan, gas heat exchanger, gas burner with integral induced draft fan, packaged controller, air filters, motorized outside air and exhaust dampers, energy recovery wheel.

.3 Prefabricated roof curb to conform to requirements of ARCA, minimum height 450 mm.

.4 Conform to ANSI/AHRI 210/240, rating for unit larger than 40 kW nominal.

.5

2.2 CABINET

.1 Cabinets: weatherproofing tested and certified to AGA rain test standards and soundproofing tested to AHRI 270, dbA at 10 m free field.

.2 Framing and supports: 2 mm thick welded steel, galvanized after manufacture, with lifting lugs at top of unit.

.3 Outer casing: weathertight 1.0mm thick galvanized steel with baked enamel finish, complete with flashing.

.4 Access: removable gasketted hinged doors with locking door handle type fasteners.

.5 Insulation: neoprene coated glass fiber on surfaces where conditioned air is handled, 50mm thick, 32 kg/m^3 density.

2.3 FANS

.1 Centrifugal, forward curved impellers, statically and dynamically balanced. Multi V-belt drive with adjustable variable pitch motor pulley, fan and motor integrally mounted on isolation base, separated from unit casing with flexible connections and spring isolators (rubber or spring) isolated hinge mounted motor. Vibration isolators: 95% efficiency.

2.4 AIR FILTERS

.1 As indicated.

2.5 HEAT EXCHANGERS AND BURNERS

.1 Gas fired, multiple flue passes, with primary heating surface of stainless steel, secondary heating surface, stainless steel tubes.

.1 Gas burner: factory mounted, wired and fire tested complete with operating and safety controls.

.2 Forced draft type.

.3 Spark ignited pilot with pilot flame safety shut-off.

2.6 CONTROLS

.1 In addition to combustion safety controls, provide low limit on supply, variable frequency control on supply and exhaust fans, and frost control. Fully BACnet compatible.

2.7 CAPACITY

.1 See drawings

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for outdoor HVAC equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Install as per manufacturers' instructions on roof curbs provided by manufacturer.

.2 Manufacturer to certify installation, supervise start-up and commission unit.

.3 Run drain line from unit into building to drain.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its product[s], and submit written reports, in acceptable format, to verify compliance of work with Contract.

.2 Provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.

.3 Schedule site visits to review work at stages listed:

.1 After delivery and storage of products, and when preparatory work on which work of this Section depends is complete, but before installation begins.

.2 Twice during progress of work at 25% and 60% complete.

.3 Upon completion of work, after cleaning is carried out.

.2 Obtain reports within 3 days of review and submit immediately to Consultant.

.3 Performance Verification:

.1 General:

.1 In accordance with Section - Cleaning and Start-up of Mechanical Piping Systems, supplemented as specified herein.

.2 Rooftop Air Handling Units:

.1 Set zone mixing dampers for full cooling, except that where diversity factor forms part of design set that percentage of zone dampers to full heating.

.2 Set outside air and return air dampers for minimum outside air.

.3 Set face and bypass dampers so face dampers are fully open and bypass dampers are fully closed.

.4 Check for smooth, vibration less correct rotation of supply fan impeller.

.5 Measure supply fan capacity.

.6 Adjust impeller speed as necessary and repeat measurement of fan capacity.

.7 Measure pressure drop each component of air handling unit.

.8 Set outside air and return air dampers for the percentage of outside air required by design and repeat measurements of fan capacity.

.9 Reduce differences between fan capacity at minimum and maximum outside air less than 5%.

.10 Set face and bypass dampers to full bypass and repeat measurement of fan capacity.

.11 Reduce difference between fan capacity with F BPD fully closed to bypass and fully open to bypass to less than 5%.

.12 Reduce difference between fan capacity at full cooling and fan capacity at full heating to less than 5%.

.13 OAD: verify for proper stroking, interlock with RAD.

.14 Measure DBT, WBT of SA, RA, EA.

.15 Measure air cooled condenser discharge DBT.

.16 Measure flow rates (minimum and maximum) of SA, RA, EA, relief air.

.17 Simulate maximum cooling load and measure refrigerant hot gas and suction temperatures and pressures.

.18 Use smoke test to verify no short-circuiting of EA, relief air to outside air intake or to condenser intake.

.19 Simulate maximum heating load and:

.1 Verify temperature rise across heat exchanger.

.2 Perform flue gas analysis. Adjust for peak efficiency.

.3 Verify combustion air flow to heat exchanger.

.4 Simulate minimum heating load and repeat measurements.

.20 Measure radiated and discharge sound power levels under maximum heating demand and under maximum cooling demand with compressors running.

.21 Verify operating control strategies, including:

.1 Heat exchanger operating and high limit.

.2 Early morning warm-up cycle.

.3 Freeze protection.

.4 Economizer cycle operation, temperature of change-over.

.5 Alarms.

.6 Voltage drop across thermostat wiring.

.7 Operation of remote panel including pilot lights, failure modes.

.22 Set zone mixing dampers for full heating and repeat measurements.

.23 Measure leakage past zone mixing dampers by taking temperature measurements. Reduce leakage to less than 5%.

.24 Measure return fan capacity.

.25 Adjust impeller speed as necessary and repeat measurement of return fan capacity.

.26 Check capacity of heating unit.

.27 Refer to other sections of these specifications for PV procedures for other components.

.3 Start-Up:

.1 General: in accordance with Section - Cleaning and Start-up of Mechanical Piping Systems.

.4 Verify accessibility, serviceability of components including motorized dampers, filters coils, fans, motors, operators, humidifiers, sensors, electrical disconnects.

.5 Verify accessibility, clean ability, drainage of drain pans for coils, humidifiers.

.4 Commissioning Reports:

.1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: reports supplemented as specified herein. Include:

.1 Report forms as specified Section 01 91 13 - General Commissioning (Cx) Requirements: Report Forms and Schematics.

3.4 DEMONSTRATION

.1 Training: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O M Personnel, supplemented as specified.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Perform cleaning operations in accordance with manufacturer's recommendations.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Unitary air conditioner package

.2 Charge of refrigerant and coil

.3 Controls and control panel.

.4 Air filters.

1.2 QUALITY ASSURANCE

.1 Provide factory assembled, package type unitary air conditioning unit, product of manufacturer regularly engaged in production of unit of type and size specified, who issues complete catalogue data on such products.

.2 Manufacturer shall be responsible for selection and operation of components furnished by him. Provide written certification that components not furnished by him have been selected in accordance with his requirements.

1.3 SUBMITTALS

.1 Show on shop drawings equipment, piping and connections, valves, strainers, thermostatic valves required for complete system.

1.4 START-UP

.1 Supply initial charge of refrigerant and oil.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Liebert, Trane, Climateworx, Mitsubishi

2.2 TYPE

.1 Provide self-contained, packaged, factory assembled, prewired unit, consisting of cabinet, compressor, condensing coil, evaporator fan, evaporator coil, discharge plenum, filters and controls.

2.3 CABINET

.1 Fabricate of heavy gauge galvanized steel with baked enamel finish, easily removed access doors or panels with quick fasteners. Insulate cabinet interior with minimum 15 mm thick rigid glass fiber. Provide drain pan with bituminous coating.

2.4 COMPRESSOR

.1 Provide hermetic compressor, 3600 rpm maximum, resiliently mounted with positive lubrication and inherent motor protection.

2.5 CONDENSER

.1 Provide co-axial, tube within a shell, water cooled refrigerant condenser with finned copper inner tube and steel outer shell.

.2 Provide water regulating valve and stubbed off piping inside cabinet for easy external connections.

2.6 EVAPORATOR FAN

.1 Provide double width, double inlet, belt drive, forward curved centrifugal fan, statically and dynamically balanced, with permanently lubricated ball bearings.

.2 Provide variable pitch belt drive.

2.7 EVAPORATOR COIL

.1 Provide direct expansion type cooling coil with seamless copper tubes and aluminum fins.

.2 Refrigerant circuit shall incorporate thermal expansion valve, filter-drier, and charging valves.

2.8 AIR FILTERS

.1 Provide easily removed flat filters with 50 mm thick disposable fibreglass media

2.9 CONTROLS

.1 Factory wired controls shall include high/low pressure cutouts, internal winding thermostat for compressor, control circuit transformer, non-cycling reset relay, temperature controller, fan-off-cool switch.

Part 3 Execution

3.1 INSTALLATION

.1 Provide shut-off valves in condenser water inlet and outlet piping.

3.2 PERFORMANCE

.1 Refer to Equipment Schedules

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Water coils.

.2 Glycol coils.

.3 Coil installation.

.4 Coil piping and accessories.

1.2 QUALITY ASSURANCE

.1 Coils shall be the product of manufacturer regularly engaged in production of coils who issues complete catalogue data on such products.

.2 Coil capacities, pressure drops, and selection procedures shall be certified in accordance with ARI Standards and bear ARI seal.

1.3 SUBMITTALs

.1 Shop drawings shall include dimensions, materials of construction and performance data to match specifications.

.2 Submit coil selection sheets or computer calculations with shop drawings.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Trane, Engineered Air, McQuay, Heat Craft.

2.2 GENERAL

.1 Provide extended surface type coils with tubes of copper or brass, and plate or helical type fins of copper or aluminum.

.2 Space fins 14 per 25 mm maximum. Helical fins may be crimped.

.3 Mount coil section in galvanized steel casing designed for bolting to other sections of ductwork.

2.3 WATER AND GLYCOL HEATING COILS

.1 Design for maximum operating limits of 1380 kPa and 104°C.

.2 Coil headers shall be cast iron, copper tube or steel pipe.

.3 Face length shall not exceed 3 m.

2.4 COOLING COILS

.1 Design for maximum operating limits of 1380 kPa at 104°C.

.2 Face length shall not exceed 3 m per section.

.3 Provide moisture eliminator of 0.70 mm galvanized steel where air velocity exceeds

.4 2.5 m/s.

.5 Provide drip pan and drain connection for each field assembled coil section.

.6 Coil headers shall be cast iron, copper tube or steel pipe.

.7 Refrigerant coils shall be serpentine type with brass or copper header arranged to prevent trappings of oil and to distribute liquid refrigerant to circuits. Silver soldered or brazed joints. Maximum operating pressure 1722 kPa.

Part 3 Execution

3.1 INSTALLATION

.1 Support coil sections on steel channel or double angle frames and secure to casings. Arrange supports for cooling coils so they do not pierce or short circuit drip pans. Level serpentine coils and install drainable tube coils with pitch within casing. Arrange galvanized steel casings for bolting to other section, ductwork or unit casings. Provide airtight seal between coils and duct or unit cabinets.

.2 Make necessary connections to coils, including valves, air vents, unions and connections from drip pans. Provide gate valve on supply line and eccentric plug valve on return line to each water coil.

.3 Locate water supply at bottom of supply header and return water connection at top to provide self-venting and reverse return arrangement. Provide manual air vents at high points complete with stop valve. Ensure water coils are drainable and provide drain connection at low points.

.4 Protect coils so fins and flanges are not damaged. Replace loose and damaged fins. Comb out bent fins unless required to be replaced.

.5 Install steam coils with 2% pitch.

.6 Provide vacuum breakers on supply to steam coils.

.7 If turn over occurs during winter months, turn over systems to the owners with all chilled water cooling coils drained and valved off from the system.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Wall fin radiation

.2 Related accessories and specialties

1.2 QUALITY ASSURANCE

.1 Terminal heat transfer units shall be product of manufacturer regularly engaged in production of such units who issues complete catalogue date on such products.

1.3 SUBMITTALS

.1 Submit, in addition to shop drawings, schedules of radiation heating elements and enclosure indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers and a comparison of specified heat required to actual heat output provided.

.2 Comply with the requirements of Section Shop Drawings, Product Data and Submittals.

1.4 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 Hydronic Specialties – Hot Water Section 23 21 30

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Trane, Engineered Air, Rosemex.

2.2 GENERAL

.1 Factory apply baked primer coat on metal surfaces of enclosure or cabinet of all wall fin.

2.3 WALL FIN RADIATION

.1 Heating Elements: 30 mm seamless copper tubing, 1 mm minimum wall thickness, mechanically expanded into evenly spaced aluminum fins, suitable for sweat fittings.

.2 Element Hangers: Quiet operating, ball bearings cradle type providing unrestricted longitudinal movement, on enclosure brackets.

.3 Enclosures: 1.3 mm steel up to 450 mm in height, 1.6mm steel over 450 mm in height complete with easily jointed components for wall to wall installation. Support rigidly, top and bottom, on wall mounted brackets at 900 mm centers maximum.

.4 Provide access door at each shut-off, control valve and balancing valve. Access door shall be 150 mm x 175 mm, integral with cabinet.

Part 3 Execution

3.1 INSTALLATION

.1 Provide each terminal heat transfer unit with shut-off valve on supply and lockshield balancing valve on return piping.

.2 Provide each unit at high points with easily accessible manual air vent. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing.

3.2 PERFORMANCE

.1 Refer to Schedules.

.2 Radiation capacities are based on 18°C entering air temperature, 55°C average water temperature with a 11°C temp. drop.

END OF SECTION

1. General

1.1 SECTION INCLUDES

.1 Cabinet unit heaters / Force flow heaters.

.2 Unit heaters

1.2 SUBMITTALS

.1 Submit shop drawings for review.

1.3 QUALITY ASSURANCE

.1 Terminal heat transfer units shall be product of manufacturer regularly engaged in production of such units who issues complete catalogue data on such products.

2. Products

2.1 CABINET UNIT HEATERS / FORCE FLOW HEATERS

.1 Cabinet: 16 gauge steel with rounded exposed corners and edges, easily removed panels, glass fibre insulation, integral air outlet and inlet grilles. Finish exposed surfaces in baked enamel of approved colour.

.2 Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes, designed for maximum operating limits of 1,380 kPa.

.3 Fans: Centrifugal forward curved double width wheels, statically and dynamically balanced, direct driven, on sleeve bearings resiliently mounted.

.4 Filters: removable 25 mm thick fibrous glass throwaway or permanent washable type.

2.2 UNIT HEATERS

.1 Casing: 18 gauge steel with threaded connections for hanger rods.

.2 Coils: Seamless copper tubing, 0.6 mm minimum wall thickness, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

.3 Fan: Direct drive propeller type, statically and dynamically balanced. Horizontal models complete with sleeve bearings and fan guard. Vertical model complete with grease lubricated ball bearings.

.4 Air Outlet: Adjustable pattern diffuser on projection models and four way louvers on horizontal throw models.

3. Execution

3.1 INSTALLATION

.1 Provide each terminal heat transfer unit with shut-off valve on supply and lockshield balancing valve on return piping.

.2 Provide each unit at high points with easily accessible manual air vent. If not easily accessible, extend vent to exterior surface of cabinet for each servicing.

.3 Grade piping to allow for air elimination

3.2 PERFORMANCE

.1 Refer to drawings - Mechanical Equipment Schedules.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Horizontal cabinet fan coil units. Cabinet shall provide full access to internal components from the side of the cabinet for underfoot installations and side of the cabinet for ceiling installations. Two pipe single coil or four pipe dual coil type as specified.

.2 Vibration isolation.

.3 Controls.

.4 Shop drawings.

1.2 QUALITY ASSURANCE

.1 Each unit shall be CSA approved and labelled.

.2 Insulation and adhesive shall meet NFPA-90A requirements for flame spread and smoke generation.

.3 Radiated sound level from each until (measured at the unit without ceiling tiles or floor panels between the measurement device and the fan coil) shall not exceed the levels indicated as follows:

Frequency [Hz] Octave Sound	Pressure Level [dBa]
30	75
60	75
120	75
250	65
500	65
1000	60
2000	60
4000	55
8000	50

Part 2 Products

2.1 EQUIPMENT

.1 Factory assembled and tested, blow through type fan coil unit for ducted installation in the ceiling space or floor access space as specified. Unit shall be complete with heating water and chilled water coils, direct drive centrifugal fan, internal motor, drain pan, and filters

.2 Fan coil units shall be complete with multi- speed controller accessible from the side of the unit. The speed adjustment shall be done manually through a knob.

.3 For ceiling hung units provide and install vibration isolators, suitable for installing suspended from the structure. Suspension equipment is to be complete with levelers to ensure balanced installation.

.4 Access floor fan coils shall be mounted on vibration isolators. Isolators shall be mounted beside the fan coil cabinet to allow the unit to sit as close to the floor as possible.

.5 Condensate pans to be extended under the cooling coil connections and to have 16mm copper fittings. Ensure that pans are sealed against leakage from the cabinet. Pan to be lined with rubber insulation for sweat proof operation and corrosion resistance. Pan to be rated to be within a air plenum space.

.6 Provide condensate drains to the nearest floor drain (gravity) and empty indirectly into floor drain.

.7 Cooling and/or heating coils are to be designed for a maximum face velocity of 1.8 L/s (

.8 350 fpm) and mounted integral to the fan coil unit. The mounting of loose coils will not be accepted. Coil penetrations of the fan coil cabinet are to be sealed with rubber grommets. Coils are to be factory tested before shipping to site.

.9 Units to be air flow and sound tested prior to shipping.

2.2 UNIT CABINET

.1 Cabinet shall be constructed of 16 gauge galvanized steel or better.

.2 Interior surfaces of cabinet panels shall be lined with 25 mm thick elastomeric closed cell thermal/acoustical insulation. Seal all edges of insulation.

.3 Supply and return duct connections to be complete with flexible duct connections.

.4 Cabinet shall have access panels to allow access to internal components. Floor units shall have panels on the sides. Ceiling units shall have panels on the sides. Panel fasteners are to be stainless steel and panel contact with cabinet is to be lined to maintain air seal and prevent vibrational noise generation.

.5 Drain pan shall be constructed of 18 gauge galvanized steel, extending under the full length and width of the coils and pitched for positive drainage. The inside and outside of the pan shall be fully coated with a fire-retardant, closed-cell foam insulation.

.6 25mm disposable filters shall be furnished and installed in the unit. Filters shall be replaceable from the side of the unit for all ceiling mounted units. Filters are to be no larger than 750mm in any one dimension. Multiple filters are acceptable complete with a filter pull system to allow for filter maintenance from one side only/

.7 Exterior surfaces shall be factory painted.

2.3 FANS

.1 Fans shall be DIDW forward curved direct drive type, constructed of galvanized steel. Units shall have heavy-duty, 14-gauge fan board.

.2 Fan motors shall be ECM motors.

.3 Fan wheels shall be double-width type with forward-curved blades and shall be statically and dynamically balanced.

.4 Fan to be sized to deliver 120% of the specified airflow performance.

.5 All motors shall be 1-phase open drip-proof type, resiliently mounted, incorporating sleeve bearings and automatic reset internal overloads.

.6 For all fancoil units, provide 3-speed manual switch to vary the speed of the motor.

2.4 CONTROL

.1 Fan coil to receive start-stop signal from BAS system through a contactor switching the power to the fan coil motor. Fan coil units to be controlled via the EMCS system. EMCS contractor to provide fan coil controller. (Revised by Addendum M1)

.2 Refer to sequence of operations and points list in controls section for other controls requirements.

Part 3 Execution

.1 A mock-up installation for each type of fan-coil will be required. One mock-up per type. The installation will be reviewed by the consultant and owner to determine suitability. Any changes to the installation deemed to be required will be incorporated into the final installation of all fan-coil units at no additional cost to the owner.

.2 Install drain line fabricated from type L copper tube. Slope drain away from unit and insulate.

.3 Install isolation valves in coil piping in accordance with valve manufacturer's instructions. Be sure valves are in proper operating position and are easily accessible for adjustment. Provide flow balancing valves on coil return pipes.

.4 Install ceiling mounted units on spring vibration isolators.

.5 Supports, piping, conduit, etc. shall allow for proper access to access panels, filters, etc.

.6 Install vibration isolation & flex connections on all ducts and pipes connected to the fan coil unit.

.7 This Contractor is to ensure that the cabinet or components of the fan coil unit do not make rigid contact with any architectural, structural, electrical, or mechanical components of the building.

.8 Provide in the O&M manual, an 11x17 sized record drawing of the fan coil installation plan overlain on the reflected ceiling plan or access floor grid. This drawing will illustrate the location of the ceiling or floor panels that can be removed for easiest access to fan coil unit for servicing.

.9 Contractor to inform consultant & owner of plans for final filter change one week prior to execution. Consultant & owner may choose to use this opportunity to perform fan coil portion of final inspection.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Dry steam humidifier with distribution manifold

.2 Controls connections

.3 Steam and condensate connections

.4 Duct mounting.

1.2 QUALITY ASSURANCE

.1 Units shall be products of manufacturer regularly engaged in production of such units who issues complete catalogue data on such products and who can provide local service personnel.

1.3 GENERAL REQUIREMENTS

.1 Factory assembles units prior to shipment.

1.4 SUBMITTALS

.1 Submit shop drawings for review.

Part 2 Products

2.1 GENERAL

.1 Humidifiers shall be suitable for electronic modulating control. Controller to be BACnet compatible

.2 Humidifier shall be steam separator type providing full separation ahead of integral steam jacketed control valve which discharge through internal steam jacketed drying and silencing chambers and a steam jacketed distribution manifold.

.3 Humidifier shall receive steam at supply pressure and discharge at atmospheric pressure.

2.2 STEAM SEPARATOR

.1 Separating chamber shall disengage and remove water droplets and particulate matter larger than 3 microns when humidifier is operating at maximum capacity.

.2 Integral metering valve shall be steam jacketed parabolic plug, capable of modulating flow of steam over entire stroke of operator.

.3 Internal drying and silencing chamber shall receive steam at atmospheric pressure and be jacketed by steam at supply pressure. Silencing chamber shall utilize stainless steel silencing medium.

2.3 DISTRIBUTION MANIFOLD

.1 The distribution manifold shall provide uniform distribution over entire length and be jacketed by steam at supply pressure.

2.4 CONTROLS

.1 Supply units with integral electronic operator.

.2 Equip with interlocked temperature switch to prevent humidifier from operating before start-up condensate is drained.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Furnish with inlet strainers and external inverted bucket steam trap.

.2 Provide galvanized steel rods to support distribution manifolds in air plenums.

3.2 PERFORMANCE

.1 Refer to Equipment Schedules.

END OF SECTION

Part 1 General

1.1 QUALITY ASSURANCE

.1 Provide a complete system of automatic controls for mechanical systems supplied and installed by firms specializing in this type of work.

.2 At completion of installation provide minimum of 3 half day instruction periods for operating personnel.

.3 Provide for complete service of controls systems, including callbacks, for one year running concurrent with guarantee.

1.2 SUBMITTALS

.1 Provide damper shop drawings which include data such as arrangement, velocities and static pressure drops for each system on shop drawings.

.2 Provide shop drawings including complete operating data, system drawings, wiring diagrams and written detailed operational description of sequences, and description and engineering data on each control system component. Include sizing as requested.

.3 At completion of work, make detailed checkout of automatic control system and submit written report to the Minister.

Part 2 Products

2.1 GENERAL

.1 Provide control systems consisting of thermostats, control valves, dampers, operators, indicating devices, interface equipment and other apparatus required to operate mechanical system and to perform functions specified.

.2 Provide the necessary components to connect factory supplied controls with certain equipment where such controls are specified.

.3 Unless specified otherwise, provide fully proportional components.

2.2 THERMOSTATS

.1 Freeze protection thermostats shall be auto reset type with 6.1 m element located to ensure maximum protection. Provide multiple thermostats for large duct cross sectional areas.

2.3 CONTROL VALVES

.1 Refer to section 25 05 61.

2.4 DAMPERS

.1 Refer to section 25 05 61.

2.5 DAMPER OPERATORS

.1 Refer to section 25 05 61.

2.6 CONTROL PANELS

.1 Provide local panels of unitized cabinet type for each system under automatic control. Mount relays, switches, and controllers with control point adjustment in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons, and clocks and switches flush on cabinet panel face.

.2 Fabricate panels from 3.0 mm furniture steel with baked enamel finish and hinged key lock door.

.3 Mount panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic name plates for instruments and controls inside cabinet and on cabinet face.

Part 3 Execution

3.1 INSTALLATION

.1 Check and verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate thermostats 1.5 m above floor.

.2 Install damper motors on outside of ducts. Do not locate in outside air stream.

END OF SECTION

Part 1 General

1.1 INTENT

.1 Read this Section in conjunction with Section 25 05 01, EMCS General Requirements and other related EMCS Sections.

1.2 RELATED REQUIREMENTS

.1 EMCS Field Sensing Devices and Actuators: Section 25 05 61.

.2 EMCS Control Sequences: Section 25 90 01.

1.3 START-UP SHEETS

.1 Provide "Physical Point Confirmation" sheets as follows:

1. Basic form of sheets shall follow ordering and layout of point sheets in section 259002. Provide sample for review prior to commencement of Start-up checks.
2. Include the following information/fields:
   - .1 System description and mnemonic
   - .2 Point description and mnemonic
   - .3 RCU number or identifier
   - .4 Point Type and Specified accuracy
   - .5 Tagged (tick box indicating presence of properly affixed identification tag/s)
   - .6 Verified (tick box indicating successful end-to-end wiring check)
   - .7 EMCS displayed value
   - .8 Field measured value
   - .9 Calibration offset value
   - .10 Identifier/name of graphic containing EMCS displayed value
   - .11 Contractor's initials
   - .12 Verifier's initials (Minister's Representative)
   - .13 Remarks

.2 Provide "Analogue Output Device Range" sheets as follows:

1. These sheets are to be used in addition to the Physical Point Confirmation sheets and shall include all EMCS analogue output devices. Order of devices shall follow ordering of analogue outputs as found on the Physical Point Confirmation sheets. Provide sample for review prior to commencement of Start-up checks.
2. Include the following information/fields:
   - .1 System description and mnemonic
   - .2 Point description and mnemonic
   - .3 RCU number or identifier

.4 Specified range
.5 FCE state at EMCS output value of 0% of range
.6 FCE state at EMCS output value of 20% of range
.7 FCE state at EMCS output value of 80% of range
.8 FCE state at EMCS output value of 100% of range
.9 FCE state at EMCS output value of 80% of range
.10 FCE state at EMCS output value of 20% of range
.11 FCE state at EMCS output value of 0% of range
.12 Actual range of device
.13 Verified FCE end-of-travel @ 0% (tick box indicating successful check)
.14 Verified FCE end-of-travel @ 100% (tick box indicating successful check)
.15 Failsafe position (NO/NC, OFF/ON, etc.)
.16 Verified (tick box indicating successful failsafe check)
.17 Contractor's initials
.18 Verifier's initials (Minister's Representative)
.19 Remarks

NOTE 1: FCE state refers to the position or value of the Final Control Element affected by the analogue output. Examples: damper or valve position, fan speed, setpoint reset value, etc.

NOTE 2: FCE end-of-travel refers to the end condition achieved by the FCE. Examples: dampers/valves achieve full open or tight shut off, fan achieves specified min/max speed, setpoint achieves specified max/min reset value, etc

.3 Provide "Flow Measuring Station Calibration" sheets as follows:

3. These sheets are to be used in addition to the Physical Point Confirmation sheets and shall include all EMCS analogue input devices used for flow rate measurement. Provide a sheet for each station. Sort sheets to follow ordering of these inputs as found on the Physical Point Confirmation sheets. For each flow station type, provide sample for review prior to commencement of Start-up checks.
4. Include the following information/fields:

.1 System description and mnemonic
.2 Point description and mnemonic
.3 RCU number or identifier
.4 Type, make, model and serial number of each measuring instrument used
.5 Flow station type, make, model, size and serial number if available
.6 Transducer:
.7 type, make and model
.8 operating range
.9 serial number if available

.10 zeroed (tick box indicating device was checked for proper zero reading)

.11 Start and stop times of measurement sequence

.12 Media (air, water, glycol) temperature

5. For Air-Flow Stations: Provide fields to record traverses according to recommendations of the 2005 A.S.H.R.A.E. Fundamentals Handbook (SI version), chapter 14 "Measurement and Instruments", page 14.17 “Measuring Flow in Ducts”. Use the Log-Tchebycheff Rule dimensions, for both rectangular and round ducts as given in Figure 7 on page 14.18. Include field to record atmospheric barometric pressure at time of testing.
6. For Fluid-Flow Stations: Provide fields to record data according to the station manufacturer’s recommended calibration procedures. Include fields to record fluid type, density and application.
7. Provide space for performing required calculations. Include all flow calculation formula used as well as fields for correction factors applied.
8. Include fields to record EMCS trend data and the calculations used in determining the average of the displayed flow rates over the duration of the tests.
9. Provide a summary area for the calculation of a flow station calibration equation that will be entered into the EMCS database or via programming.

.4 All values and calculations shall be in MKS (metric) units.

1.4 DOCUMENTATION

.1 Submit complete system documentation before start of testing, including:

1. programmer's instruction manuals.
2. CCU operating system software manuals and original diskettes.
3. application software program manuals and original diskettes.
4. operating manuals for terminals and end devices.
5. interlock and control schematics for each system controlled, identifying each EMCS physical point by mnemonic.
6. table of operating set points and alarm limits for each system.
7. device calibration methods and procedures.
8. list of all real and virtual mnemonics, with full English description of each mnemonic.
9. well documented User Control Language software with comment lines to explain control strategies. Alternatively, written description of control strategy for each software module.
10. backup disks for User Control Language Software.

Part 2 Products

Not Used

Part 3 Execution

3.1 HARDWARE

.1 Verify that each hardware component has been properly installed as recommended by manufacturer and is functioning correctly.

.2 Verify that all circuits are complete and all terminal wiring connections are tight.

.3 Electronic hardware:

1. Start-up electronic hardware as recommended by manufacturer.
2. Replace defective components.
3. Prove proper operation, use software diagnostic.

.4 Interfaces:

1. Test to ensure interfaces with Division 26 and other control packages are complete.
2. Verify that interface cabinets comply with applicable codes and specified requirements.

.5 Check operation of system under failure modes:

1. Power failure.
2. RCU failure.
3. Network failure.
4. Sensor failure.

3.2 POINT CHECK OUT

.1 Verify point mnemonic, hardware address, correct physical location and proper Functioning of each hardware point on system. Record verification of each point on “Physical Point Confirmation” sheets.

.2 Calibrate all analogue input/output devices, actuators, transducers and sensors as recommended by manufacturer.

.3 Achieve end-to-end (between field device and actual value displayed on screen) calibration accuracy over full expected operating range as specified for each analogue point type in Section 25 05 61:

1. Calibration may be performed on the hardware device if this feature is available, or may be entered into database/software provided correction is not greater than five (5) times specified accuracy for device. Device must be replaced and calibrated again if correction is outside this band. Combination coarse hardware and fine database/software calibration is allowed.
2. Simple offset calibration is acceptable where the operating range is less than 25% of the device span. Slope calibration is required for devices operating over larger spans. A two-point slope calibration, where the samples are about 20%

from each end of the operating range is acceptable if the resulting offset at the middle of the operating range falls within the specified accuracy.

3. All database/software calibrations must be entered even if these fall within the specified accuracy.
4. Document each calibration correction on "Physical Point Confirmation" Sheets.

.4 Check range and repeatability of each analogue output point. Ensure tight shut-off of dampers and valves.

.5 Variable Air Volume systems with Air Flow Measuring stations:

1. Statically adjust each pressure transducer to zero with both ports at ambient pressure. Check each transducer's span for linearity and range using an inclined manometer or a Shortridge Air Data Multi-meter in parallel with the transducer.
2. Dynamically calibrate each Air Flow Measuring station using the procedure defined on "Flow Measuring Station Calibration" sheets. Document the results on "Flow Measuring Station Calibration" sheets. For air systems flowing less than 5000 l/s, it is acceptable to use two calibration points at 60% and 85% vane/speed position. For small air systems flowing less than 2000 l/s, it is acceptable to use a single calibration point at 75% vane/speed position.
3. If, at any flow setting, the EMCS displayed flow rate differs by more than 5% from the measured flow rate, add an air flow measuring station calibration correction equation to the controls software or point database. The equation must go through the origin. Any zero offset usually corresponds to an improper zeroing of the velocity pressure transducer. A linear equation that provides a simple slope correction to achieve final accuracy to better than 5% is preferred.

3.3 APPLICATION SOFTWARE

.1 Ensure all hardware is installed and started and fully operational before software start-up.

.2 Enter each physical point into database and include following:

1. Set up run time capture for each digital output.
2. Enter engineering units for each analogue point.
3. Set up an alarm point for each digital input/output pair, with delay before alarm is enunciated.
4. Set up an alarm point for each analogue input with high and low limits. Provide a reset differential.
5. Enter physical point calibration corrections.
6. Enter analogue input conversion equations for fluid velocity measuring devices.

.3 Enter start/stop schedules for all systems not required to run continuously.

.4 Trend Logs:

1. Enter trend logs for each physical analogue input and output point in EMCS database.
2. Trend logs shall retain a minimum of four readings per hour for 24 hours.

3. Trend logs shall be continuous and shall overwrite information that is 24 hours old.
4. Provide an additional trend log of 120, ten second interval, readings for each P.I.D. loop controlling and controlled variable.
5. Grouping of trend log points on print outs shall be agreed with the Minister.

.5 Verify proper operation of dynamic graphics:

1. Proper identification of system and points on screen.
2. Data refresh period.
3. Dynamic valve/damper actuators displayed on screen.
4. Colour change on status change.
5. Reaction to alarms.
6. Trend graph reporting.

3.4 DEMONSTRATION OF APPLICATION SOFTWARE

.1 Demonstrate following to the building operator:

1. Man/machine interface to EMCS system, including operator access, all monitoring functions and command of points.
2. Saving and reloading of database. Provide a checklist describing the procedures to be followed.
3. The use of disk backup utilities by creating bootable CDs containing a complete image backup of the hard disk. Save must be performed at the highest rewrite speed available on CD-RW drive. Provide a checklist describing the procedures to be followed.
4. User Control Language program entry and editing.
5. Operation of specific application software such as:
   - .1 demand limiting.
   - .2 peak shaving.
   - .3 night setback.
   - .4 optimum start of heating/cooling systems.
   - .5 building dynamic control.
   - .6 alarm conditions and printouts.
   - .7 automatic report generation.

3.5 3.8 USER CONTROL SOFTWARE IMPLEMENTATION

.1 Demonstrate User Control Language software operation, start up and shut down sequences, software interlocks, fail safe, emergency shut down and alarm condition control strategies in accordance with the requirements of Section 25 90 01.

END OF SECTION

Part 1 General

1.1 INTENT

.1 This Section specifies general requirements common to all energy management and control system (EMCS) work. Read this Section in conjunction with all Sections that specify EMCS work.

1.2 RELATED REQUIREMENTS

.1 Information Documents: Section 00 31 00.

.2 Electrical General Requirements

.3 Conduit: Section 26 05 34.

1.3 PRODUCTS OPTIONS AND SUBSTITUTIONS

.1 Refer to Division 01 for requirements pertaining to product options and substitutions.

1.4 ABBREVIATIONS

.1 BACnet: ASHRAE Standard Building Automation & Control Network Protocol

.2 BIBB: BACnet Interoperability Building Block

.3 Blu_Ray: High density digital video/data disk

.4 CCS: Central Control Station

.5 DDC: Distributed Digital Control

.6 DVD: Digital Video Disk (-R, +R, -RW etc)

.7 EEPROM: Electrically Erasable Programmable ROM

.8 EMCS: Energy Management Control Systems

.9 EPROM: Ultraviolet Erasable Programmable ROM

.10 LonWorks: ANSI/EIA 709.1 Control Networking Standard

.11 LonMark: LonWorks devices certified by the LonMark Interoperability Association

.12 Objects: Data constructs containing information including, but not limited to, physical or virtual points and attributes.

.13 Examples: analogue or digital inputs, outputs and calculated values, occupancy schedules, control loops, alarms, commands, programs, etc.

.14 PCS: Portable Control Station

.15 PID: Proportional Integral Derivative

.16 RAM: Random Access Memory

.17 RCU: Remote Control Unit

.18 ROM: Read Only Memory

.19 TCU: Terminal Control Unit

.20 UCL: User Control Language

1.5 CONSTRUCTION SCHEDULE

.1 Comply with requirements of Division 01.

.2 Include EMCS installation schedule as part of the construction progress schedule. Include start and finish dates for:

1. equipment ordering and delivery.
2. hardware installation.
3. start-up and point calibration
4. software loading and testing
5. system testing and trial use by owner.

.3 Coordinate EMCS schedule with construction schedule.

1.6 CONSTRUCTION PROGRESS MEETINGS

.1 Comply with requirements of Division 01.

1.7 SHOP DRAWINGS AND INFORMATION

.1 Comply with requirements of Division 01 and as follows:

1. Within 30 days of contract award, provide:
   - .1 CAD drawings of the proposed system architecture. Include all CCSs, RCUs and TCUs as well as LAN devices.
   - .2 point layouts of all RCUs as well as wiring diagrams for attached devices. Include Logical Point Mnemonics.
   - .3 technical data sheets for all equipment and devices.
2. Within 60 days of contract award, provide:
   - .1 control software descriptions, by module, explaining EMCS control sequences and logic. Include Logical Point Mnemonics for all virtual points as well as print out or code for each module.
   - .2 dynamic graphic displays, for key plan, each mechanical system and floor plan.

1.8 PROJECT RECORD DOCUMENTS

.1 Comply with requirements of Division 01.

1.9 EMCS MANUALS, CATALOGUES AND BACKUPS

.1 Operators' Manuals: Provide operators' instruction manuals. Manuals shall guide operators through all menu options, with an explanation of each option. Manuals shall describe the use of operator's interface including all function keys, "hot" keys, reporting features, start/stop scheduling, etc.

.2 Programmers' Manuals: Provide programming instruction manuals for the User Control Language. Manuals shall list all procedures, functions, operators and reserved words together with a description and examples of their use in programming.

.3 Application Program Manuals: Provide instruction manuals for any brand-name or proprietary software used for terminal emulation, communication, graphics generation, etc.

.4 Computers, Peripheral and Device Manuals: Provide instruction and maintenance manuals for all CCSs, PCSs, printers and modems as well as any other peripheral or electronic device supplied under this contract.

.5 Proof of ownership: Provide proof-of-ownership in the form of licensed disks, software manuals, registration cards, or, in the case of proprietary software, formal letter of transmittal, for all software that is required to fulfill contract requirements.

.6 EMCS Catalogue: Provide a current catalogue and price list that includes the components provided under this contract as well as related system components and accessories.

.7 Backups: Download all RCU and TCU databases and programs onto the primary CCS hard disk prior to performing a comprehensive backup. Provide three (3) complete system backup packages. Each package shall contain everything necessary to restore the EMCS to full operation should a catastrophic failure occur and as follows:

1. Include an image backup of the complete CCS hard disk, onto removable media, using the system backup software specified in Section 23 09 25 "EMCS Central Control Units and Peripherals".
2. Include a copy of the software required to restore the hard drive from the image backup.
3. Include text files of the CCS's CMOS settings as well as any important configuration files such as config.sys and autoexec.bat.
4. Include a hardcopy sheet describing the exact steps required to restore the hard drive.
5. Include a hardcopy sheet describing the exact steps required to restore an RCU or TCU.
6. One backup package shall be left at the primary CCS location. Another is to be included in the Operation & Maintenance Manual that will remain on site. The final package shall be turned over to [Roman G. Unyk, P.Eng., Manager, EMCS].

1.10 OPERATION & MAINTENANCE MANUALS AND O&M DISK

.1 Provide three (3) complete copies of an EMCS Operation and Maintenance Manual.

1. Organize manual as follows:
   .1 Operations Division: EMCS Hardware (Configuration/Installation)

.2 Operations Division: EMCS Software (Database/Programming)
.3 Operations Division: Pneumatic/Electric (Non-EMCS Subsystems)
.4 Maintenance Division
.5 Contract Documentation Division
.6 O&M Disk (full manual and system backup in electronic format)

2. Split manual into two or more binders if content exceeds 75mm in thickness.
3. At the beginning of each binder, provide a table of contents listing divider tabs in all binders making up the full manual.
4. D-ring binders with two plastic sheet lifters and clear outside overlay pockets are acceptable if total contents are less than 35mm in thickness. Otherwise provide binders that are silk screened, commercial quality, fabric coated, three post, with hard covers attached to spine with metal piano hinges.
5. Each binder cover and spine shall display the following information:
   .1 City/Town
   .2 Building Name
   .3 Project Title
   .4 Binder Name, examples:
      .1 EMCS Operations and Maintenance Manual
      .2 EMCS Operations and Maintenance Manual
      .3 (Operations Division: Hardware and Software)
      .4 EMCS Operations and Maintenance Manual (Maintenance and Contract Divisions)
      .5 Date (month and year only)

.2 Operations Division - EMCS Hardware (Configuration/Installation):

1. Organize the information into sections, with index and divider tabs, as follows:
   .1 EMCS Configuration (include explanations of architecture)
   .2 TCU Cross References
   .3 System Schematics
   .4 RCUs/TCUs
2. EMCS Configuration: Provide a basic configuration diagram showing each CCS, peripheral devices and RCU with information as to their locations. Provide lists or diagrams showing which TCUs are connected to what RCU. Provide an explanation of system architecture. Describe each hardware component and the networks that manage system communications.
3. TCU Cross References: Provide two cross referenced TCU listings. One listing to be sorted by TCU identifier, the other to be sorted by room number. Each listing to have the following columns:
   .1 TCU identifier
   .2 RCU sub-network if this data is not in TCU identifier
   .3 TCU type and model number
   .4 Terminal equipment identifier (box number etc.)
   .5 Room number
4. System Schematics: Provide schematics of each mechanical system indicating point locations, mnemonics and hardware address. Include any wiring details and

equipment schematics showing where and how equipment is interfaced to EMCS. Drawings must be clear and of adequate size for easy reading. If necessary, fold larger sheets into binder.

5. RCUs/TCUs: Provide a divider tab for each RCU. Under each RCU provide the following information separated with coloured sheets:
   - .1 RCU panel directory showing point mnemonics, termination addresses and wiring numbers.
   - .2 Panel directory of each associated equipment cabinet.
   - .3 Panel directories of each associated TCU showing point mnemonics, termination addresses and wiring numbers.

.3 Operations Division - EMCS Software (Database/Programming):

1. Organize the information into sections, with index and divider tabs, as follows:
   - .1 Point Lists
   - .2 Graphics
   - .3 Descriptions and Procedures
   - .4 TCU General
   - .5 RCUs/TCUs
   - .6 CCS Setup
2. Point Lists: Provide two complete lists containing all the physical and virtual points in the facility as well as a suitable description as to each points function. The first listing to be sorted by logical point mnemonic, the second to be sorted by hardware address. Each listing to have the following columns:
   - .1 Logical point mnemonic
   - .2 Description
   - .3 Hardware or virtual point address
3. Graphics: Provide a hardcopy of all dynamic graphic display screens if a graphical user interface has been provided. Good quality screen dumps may be used for this purpose.
4. Descriptions and Procedures: Provide a brief description of overall control philosophy. Describe all hardware interlocks with other equipment that may affect or override action of software control modules. Provide procedures for operating staff to interface with software control modules, to override system or component operation, to adjust system or building control setpoints, etc. Name virtual points provided in software for this purpose and recommend adjustment increments and limits where applicable
5. TCU General: Provide a divider tab for each type of TCU and include the following information separated with coloured sheets:
   - .1 A short general description of the TCU and intended application followed by a listing and description of every available parameter, input and output.
   - .2 A detailed description of each configurable module, object, function, procedure and related sequence of operation.
   - .3 For LonWorks based TCUs, provide functional profile diagrams and descriptions of all Mandatory and Optional Network Variables.
6. RCUs/TCUs: Provide a divider tab for each RCU. Under each RCU provide the following information separated with coloured sheets:

.1 List of physical and virtual point mnemonics, with a description of the meaning of each mnemonic.

.2 For each User Control Language Program module in the RCU provide:

.1 a description of purpose and logic of module.

.2 a hardcopy listing of the program module.

.3 Complete hardcopy listing of the RCU database. Include each hardware point, virtual point, schedule, report, trend, controller etc.

.4 Provide a divider sub-tab for each associated TCU and include the following information separated with coloured sheets:

.1 References to any common configurable modules described under the TCU General section and a listing of the configuration data for the respective TCU.

.2 List of any physical and virtual point mnemonics, with a description of the meaning of each mnemonic.

.3 For any User Control Language Program in the TCU provide:

.1 a description of purpose and logic of module.
.2 a hardcopy listing of the program module.

.4 Complete hardcopy listing of the database. Include each hardware point, virtual point, schedule, report, trend, controller etc.

7. CCS setup: Provide hardcopy listings of all configuration information including CMOS setup, directory listing showing all installed files and locations as well as user interface program configuration data.

8. All listings to be laser printed.

.4 Operations Division: Pneumatic/Electric (Non-EMCS Subsystems)

1. Provide system configuration, schematic diagram, detailed operating sequence and component listing for each non-EMCS controls subsystem.

.5 Maintenance Division:

1. Summarize data for this section from supplier and sub trade maintenance submissions, supplemented by appropriate additional material. Organize the information into sections, with index and divider tabs, as follows:

.1 Maintenance

.2 Spare Parts

.3 Suppliers and Contractors

2. Maintenance: Provide a description of maintenance procedures for all equipment and systems. Include a schedule for recommended planned and preventative maintenance work and intervals.

3. Spare Parts: Provide a list of recommended spare parts.

4. Suppliers and Contractors: For each piece of equipment, provide a list of resources to call upon for maintenance and servicing of equipment. Include the supplier’s name, address and phone number as well as the service contact.

.6 Contract Documentation Division:

1. Organize the information into sections, with index and divider tabs, as follows:

.1 Drawings List

.2 Shop Drawings and Product Data

.3 Certifications and Reports

.4 Warranties and Bonds

2. Drawings List: Provide a list of all drawings used in performance of the contract.

3. Shop Drawings and Product Data: Provide final reviewed copies of all shop drawings and product data. Provide copies of all manufacturers' data sheets, installation and maintenance brochures pertaining to each installed device, piece of equipment or system. Organize by system with a separate divider tab for the common devices and components.

4. Certifications and Reports: Provide copies of Contractor certifications for performance of products and systems. Collect and include field reports:

   .1 EMCS physical point confirmation and calibration reports as specified in Section 25 01 11.

   .2 Start-up and testing reports as specified in Sections 25 01 11.

   .3 EMCS software verification reports as specified in Section 25 05 01.

   .4 EMCS Quality Assurance Logbook as specified in Section 25 05 01.

   .5 Any other test report verifying performance of EMCS products and systems.

5. Warranties and Bonds: Provide one copy each of the EMCS Contractor's warranty, EMCS Manufacturers' warranties, and any EMCS service contracts provided by the Contractor. Provide a copy of the bond only in contracts where the EMCS contractor is the general.

.7 O&M Disk (full manual and system backup in electronic form):

1. In addition to the hardcopy manuals, provide the Operation and Maintenance Manuals in electronic form as follows:

   .1 O&M data shall be organized exactly as specified for the hardcopy manuals.

   .2 Data shall be compiled into Adobe portable document format and assembled into as few files as practical. (NOTE: It would be preferable if there were no more than one file per division.)

   .3 Include table of contents links that allow direct access to data as per the divider tabs required in the hardcopy manual.

2. Provide the O&M Disk, in the form of a CD/DVD/BD for each hardcopy manual and backup package. CD/DVD/BD backup disks shall be archival quality, adequately labeled, protected in paper sleeves and inserted into archival quality plastic binder pages.

3. Provide an electronic copy of the O&M Disk onto each CCS and PCS hard drive under the C:\O&M_Manual directory.

4. Install a shareware copy of the latest version of Adobe Acrobat Reader on each CCS and PCS and create desktop shortcuts to the .pdf files to ease access.

1.11 QUALITY ASSURANCE

.1 Provide and install a fully proven system as described, including field tested hardware, operating system and applications software.

.2 Demonstrate capability to service system from service departments or organizations located within Alberta. Provide names, call out phone numbers and resumes for applicable service personnel.

.3 Provide a Quality Assurance Logbook at location of primary CCS. Logbook shall have holes appropriate for inclusion in O&M Manual binder. On completion of high speed trunk wiring and RCU installation, begin recording each RCU, TEC or unexplained failure (glitch). Provide the date, device identifier, type of failure, cause and how problem was resolved. Include all hardware failures as well as software/firmware problems such as panel lock-ups and loss of programming.

1.12 CONTRACT ACCEPTANCE PROCEDURES

.1 Comply with requirements of Division 01.

.2 Prior to Interim Acceptance of the Work provide all EMCS Manuals and Backups as well as the Operations and Maintenance Manuals.

.3 Prior to Interim Acceptance of the Work, complete all requirements of Section 25 01 11 “EMCS Start-up and Testing”. Submit a copy of the completed point checkout sheets. Provide reports or electronic copy on diskette of all trend logs and other data generated to prove correct function of each control module and tuned PID loop.

.4 Prior to Interim Acceptance of the Work, the installed system must be of acceptable quality by having:

1. no RCU failures over the previous 60 days of continuous operation.
2. not more than one TEC failure for every 300 installed TECs in the previous 40 days of continuous operation.
3. no significant unexplained failures (glitches) over the previous 20 days of continuous operation.

1.13 WARRANTY

.1 Correct all defects in workmanship, material or software during the duration of the warrantee period.

.2 Correct all system failures occurring during warranty period. After each occurrence:

1. Reload software lost as a result of system failure.
2. Record changes made to software in site log.
3. Download any changed databases and programs onto the CCS hard disk.
4. Backup RCU and TCU databases onto removable disk.

Part 2 Products

2.1 ELECTRONIC DEVICES

.1 All RCUs and TCUs, whether fully user programmable or just configurable, as well all engineering and user interface software provided under this contract, shall be current product from the same manufacturer.

.2 . All user programmable devices such as RCUs and TCUs shall utilize a single identical User Control Language throughout the system. Systems that do not meet this requirement are NOT acceptable.

.3 BACnet devices shall be BACnet Testing Laboratory (BTL) Certified.

2.2 TAGS, LABELS, NAMEPLATES AND DIRECTORIES

.1 Comply with the identification requirements of Section “Field Work”.

Part 3 Execution

3.1 IDENTIFICATION

.1 Comply with the identification requirements of Section “Field Work”.

3.2 START UP AND TESTING

.1 Start and test the EMCS system as specified in Section 25 01 11 EMCS Start-up and Testing

3.3 TRAINING OF OPERATORS

.1 Provide training for three operators according to the following schedule:

1. 1/2 day, ten days before Interim Acceptance of the Work, covering all aspects of system use as follows:
   - .1 Operation of hardware components.
   - .2 Tour of EMCS components.
   - .3 System software configuration.
   - .4 Man-machine interface.
2. 1 day of advanced training within one month after Interim Acceptance of the Work, covering all aspects of system use and maintenance as follows:
   - .5 Basic review of earlier training.
   - .6 Advanced man-machine interface.
   - .7 Programming basics.
   - .8 Calibration of sensors.
   - .9 Trouble shooting of system and components.
   - .10 Preventive maintenance.
3. ½ day seminar six to twelve months after Interim Acceptance of the Work for clarification of system operating techniques. Operators shall determine agenda.
4. Provide a sign off sheet, for inclusion in the system documentation manuals, which will be signed by the Contractor and the engineer representative at the completion of each phase of operator training.

3.4 FINAL UPDATES, BACKUPS AND O&M DISKS

.1 Just prior to Total Completion of the Work, provide the latest versions of all software and firmware in all CCSs, PCSs, RCUs, and TCUs.

.2 Just prior to Total Completion of the Work, provide updated backup packages.

.3 Just prior to Total Completion of the Work, provide updated O&M Disks. Copy these updates to all CCS and PCS hard drives.

END OF SECTION

Part 1 General

1.1 INTENT

.1 Read this Section in conjunction with Section 25 05 01 - EMCS General Requirements and other related EMCS Sections.

Part 2 Products

2.1 NETWORK COMMUNICATIONS

.1 Architecture:

.1 The EMCS shall support a two tiered network:

.1 The high speed primary network shall be Ethernet and shall operate at a speed of 10 Mbps or higher.

.2 The high speed primary network shall support multiple Remote Control Units (RCUs) and utilize a peer-to-peer protocol in a multi-drop architecture. Master-slave protocols are NOT acceptable. Any Central Control Stations (CCSs) or file servers, tied directly to this network, shall not significantly affect inter-RCU communications.

.3 Each RCU shall have a 9600 baud minimum speed sub-network to communicate with Terminal Control Units (TCUs) or protocol compliant equipment and smart devices.

.2 Information passing:

.1 Support direct peer-to-peer data sharing between all RCUs on the primary network so that physical or virtual point values resident in one RCU are available to all other RCUs. All CCSs/PCSs shall have data access to all RCUs on the primary network.

.2 Support data sharing between the RCU and its sub-networked TCUs/equipment/devices so that all physical or virtual point values, resident in the host RCU, are available to all TCUs/equipment/devices. As well, all physical or virtual point values, resident in the TCUs/equipment/devices, shall be available to the RCU hosting the sub-network and thus also available to all CCSs/PCSs.

.3 Values, statuses and attributes of physical and virtual points from one RCU, TCU or protocol compliant equipment or smart device shall be available for use in any other RCU, TCU, CCS, PCS or protocol compliant equipment or smart device without change of logical point mnemonic. The use of such information within a RCU, TCU function or program, shall require only that the correct logical point mnemonic be used within the program. As well, the use of such information in CCS/PCS graphics, reports, trending, alarming or configuration/ programming of any other CCS/PCS function shall require only that the correct logical point mnemonic be used within the function's setup.

.4 Setup of data sharing for the functionality described in the above clauses shall be automatic, requiring no programmer or operator action. Any broadcast points,

send-receive blocks, data binding, or other form of table that is required to initialize and accomplish this function shall be invisible to the programmer and be created automatically without user intervention. Systems that require any form of manual mapping of data transfer at any level are NOT acceptable.

.5 The system shall automatically discover what objects are available form any RCU, TCU or protocol compliant equipment or smart device connected to the high or low speed networks. This "auto discovery" shall occur, without manual intervention, whenever a new device restarts or is connected to a network.

.3 Logical point mnemonic:

.1 Each physical or virtual point, controller point or schedule, shall have a unique, user-definable, system-wide, logical point mnemonic. A length of at least 12 characters is required. Any combination of alphabetic or numeric characters shall be allowed plus a delimiter (at least one of the following: - _ , . /). The format of these point mnemonics shall conform to the Alberta Infrastructure EMCS Guideline for Logical Point Mnemonics.

.2 Once a logical point mnemonic has been defined, the point's hardware address shall not be required for control sequence programming or any man-machine interface function.

.4 Network failure modes:

1. On communication failure, retain the last legitimate value of global points. Continue to control the systems based on these values.
1. Failure of any panel on the primary network or on any sub-network shall not affect the ability of all other panels to communicate over the network.
2. A panel shall detect the failure of any other panel. This information shall be useable in custom control programming.
3. A panel shall detect the failure of any point it receives from the network. This information shall be useable in custom control programming.

.5 Network Protocols:

1. The RCU hosted sub-network protocol shall be BACnet compliant. Proprietary sub-network protocols are NOT allowed.
2. The BACnet protocol shall be used for all communications among RCUs, CCSs and PCSs. Future BACnet RCUs shall be able to be connected to the system's high speed network, at any RCU location, without the need to provide additional protocol interface devices or related software/firmware.
3. Wireless BACnet over ZigBee is allowed for TCUs and non-critical net-sensors. Proprietary protocol over ZigBee is NOT allowed. Communications among RCUs and CCSs is to be hard wire.

Part 3 Execution

3.1 CONTROL LOOP CONFIGURATION

.1 Control loops shall be configured so the control loop, setpoint variable and all associated hardware points are in the same RCU.

.2 Control loops shall not be closed across inter-panel communications links.

1. A single BACnet sub-network from a single RCU, to individual field devices such as smart sensors and actuators and/or to individual field equipment such as a variable speed drives, boilers or chillers, is not considered to be an inter-panel link.
2. Such BACnet networks shall have a total length of less than 100 meters and be connected to no more than 16 devices.
3. Interposing gateways, protocol converters or network extenders are not allowed on such networks.

3.2 SYSTEM CONFIGURATION

.1 Provide a system configuration which complies with the general configuration shown on the diagram appended to this Section.

.2 Provide one CCS as follows:

1. CCS, keyboard, monitor and mouse.
2. Hard copy report printer.
3. Computer Desk

.3 Provide one RCU minimum:

1. for the boiler system

.4 Provide one RCU for each air handling unit. For packaged roof-top units locate RCU in unit service corridor.

.5 Provide one TCU for each heating zone.

.6 The TCUs of all heating zones served by a particular air system, shall be on the sub-network from the RCU controlling that air system.

3.3 INTEROPERABILITY

.1 Co-ordinate RCU sub-network communication protocols and functional requirements to allow specified device interoperability.

.2 Select/configure/create system parameters/variables/BIBBs/etc. as necessary to allow the following data to be: a) displayed on CCS/PCS graphic screens, b) manually accessed from the CCS/PCS via operator command, c) automatically accessed by the RCU under control of operating sequences created with the User Control Language:

1. TCUs: As required under section 25 30 03 “EMCS Terminal Control Units”.

END OF SECTION

Part 1 General

1.1 INTENT

.1 Read this Section in conjunction with Section 25 05 01 EMCS General Requirements and other related EMCS Sections.

1.2 REFERENCE DOCUMENTS

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No. 45 M1981 Rigid Metal Conduit

.2 CSA C22.2 No. 75 08 Thermoplastic-Insulated Wires and Cables

.3 CSA C22.2 No. 83 M1985(R2008) Electrical Metallic Tubing

1.3 REGULATORY REQUIREMENTS

.1 Comply with Electrical Protection Act of Alberta and rules and regulations made pursuant thereto, including the Canadian Electrical Code.

.2 Unless otherwise indicated, all references to "Canadian Electrical Code" or "CEC" shall mean the edition of the Canadian Electrical Code, Part I, CSA C22.1, and the variations made thereto by Alberta regulation, which are in force on the date of bid closing for the Contract.

.3 All electrical products shall be approved by the Canadian Standards Association (CSA) and bear the CSA label. Alternatively, where a product does not bear a CSA label, it shall be approved in writing by the authority having jurisdiction.

.4 Submit to authority having jurisdiction and utility company, necessary number of drawings and specifications for examination and approval prior to commencement of work. Pay associated fees.

.5 Submit to owner, copy of electrical permit obtained from authority having jurisdiction.

.6 If authority having jurisdiction conducts an electrical inspection, submit copy of certificate of acceptance provided by authority having jurisdiction.

Part 2 Products

2.1 CONDUIT

.1 EMT: to CSA C22.2 No. 83. Provide rain tight fittings in weatherproof and damp areas.

.2 Rigid Metal: to CSA C22.2 No. 45.

2.2 WIRE

.1 Wiring: to CSA C22.2 No. 75, copper conductor, 600 V RW90 X link insulation. 300 V insulation allowed for conductors not entering enclosures containing line voltage.

.2 120 VAC Control Wiring: minimum #14 AWG.

.3 Low Voltage Field Wiring:

.1 Minimum #22 AWG.

.2 Twisted pairs.

.3 Stranded, except #18 AWG and larger may be solid.

.4 Shielded with drain wire, except for digital input/output wiring carrying less than 25mA and not installed in tray.

.5 Multiconductor wiring must have individually twisted and shielded pairs with a *drain wire for each pair. Cable must have overall shield. Maximum 6 pairs.*

.6 *Exposed wiring in ceiling spaces to be rated for return air plenum use. Exposed wiring must utilize FT6 jacket. FT4 jacket is not approved.*

.7 Aluminum wiring is not allowed.

2.3 IDENTIFICATION MATERIALS

.1 Wiring Identification Materials:

.1 Use one of the following:

.2 Heat shrink sleeves, with printed or legible hand written identifier.

.3 Snap on or slide-on sleeves, or crimp-on pins with integral sleeve. Length to suit number of characters required in identification code, 6 (six) characters minimum. Marking elements to be removable yet secure when inserted into sleeve. Standard of quality: Grafoplast Wiremarkers Inc.

.4 Factory coded slip-on identification bead markers or sleeves.

.1 Size of sleeves to be selected so that they do not slip off when wire is removed from termination and shaken.

.2 Wrap-on adhesive strips not allowed. Hand written identifiers not allowed.

.5 Point Identification Tags: 0.75 mm thick plastic laminated luggage style tags containing imprinted information label. Printing on surface of plastic not allowed. Printing shall be 14 point font or larger.

.6 Engraved Plastic Nameplate: self-adhesive composite laminated plastic nameplates with one smooth white surface and core of black plastic designed to leave black lettering on a white background. Engraved lettering height as follows:

.1 RCU, TCU and Equipment Cabinets: 20 mm.

.2 Magnetic contactors for EMCS controlled equipment: 20mm.

.3 All other: 8mm.

.7 Wiring Directories: for each RCU and TCU provide a laminated sheet with a cross reference listing of logical point mnemonic, descriptor, wiring label and hardware address for each wire terminated in cabinet. Order and placing of information shall mimic pattern of wiring terminations.

.8 Equipment Cabinet Directories: for each equipment cabinet provide a laminated sheet graphically showing location of each transducer, relay or other device in cabinet. Each device outline to be labeled and function of device indicated. Provide logical point mnemonic, descriptor, wiring label and hardware address for field wiring terminating at transducers and relays within cabinet.

Part 3 Execution

3.1 CONDUIT

.1 Use EMT conduit:

.1 for all high speed communications trunk wiring between RCUs.

.2 for wiring that would be exposed to mechanical damage.

.3 for wiring in inaccessible areas.

.4 where indicated on drawings or otherwise required by CEC.

.5 Use rigid metal conduit for all wiring in areas designated as hazardous.

.6 Conduit sizing and installation shall comply with CEC requirements. Wire fill shall not exceed 50%.

.7 Wherever practical, conceal conduit in walls, floors and ceilings.

.8 Install conduit parallel or at right angles to building lines; minimize crossovers and conserve space and headroom.

.9 Do not install conduit in or under ground floor slabs.

.10 Do not use metallic or non metallic sheathed cable except where otherwise indicated.

3.2 WIRING

.1 Neatly arranged panduit with snap on covers shall be used to restrain wiring inside cabinets larger than 300mm square.

.2 Neatly train and cable tie wiring in cabinets smaller than 300 mm square. Adhesive backed twist ties or adhesive backed cable tie holders are not allowed. Wiring shall be secured to cabinet back with mountable cable ties fastened with #8 or larger sheet metal screws.

.3 Each field device shall have its own signal and return wire individually terminated in the panel. The use of a common return wire or ground for more than one control point is not allowed.

.4 Plenum rated cable:

.1 Telecommunications cable tray is not permitted for use by EMCS wiring.

.2 Shall follow building lines, close to the building structure, well above any ductwork or piping.

.3 Shall be secured to the building structure at intervals not exceeding 2 meters with bundles wire-tied every 1 meter. Cable shall not be attach to ceiling support system, piping or ductwork.

.4 Shall not be tied against sharp edges (sheet metal, redi-rod) without sufficient additional protection. Provide grommets at entry to boxes and into conduit.

.5 Shall not be kinked or bent to a radius less than 100mm. Provide a full loop of slack at entry to boxes and conduits.

.5 A single continuous non-spliced cable shall be used for connecting each field device. Joining of cables is only permitted as follows:

.1 New points: Only one splice for every 100 meters of cable.

.2 Existing points where the existing wire is allowed to be reused: Only if the final length of unspliced run exceeds 10 meters.

.3 The type of wire, gauge, colour and number of conductors to any device, shall remain the same right from the device through to the termination connectors in the control panel.

.4 Splices are only allowed within equipment cabinets or junction boxes. The shield drain wire for each pair must be connected. Splices shall expose no more than 2cm of unjacketed wire.

.5 Except as indicated next, only properly sized insulated spring wire connectors with plastic insulating caps or solderless pressure connectors with insulated covers by Marr, Ideal or 3M are allowed for splicing. The use of screw type terminal blocks is required for splicing ALL wiring entering a cabinet or junction box when any one of the following conditions exists:

.6 The panel or junction box contains more than 10 connections.

.7 Multi-conductor cables with more than 4 wires are to be spliced.

.1 Terminal blocks must be screw mounted with #8 or larger sheet metal screws in panels or junction boxes no smaller than 150mm square.

.8 Where hand/off/auto (HOA) switches are available on the MCC or are provided under this contract, the digital output points shall be wired such that the equipment is under EMCS control when the HOA switch is in the auto position. Confirm proper operation of equipment under hand and off operation. Correct wiring as necessary.

3.3 GROUNDING

.1 Provide a complete ground system for all EMCS equipment, including panels, conductors, conduit, raceways, connectors and accessories. Grounding shall be by means of electrical supply conductor bonding method. Separate grounding conductors not permitted.

.2 Grounding between control panels and field devices shall have a star configuration. The shield for a field device shall be grounded at the panel only.

.3 The shield for communications wiring must be contiguous throughout its full length and shall be grounded at one point only. For TCUs, the ground shall be at the RCU. Except for this single ground connection, when splicing to an RCU/TCU the shield drain wire must be connected through and not to the RCU/TCU ground. Splices shall expose no more than 2cm of unshielded wire.

3.4 IDENTIFICATION

.1 Conduit:

.1 Apply paint or colour banding tape in fluorescent orange for control wiring conduit in 35 mm wide bands all around conduit as follows:

.2 At least once in each 10 m of conduit run.

.3 Where conduit enters inaccessible ceiling, wall and floor spaces.

.4 At least once in each room or area through which a conduit passes.

.1 Applying fluorescent orange paint to all conduit fittings prior to installation is an acceptable practice. However, additional identification banding shall be added as required to meet all requirements of this article.

.5 Wiring:

.1 Wiring more than 1 meter in length must be labeled at both ends.

.2 Labels for all system point wiring shall, as a minimum, contain the following information:

.6 Panel end: panel terminal number or hardware address.

.7 Device end: panel number as well as panel terminal number or hardware address.

.8 Label panel power supply wiring with the panel connector number.

.9 Label communications port wiring with panel connector number and device name (e.g. “J1-modem”, “J2-printer”).

.10 Label communications trunk wiring with the panel number, router number etc. to which the other end of the cable is connected.

.11 Wiring on each side of a terminal block or splice shall be labeled with the information required for the device end of the wire.

.12 In retrofit situations the above labeling requirements are in addition to any existing labeling.

.13 Point Tagging:

.1 Identify all input sensors and devices as well as all EMCS controlled output actuators, motors and equipment, with Point Identification Tags. Provide multiple tags as necessary. Additional requirements as follows:

.14 Tag control wiring for major mechanical equipment at equipment terminal strip.

.15 Tag any input/output transducers not identified on an Equipment Cabinet Directory.

.16 Tag electric motors on power cable near motor end.

.1 Point Identification Tags shall be attached using two nylon cable ties. One tie is to provide a loose loop through the tag while the other tie is to hold this loop to the wire or conduit.

.2 All Point Identification Tags shall include the following minimum information:

.1 Logical Point Mnemonic (refer to Section 23 09 30)

.17 Point Hardware Address (RCU/TCU and connection terminal identifiers)

.18 Associated System Identification

.19 Point Description

.20 Nameplates:

.1 Identify the following with engraved plastic nameplates:

.21 Magnetic contactors and related local disconnect switches.

.22 Space temperature sensors and intelligent thermostats.

.23 RCU cabinets, TCU cabinets, associated equipment cabinets.

.24 Front panel mounted switches, displays and devices; identify function of each item.

.1 Nameplates shall include logical point mnemonic as applicable. Refer to Section 25 90 02.

.2 All nameplates to be easily visible without need to use ladder or extraordinary body position. Affix additional nameplates if necessary.

.3 Provide the owner with an example of the contents of each type of nameplate as indicated in 3.2.1 above. Obtain approval prior to engraving.

.25 Directories:

.1 Permanently mount laminated Wiring Directories on door inside surface of each RCU and TCU cabinet.

.2 Permanently mount laminated Equipment Cabinet Directories on door inside surface of each equipment cabinet.

END OF SECTION

Part 1 General

1.1 INTENT

.1 Read this Section in conjunction with Section 25 05 01 - EMCS General Requirements and other related EMCS Sections.

.2 The letters under the "Type" column in the following Schedule are the same used in Section 25 90 02 “Point Database Schedule” and also on the drawings.

Part 2 Products

2.1 SENSING DEVICES

.1 Provide field instrumentation and sensing devices, analog or digital as applicable, which measure temperature, humidity, pressure, flow, current, voltage, equipment states, etc. and which input signals to the RCU or TCU terminal strip that conform to the input requirements specified in Sections 25 30 02 and 25 30 02, "Signal Processing" articles.

.2 The end-to-end accuracy called for in the following Schedule includes the combined effect of all the errors in all the interposing devices and components between the measured variable and the value displayed at the Central Control Station.

.3 For all sensors in piping, provide stainless steel wells and all required adaptors. Provide **rigid metal** nipples between well and sensor junction box. For retrofit projects, existing wells may be reused if they are no longer required for any other purpose, are in good condition and are compatible with the new sensors.

2.2 ACTUATORS

.1 Provide output devices, motors and actuators which convert the digital or analog output signal from the RCU or TCU to activate relays or open and close valves, dampers, etc., that conform to the output requirements specified in Sections 25 30 02 and 25 30 02 “Signal Processing” articles.

.2 The end-to-end accuracy called for in the following Schedule includes the combined effect of all the errors in all the interposing devices and components between the value entered at the Central Control Station and the position of the final control element. In retrofit situations, where the final control elements or actuators are allowed to be reused, end-to-end accuracy refers only to the signal sent to the final control element or actuator.

.3 Actuators shall be gear driven with spring return to "fail safe" in normally closed position as dictated by freeze, fire or temperature protection. Actuator shall include a manual override allowing end device to be positioned and locked into place should the actuator fail.

.4 For dampers provide actuator motor with 0.56 Nm per 0.929 m^2 of damper area.

.5 Standard of quality: Belimo

2.3 CONTROL VALVES

.1 Provide valves in accordance with general valve specification. Provide position indicators on valves.

.2 Valves shall "fail safe" in normally open or closed position as dictated by freeze, humidity, fire or temperature protection as follows or as specified in Sections 25 90 02 “Point Database Schedule or 25 90 01 EMCS Control Sequences.

.1	Zone Perimeter Heat Valves	N.O.
.2	Force Flows & Unit Heaters Valve	N.O.
.3	Fan Coil Heating Valve	N.O.
.4	Fan Coil Cooling Valve	N.C.
.5	Air System Heating Valve	N.O.
.6	Air System Cooling Valve	N.O.
.7	Air System Humidifier Valve	N.C.
.8	Differential Pressure Control Valve	N.C.
.9	Main Heating System Valves	N.O.

.3 Terminal equipment two-way valves shall be pressure independent. Each valve shall be complete with PT ports. Size valves for a maximum of 30 kPa pressure drop. Pressure independent functionality shall operate between 5 to 58 PSI. Heating zone valves shall be spring return normally open and cooling valves shall be spring return normally closed. During contractor commissioning of valve, set and or verify that the adjustable CV or flow setting is set to the correct value.

.4 Three way valves shall have linear characteristics. Size valve operators to close valves against pump shut off head. Size three-way valves that are in series with a pump for a maximum of 10 kPa pressure drop. Heating valves shall be spring return normally open and cooling valves shall be spring return normally closed.

.5 NPS 2 and under: Screwed National Pipe Thread (NPT) tapered female connections. Valves to ANSI Class [250], valves to bear ANSI mark. Turndown [50:1] minimum.

.6 NPS 2.5 and larger: Flanged connections. Valves to ANSI Class [150] or [250] as indicated, valves to bear ANSI mark. Turndown [100:1] minimum.

.7 Butterfly Valves NPS 2 and larger:

.1 Body: for chilled water ANSI Class [150] cast iron [lugged body] [wafer body] installed in locations as indicated. For steam and heating water ANSI Class [150] carbon steel [lugged body] [wafer body].

.2 End connections to suit flanges that are ANSI Class [150].

.3 Extended stem neck to provide adequate clearance for flanges and insulation.

.4 Pressure limit: bubble tight sealing to [170] kilopascals.

.5 Disc/vane: [316 stainless steel], [aluminum bronze to ASTM B148].

.6 Seat: for service on chilled water [PTFE (polytetrafluoroethylene)], [EPDM (ethylene propylene diene monomer)]. For service on steam and heating water [PTFE], [RTFE (reinforced PTFE)].

.7 Stem: [316] stainless steel.

.8 Flow factor (KV) as indicated on control valve schedule: CV in imperial units.

.9 Flow characteristic [linear].

.10 Maximum flow requirement as indicated on control valve schedule.

.11 Maximum pressure drop as indicated on control valve schedule: pressure drop not to exceed one half of inlet pressure.

.12 [Normally open] [Normally closed], as indicated.

.13 Valves are to be provided complete with mounting plate for installation of actuators.

.8 Steam valves shall have modified linear characteristics with stainless steel seats. Provide separate valves on individual coils. Two valves in parallel shall have 1/3 - 2/3 load capacities sequenced so that smaller valve opens first. The larger valve shall start opening just before the small valve's fully open position.

2.4 DAMPERS

.1 Provide low leakage type dampers with hollow blades filled with extruded polyurethane insulation for outside air or exhaust air dampers. Damper assembly shall have a thermal insulation value of R 0.35 ^{o}C m^2/W Tamco 9000 or equal.

.2 Blades shall be minimum 2.75 mm extruded aluminium. Blades shall be of air foil design, 150 mm wide. Maximum blade length 1200 mm.

.3 Damper seals shall be designed for minimum air leakage by means of overlapping seals.

.4 Frames shall be minimum 2.75 mm extruded aluminium channel with grooved inserts for seal.

.5 Install blade linkage hardware in frame out of air stream.

.6 Arrange linkage and provide an adequate number of damper operators to ensure that the interconnected damper sections operate in unison without binding.

.7 Damper operators shall be supplied by controls contractor and installed by the Air Processing Unit manufacturer at the factory, in accordance with instructions from controls contractor. Extend drive and provide mounting bracket to place outdoor air actuators outside air stream. Check unit and room height to ensure adequate space if extended through top of cabinet.

.8 Jack shafts:

.1 25 mm diameter solid shaft, constructed of corrosion resistant metal complete with required number of pillow block bearings to support jack shaft and operate dampers throughout their range.

.2 Include corrosion resistant connecting hardware to accommodate connection to damper actuating device.

.3 Install using manufacturer's installation guidelines.

.4 Use same manufacturer as damper sections.

2.5 ANALOG INPUT SENSORS – TEMPERATURE

Application	Type	Operating Range	End to End Accuracy	Remarks
Duct Probe	Tp	0°C to 60°C	±0.3°C	Length to suit duct size.
Pipe Well	Tw	0°C to 50°C 0°C to 100°C 50°C to 150°C	±0.3°C ±0.5°C ±0.5°C	C/w stainless wells, range to suit application c/w rigid metal nipples and metal junction box
Averaging	Ta	-30°C to 50°C	±0.5°C	C/w supporting wire and brackets. Sensors to be covered with copper sheathing.
Room/Space	Tr	10°C to 30°C	±0.3°C	C/w tamper proof cover.
Outside Air	To	-50°C to 50°C	±0.5°C	C/w solar shield.
Surface	Ts	0°C to 50°C 0°C to 100°C 50°C to 150°C	±0.3°C ±0.5°C ±0.5°C	C/w anchor strap.

2.6 ANALOG INPUT SENSORS - RELATIVE HUMIDITY

Application	Type	Operating Range	End to End Accuracy	Remarks
Duct Probe	Hp	5 to 90% RH 0°C to 60°C	±3%	Must be usable over 0 to 100% RH range
Room/Space	Hr	10 to 90% RH 10°C to 30°C	±3%	C/w tamper proof cover.
Outside Air	Ho	5 to 90% RH-50°C to 50°C	±5%	C/w solar shield. Must be usable over 0 to 100% RH range

2.7 ANALOG INPUT SENSORS – PRESSURE

Application	Type	Operating Range	End to End Accuracy	Remarks
Static	Ps	as required: 25 - 50% greater than max design	±2% full scale	Materials to suit medium in contact with device
Differential	Pd	as required: 25 - 50% greater than max design	±2% full scale	Materials to suit medium in contact with device.
Velocity Pressure	Pv	as required: 25 - 40% greater than max design or max measured velocity pressure at full flow rate.	±1.0% full scale	Air: Multi-point static & total pressure sensing element, self-averaging manifold, air equalizer and straightener, max pressure loss 36 Pa @ 10 m/sec. Water & Steam: Annubar or orifice plate.

2.8 ANALOG INPUT SENSORS – ELECTRIC

Application	Type	Operating Range	End to End Accuracy	Remarks
Watt Meter	Kw	as required	±0.25% Full scale	3 current transformers 2 potential transformers as applicable for “Y” or “D” configuration.
Current Transformer	Kw	as required:	±0.25% full scale	
Current Transducers	Ct	as required:	±0.25% full scale	4 to 20 mA DC or 0 to 10 VDC.

2.9 ANALOG INPUT SENSORS – MISCELLANEOUS

Application	Type	Operating Range	End to End Accuracy	Remarks
Carbon Monoxide	Co	0 to 200 PPM	±5% Full range	Electrochemical devices ONLY Device must not be sensitive to ambient air temp or relative humidity.
Turbine Water Flow Meter	Fw	175:1 turn down from 0.052 to 9.14 m/s	±5% Full range	Onicon F-1100 or F-1200 series as required to meet minimum straight pipe requirements.
BTU Meter	BTU	Flow sensor 175:1 turn down from 0.052 to 9.14 m/s	±5% Full range	Onicon System-10 complete with flow and temperature sensors. Available with LONWORK, MODBUS, JCI N-2, Siemens P-1 and BACnet network cards.
		Temperature sensors 0-93.3°C	±0.08°C	
Thermal Dispersion Airflow Measurement	Fag	0 to 25.4 m/s	± 2% of reading	Ebtron Gtx116-P series # of sensors as required to meet C density at minimum straight duct requirements.
Thermal Dispersion Airflow Measurement	Fah	0 to 25.4 m/s	± 2% of reading	Ebtron HTx104-P series # of sensors as required to meet C density at minimum straight duct requirements.
Thermal Dispersion Airflow Measurement	Fas	0 to 25.4 m/s	± 2% of reading	Ebtron STx102 series # of sensors as required to meet C density at minimum straight duct requirements.
Thermal Dispersion Airflow Measurement	Fae	0 to 25.4 m/s	± 2% of reading	Ebtron ELF series.

2.10 ANALOG OUTPUT DEVICES – ELECTRIC

Application	Type	Operating Range	End to End Accuracy	Remarks
To Damper Motors	Dm	4 to 20 mA DC 0 to 10 VDC 0 to 5 VDC	±2% Full Range	Match range if existing
To Valve Motors	Vm	4 to 20 mA DC 0 to 10 VDC 0 to 5 VDC	±2% Full Range	
To Equipment Supplied By Others	Vo	4 to 20 mA DC 0 to 10 VDC 0 to 5 VDC	±2% Full Range	

2.11 ANALOG OUTPUT DEVICES – PNEUMATIC

Application	Type	Operating Range	End to End Accuracy	Remarks
To Damper Actuators	Da	20 - 104 kPa	±2% Full Range	I/P transducer, provide output pressure gauge.
To Valve Actuators	Va	20 - 104 kPa	±2% Full Range	I/P transducer, provide output pressure gauge.

2.12 DIGITAL INPUT DEVICES

Application	Type	Operating Range	End to End Accuracy	Remarks
Dry Contact	Dc	N/A	N/A	
End Switch	Esw	N/A	N/A	Adjustable position.
Level Switch	Lsw	N/A	N/A	Adjustable setpoint and differential. Pressure rating suitable to application.
Pressure Switch	Psw	as required	±1.5% Full Scale	Adjustable setpoint and differential.
Temperature Switch	Tsw	as required	±1°C	Adjustable setpoint and differential. Manual reset for freeze protection.
Current Sensitive Relay	Ri	as required	N/A	Adjustable trip setpoint and Differential.
P/E Relay	Pe	0 – 120 kPa	N/A	Adjustable setpoint and differential.

2.13 DIGITAL OUTPUT DEVICES

Application	Type	Operating Range	End to End Accuracy	Remarks
Relays	Ry	N/A	N/A	DPDT, plug-in type terminal base. Contacts rated to suit motor starter.
E/P Relays	Ep	N/A	N/A	

Part 3 Execution

3.1 INSTALLATION

.1 All transducers and devices are to be mounted in equipment cabinets with hinged doors. Unless specifically approved in writing, equipment cabinets shall be installed near RCU cabinets, at eye level, in easily accessible areas, on solid walls or supported away from vibrating equipment. Cabinets not in mechanical rooms shall have lockable doors keyed the same as RCU cabinets.

.2 For all sensors in piping, confirm locations of wells and availability of any existing wells where applicable. Use thermal conductive compound when installing sensors to ensure proper thermal coupling of sensor to well. No more than 2 meters of flex shall be used between sensor housing and raceway. Flex to be secured within 1 meter of sensor.

.3 Install a pressure gauge on the signal line of each electro-pneumatic transducer (EPT) or pneumatic controller, excepting room temperature controllers.

.4 Install a brass tee in the high and low side lines of every air flow station and differential pressure transducer, excepting those on room VAV box controls. Cap off open end of tee with 10 cm stub and plug or brass coupling and rubber cap Tees to be located close to device in such a manner as to allow for easy access during commissioning procedures.

.5 Coordinate with mechanical contractor to ensure flow stations supplier minimum straight duct requirements are maintained.

END OF SECTION

Part 1 General

1.1 INTENT

.1 Read this Section in conjunction with Section 25 05 01 - EMCS General Requirements and other related EMCS Sections.

.2 The Central Control Station (CCS) hardware consists of the IBM-PC compatible computer, alarm printer, report printer and power side protection.

.3 The external system serial interface device (modem or serial device server) is included to allow a Portable Control Station (PCS) to have off-site access to the EMCS. It is intended that this device be connected directly to an RCU so that operation of the CCS is not necessary to gain access to the system.

Part 2 Products

2.1 CCS COMPUTER - HARDWARE FEATURES

.1 PC compatible computer, fitted in tower case, utilizing current industry standard ATX form-factor motherboard with the following features minimum:

.1 Intel Quad Core 3.6 GHz. I7 microprocessor LGA2011 socket

.2 Three x16 - PCIe slots.

.3 8 Gbytes of RAM

.4 Three USB 3.0 ports, (one to be front panel mounted).

.5 One front panel mounted multi-card slot for (SD, miniSD, etc)

.6 One external eSATA III 6Gb/s interface port

.7 Two Ethernet ports (100 Mbps minimum)

.8 Ability to boot from hard drive and Blu-Ray drive.

.2 Redundant mass storage devices in the form of TWO mirrored hard drives. Mirroring shall be accomplished using a Raid 1 capable hard drive controller specifically designed for this purpose. Software-only mirroring solutions are not acceptable. Both hard drives shall be identical (same make, model, speed and capacity) with the following features:

.1 1 Tbytes minimum capacity.

.2 7200 RPM minimum rotational speed.

.3 6ms maximum average seek time.

.4 6 Gb/s SATA interface

.5 Enterprise RAID service rated for 24-7 operation (eg. WD RE4)

.3 Trend Storage:

.1 Size CCS redundant mass storage devices to allow the following data

.1 30% of all connected physical points

.2 All set-points

.3 All controller output values to be recorded every 5 minutes for a duration of 6 months.

.4 If required data storage exceeds 30% of available space on the CCS redundant mass storage's two mirrored hard drives, OR if system capabilities do not reliably allow required rate of trend storage with CCS hardware, provide a Trend Storage Device as follows:

.1 Self-contained, separately powered, modular drive cabinet capable of holding 4 drives minimum.

.2 Enterprise RAID service rated drives for 24-7 operation (eg. WD RE4)

.3 RAID 5 with hot spare or RAID 10

.4 Ethernet (1Gbs) BACnet TCP/IP interface.

.5 Include all necessary software and cabling and configure for turn-key operation.

.1 Submit calculation of storage requirement.

.5 Blu-Ray HD DVD drive capable of 12X BD-R read/write, 6X BD-RE rewrite, 16X DVD+/-R read/write, 40X CD-R read/write. Provide 5 BD-RE disks and 10 DVD+RW disks.

.6 Mass storage backup in the form of one external hard drive with the following features:

.1 USB 3.0 interface

.1 minimum 100g shock rating

.2 1 Tbyte minimum capacity

.3 padded carrying case

.7 Colour monitor and graphics card:

.1 LCD TFT Monitor, minimum screen size 609 mm (diagonal measurement).

.1 Minimum 1920x1080 pixel resolution.

.2 600:1 minimum contrast ratio, 160 degree minimum viewing angle

.3 250 cd/m2 minimum brightness , 8ms or better response time

.4 Screen brightness, contrast and image sizing controls.

.5 Video card to have compatible PCIe bus and capable of driving supplied monitor to its maximum resolution including 1680x1050, 1280x1024, and 1024x768 all in 32 bit colour as well as IBM SVGA and VGA in 16 bit colour.

.6 Screen image must be free of flicker, clear and sharp over entire screen area at all display resolutions.

.8 101 key keyboard with built in numeric keypad and 12 function keys.

.9 Optical wheel mouse with mouse pad. Wheel button to be programmed to act as double left click. Wheel to be programmed for scroll function.

.10 Safe shutdown of the CCS and mass storage components when power failure to the computer is detected. Provide for automatic restart of control system interface software once power has returned and has been stable for at least 1 minute.

2.2 CCS REPORT PRINTER

.1 Paper sheet fed printer, HP III laser jet compatible, with:

.1 2.0 Mbytes memory minimum.

.2 six page/minute minimum speed.

.3 250 sheet minimum capacity feeder tray.

2.3 CCS POWER SIDE PROTECTION

.1 For each CCS provide an uninterruptable power source (UPS) with:

.1 true continuous duty Delta-Conversion on-line design, 1500VA minimum. Inverter section rated for full load +10% short term overload. Standby models not acceptable.

.2 input harmonic current content less than 15%.

.3 pure sine wave output synchronized to utility line. Output harmonic current content less than 15%. Square, triangular or stepped output waveforms not acceptable.

.4 continuously regulated output 115 Vac +/- 5%, 60Hz +/- 0.1% for input voltages between 90 and 132 volts.

.5 isolated neutral and both normal and common mode transient protection with response time of less than 5 nanoseconds.

.6 dynamic clamping when tested against ANSI/IEEE C62.41-1991, and as follows:

.1 A Ringwave clamping 250V, peak 350V.

.2 B Ringwave clamping 250V, peak 350V.

.3 B Impulse clamping 400V, peak 450V.

.7 series or isolating design with silicon suppressors (transorbs, avalanche diodes). Devices that rely solely on MOVs not acceptable.

.8 over current and over temperature protection with failure indication.

.9 sealed maintenance free batteries with sufficient capacity to provide 20 minutes of on-battery power to the CCS, alarm printer and serial interface device.

.10 a recharge period, after 90% discharge, not exceeding 6 hours.

2.4 CCS Desk

.1 Provide a computer desk with the following features:

.1 Raised platform for monitor and alarm printer. Platform to be of sufficient height to allow keyboard, mouse and pad to slide underneath.

.1 Book shelf capable of storing all provided computer and O&M manuals.

.2 Two drawers with roller or ball bearing slides.

.3 Adequate space for computer, all peripherals and UPS or line conditioner as applicable. If location is enclosed or has a door or panel that can be closed, then ensure adequate ventilation is provided. Ambient temperature around computer and UPS shall not exceed 40 degC with all equipment powered and in active operation.

.2 No electronic peripheral or device shall be located on the floor.

.3 With all peripherals and devices in place, there shall be a clear work surface on the portion of the desk directly in front of the monitor. The size of this space shall be no smaller than 50cm by 80cm.

2.5 SYSTEM SERIAL INTERFACE DEVICE AND REMOTE COMMUNICATIONS

.1 Serial device server for encapsulating serial data and transporting it over Ethernet for remote communications using a common web browser. Device shall connect to system RS-232C port and include all required software to configure unit as well as create a virtual serial link over the corporate intranet. Standard of quality: Lantronix UDS-10-IAP.

2.6 OPERATING SYSTEM AND BACKUP UTILITIES SOFTWARE

.1 For each CCS and PCS, provide the latest full version of an industry standard operating system such as Windows XP/NT, complete with all available commands and functions.

.2 For each CCS and PCS, provide a complete set of disaster recovery CD-R drive utilities such as Symantec/PowerQuest Drive Image, capable of:

.1 creating a complete image backup of the CCS or PCS hard drive onto multiple spanned CD-Rs or an external backup hard drive.

.2 restoring hard drive contents by simply inserting a backup CD and turning on CCS or alternatively inserting a recovery disk followed by image backup CDs.

.3 partitioning and formatting a newly installed hard drive.

.4 automatic unattended backup of selected EMCS data directories into a separate backup directory.

.3 For each CCS, provide utilities that allow one of the mirrored hard drives to be replaced should a failure occur. The utility shall be capable of automatically rebuilding a complete bootable image of the good hard drive onto the new replacement hard drive. If such capability is available via the computer's firmware, then additional utilities are not required.

.4 Provide complete installation CD/DVDs for each copy of system and utility software. Include all hardcopy manuals. If programs were delivered via download, then copy all such programs, required license files and serial numbers as well as installation notes, onto CD/DVD. Print installation notes and include with CD/DVDs in suitable marked binder.

2.7 GRAPHICAL OPERATOR INTERFACE APPLICATION SOFTWARE

.1 For each CCS and PCS provide an operator interface which allows:

.1 complete manual and automatic unattended saving, to the CCS's/PCS's hard drive, of ALL volatile and configurable information in every RCU and TCU. Battery backed RAM and EEPROM is considered volatile for these purposes.

.2 complete loading of all information specified above.

.3 editing of all programmable or configurable information including but not limited to database, passwords, User Control Language programs, control loop parameters, report setups, equipment start/stop schedules, etc.

.4 loading of User Control Language programs created and edited off line on an compatible computer.

.2 The PCS operator interface shall:

.1 be able to interface to the EMCS locally through a hardwire connection at any RCU location or from off-site via the system serial interface device.

.2 provide the same compliment of functions and be identical in look and feel to the CCS interface no matter the type of connection or method of access.

.3 be a complete software package unto itself. Screen/keyboard mimicking software such as "PC Anywhere" is not allowed.

.3 Basic features:

.1 Windows style point and click operation with mouse, pull down menus or pop-up windows.

.2 Integrated "Help" application with information on basic operating procedures etc.

.3 Real time display of clock and operator identification.

.4 Automatic logging of operator sign-on/off including time and operator ID.

.5 Automatic display and logging of alarm occurrence including point mnemonic, message, time and date.

.6 Minimum 256 colour capability.

.4 Real time dynamic graphing display of trend data:

.1 Minimum of 4 points per graph with data from each point in a different colour.

.2 Allow analogue and digital data from physical and virtual points on same graph.

.3 Ability to select/deselect point data that is displayed.

.4 Two vertical scales with automatic grouping of points with same units.

.5 Automatic scaling on both axes to fit range of data displayed with ability to manually expand, under direct mouse control, any portion of the time scale to magnify data of interest.

.6 Graphing shall be in real time so as to include new data as it is trended.

.7 NOTE: Trend definition and setup are defined as RCU functions.

.5 Allow user to **view** dynamic point data superimposed upon a schematic diagram, photograph or blank background as required by the type of information displayed. These dynamic graphic displays (graphics) shall have the following features:

.1 Allowed number of graphics shall be no less than:

.2 6 + (number of TCUs) + (total number of RCU physical points / 15)

.3 Graphics shall be linked so as to allow for logical navigation through the displayed information.

.4 Each graphic shall be capable of displaying point mnemonic, value, units, alarm condition and operational status (auto/manual/failed) from at least 32 physical or virtual points. Data shall be logically positioned on the graphic screen.

.5 Displayed points shall be able to be commanded to any allowed state or value directly through the graphic. A point and click shall reveal the states/value window for the selected point. A state selection or value entry followed by a confirming click should end the operation and place the point into the desired state.

.6 Automatic update period for entire graphic shall be no longer than 10 seconds.

.6 Allow user to view documentation files for a displayed mechanical system by simply clicking upon a documentation link on the menu bar.

.7 Allow user to create and edit simple, text based, dynamic point data display pages as follows:

.1 The number of available display pages shall be no less than:

.2 10 + (number of TCUs) + (total number of RCU physical points / 10)

.3 Each display page shall be capable of showing data from at least 20 physical or virtual points.

.4 Each point location shall display point mnemonic, value, units, alarm condition and operational status (auto/manual/failed).

.5 Automatic update period for the entire page shall be no longer than 10 seconds.

.6 Pages shall be able to be able to be linked in whatever order is necessary to allow for logical navigation through the information.

.8 Provide complete installation disks or CDs for each copy of operator interface software.

2.8 GRAPHIC SCREEN CREATION/EDIT APPLICATION SOFTWARE

.1 For one CCS provide a dynamic colour graphics package which allows user to create, modify and delete dynamic graphics screens used within the Graphical Operator Interface.

.2 Basic features:

.1 Windows style point and click operation with mouse, pull down menus or pop-up windows.

.2 Allow creation of graphic links among screens and to trend graphs.

.3 Mechanism for copying, editing and saving graphics with similar layouts to create a custom library of generic schematics.

.4 Often used functions shall have a keyboard counterpart to improve the efficiency of the editing process.

.5 Minimum 256 colour capability.

.3 Creation and modification of graphics backgrounds shall allow:

.1 owner creation of symbols which can be stored in a custom symbol library.

.2 control of symbol scale, infill colour and location on screen.

.3 control of line and geometric shapes drawing.

.4 control of alpha numeric text and information windows.

.5 editing of text with search and replace feature.

.6 photographs to be used as graphics backgrounds or portions of backgrounds.

.4 Addition and modification of superimposed dynamic data shall allow:

.1 any combination of analog/digital information, graphic symbols or text, to be displayed at any location on the screen, minimum of 32 physical/virtual points per graphic.

.2 any combination of logical point mnemonic, descriptor, value, units and whether the point is in auto or manual operation, to be assigned for display at any point location.

.3 different symbol infill colours to be displayed based upon the state of a linked dynamic digital input or alarm point.

.5 Provide features to link Adobe Portable Document Format (.pdf) or text (.txt) based documentation files to graphic screens. Provide required editors to create and modify documentation file contents.

.6 Provide complete installation disks or CDs for each copy of graphics screen creation/edit software.

Part 3 Execution

3.1 INSTALLATION

.1 Install all CCS hardware, software and peripheral devices at location specified. Neatly arrange all interconnect cabling. Loop and wire tie as necessary. Affix power bar and cabling to rear of desk as appropriate to ensure wiring remains off floor.

.2 CCS shall be connected to emergency power if such is available in the facility.

.3 All CCS hardware shall be powered from the same electrical outlet on the same circuit. The power side protection device UPS shall serve all of the CCS hardware.

.4 Under no circumstances shall the CCS share the same circuit as motorized equipment. Provide a separate circuit if necessary.

.5 Install an optically coupled data communications isolation and surge suppression device if the CCS is connected to an RCU with a non-isolated connection (i.e. RS-232 etc.) and any one of the following conditions exist:

.1 The CCS and RCU are not on the same electrical circuit.

.2 The CCS to RCU communications cable is more than 30 meters long.

.6 Install system serial interface device (modem or serial device server) at any convenient RCU. Securely attach device inside RCU or adjoining equipment cabinet, neatly arrange and wire-tie all cables. Install all required communications software and setup system alarming/messaging structure. Device shall be powered from the same electrical circuit as

the device to which it is connected. If specified above, install data line isolation device at modem end of the RS-232 connection.

.7 Configure automatic backup and notification features of user interface and disk utilities as follows:

.1 Every two weeks, backup onto hard drive, ALL volatile and configurable information in every RCU and TCU.

.2 Every month, backup into separate hard drive backup directory, labeled by month (i.e. C:\Backup_Jan, C:\Backup_Feb, etc), the latest bi-weekly system backup.

.3 Every 3 months, send a notification message to the CCS screen as well as to the printer, requesting the operator to create a complete disk image backup onto DVD-R or removable hard drive.

3.2 SYSTEM GRAPHICS

.1 Every installed physical point, schedule, setpoint, user adjust point and alarm must appear at least once on an appropriate screen graphic. Locate points as close as possible to their graphical representations. Schedules and system user adjusts shall be located under the respective system title, left justified. Setpoints must be located under the sensed value but displayed in a different, less prominent colour.

.2 Selection of data shall be appropriate with regard to the underlying system schematic diagram and allow for complete operation and trouble shooting as determined by the sequence of operation. Virtual point data that is important to determining the proper operation of the system shall be included. These may be schedules, user adjusts, space condition information, control loop output values, etc.

.3 Air systems and major equipment shall be rendered as simple 2-dimensional or very flat 3-dimensional outlines with solid colour fill. The outline colour shall be similar to, but provide some contrast against the fill colour. Ductwork outlines, fans and pumps shall have a shape or arrow indicating direction of flow. In general colours shall be as follows:

.1 Air systems: Grey

.2 Boilers, coils and related piping: Yellow

.3 Chillers, coils, cooling towers and related piping: Green

.4 Domestic cold water: Light Blue

.5 Domestic hot water: Green

.6 Fire equipment and related piping: Red

.7 Glycol heat exchangers, coils and related piping: Vista Green

.4 Equipment outlines shall be sized to allow sufficient room for all required dynamic display information to be placed on the screen without creating a cluttered appearance. The graphic designer shall strive to create graphics that provide ease of operation, simplicity and a clean appearance. Text must be large enough for easy viewing and colours should be selected to match visual impact with the importance of the information being displayed. However, the use of too much or clashing colours, or colour combinations that cause eye strain because of incompatible perceptual depths, must be avoided.

.5 Units of ON/OFF shall be reserved for a device's actual input point operating status. The commanded condition of a device or virtual point flag shall be defined as Start/Stop, Enable/Disable, Yes/No, Go/NoGo, etc.

.6 Analogue input or output values with units of "%" shall be shown as % of product. This is to be the case regardless of the safe failed position of the final control element. Example: cooling coil valve at 100% means full flow through coil, heating coil valve at 100% means full flow through coil even though signal to valve may actually be zero.

.7 A depicted device, or portion of that device shall show green when the device command state and status are ON, grey if they are both OFF and flashing red when in an alarm condition. An alarm shall not be displayed unless command value and status do not match and then only after the allotted alarm timeout has expired.

.8 Every point on every graphic shall indicate, with colour change or appended letter, whether or not it is under manual override control.

.9 Floor plans are to be colour coded to the air handling unit serving that portion of the floor. Selecting (left clicking) the area shall bring up the air handler's graphic. Co-ordinate colour scheme with Owner.

.10 For facilities with large floor plates, provide a small key plan in the lower right hand portion of each screen to show the depicted floor plan as a shaded portion relative to the building outline. Include floor number if appropriate. Provide links in the key plan to allow navigating to other areas of the same floor, or to jump to the same portion on another floor.

.11 Graphic titles shall be located at the top center of each screen in a simple bold font of sufficient size to be obvious as a title. Colour shall be white or other neutral colour that provides sufficient contrast against background without detracting from the mechanical system portrayed.

.12 The date of the last revision shall be located in the very top right hand corner of the graphic. Format as yyyy/mm/dd using a small but legible font in a shade that has just enough contrast to be seen without making it obvious to a casual glance.

.13 Create a menu bar containing links at the bottom of each graphic screen with the exception of the Startup screen. The bar shall be placed in exactly the same location on every graphic and have link buttons of exactly the same size to allow logical browsing through the mechanical systems without moving the mouse. The bar shall provide the following links to standardize movement:

.1 MAIN: locate in first (furthest left position) on all but the Main screen. Selection of MAIN will cause Main screen to be displayed. On the Main screen, put "BYE" in this location. Selection of BYE will sign-off operator and display startup screen.

.2 PREVIOUS: locate in second position on all but the startup screen. Selection of this link button will bring up "last viewed" graphic.

.3 Custom Buttons: locate in center area of bar. Name and arrange to scroll through screens in logical order.

.4 MLOG: locate in second last position on every screen. Selection of MLOG will display and operator editable text file that can be used by the operators to enter useful maintenance information or to document equipment problems.

.5 DOC: locate in last position on all but the Main screen. Selection of DOC will display the documentation relating to the portrayed mechanical system. On Main screen, put "HELP" in this location. Selection of HELP will bring up the EMCS's help application

.14 As a minimum, create and link dynamic graphic display screens as follows:

.1 One or more graphic screens for each mechanical system under EMCS monitoring or control as well as for miscellaneous systems such as domestic hot/cold water, emergency generator, parking garages, lighting, parking lots, etc.

.2 Link the relevant portions of the electronic Operating and Maintenance Manual, located in the C:\O&M_Manual directory, to the "DOC" button on the menu bar of each graphic screen. As an acceptable alternative, create text based mechanical system documentation files for each mechanical system and link these to the relevant "DOC" buttons.

.3 One graphic screen for each Terminal Control Unit (TCU).

.4 Building floor plans showing location of TCUs and displaying each room temperature. Besides normal menu bar, provide suitably located links to each TCU graphic.

.5 TCU summary screens showing the space temperatures, setpoints, damper positions and flow rates (VAV) for a group of TCUs. Group TCUs as per the air system serving a particular area. Provide links to respective air systems and to individual TCU graphics.

.6 Alarm summary screens.

.7 Schedule summary screen.

.8 Main screen with overall building plan showing approximate locations of mechanical rooms. Title "MAIN SCREEN". Besides normal menu bar, provide suitably located links to floor plans, alarm summary and schedule screens as well as all mechanical systems depicted on the overall plan. Main screen must display outdoor air conditions.

.9 A startup screen that is displayed when no operator is signed onto the system. It shall consist of a photograph of the front of the building with the title being the building name. Outdoor air conditions may be displayed but nothing more. A selection (left mouse click) anywhere on the screen shall bring up the system's sign-on window. On proper sign-on, main screen shall be displayed.

END OF SECTION

Part 1 General

1.1 INTENT

.1 Read this Section in conjunction with Section 25 05 01 EMCS General Requirements and other related EMCS Sections.

Part 2 Products

2.1 REMOTE CONTROL UNITS GENERAL

.1 Each RCU shall:

include a real time operating system that:

.2 executes control, timing and sequencing of all programs.

.3 performs multi-tasking to run programs and concurrently communicate with other RCUs and the CCS over the high speed network, with TCUs connected its sub-network or with the serial ports.

.4 provides automatic means of sharing physical and virtual point information with rest of system.

.5 automatically restarts RCU when power is restored.

.6 as diagnostic software to test RCU integrity, and data transmissions.

1. provide fully stand-alone operation by acquiring information from input points and locally processing this information to control output devices according to the User Control Language.
2. record, evaluate and report changes of state/value that occur to physical or virtual points within the RCU.
3. keep a record of security passwords, and supervise any local operator access to the EMCS.
4. include all necessary hardware, software and firmware as required to interface to primary network and the sub-network as defined in Section 25 05 02.
5. allow the processing and execution of operator commands as well as the downloading of the complete RCU programming and database, from a Central Control Station (CCS), locally connected laptop computer (PCS) or from a remote PCS through serial interface device (modem).

.7 Any slave panel, sub module, or any form of point expansion panel that is connected to an RCU, and located within 1 meter of the RCU, shall be considered an integral part of the RCU.

.8 The data base and control strategies for any point connected to a slave panel, sub module or point expansion panel shall be resident in the RCU.

.9 Only BACnet devices are allowed.

2.2 REMOTE CONTROL UNITS FEATURES

.1 Minimum 32 bit full floating point mathematics.

.2 Minimum 8 inputs and 8 outputs. Maximum of 128 input/output points.

.3 Minimum of one sub-network port.

.4 Minimum of two serial ports for communication with any two system peripherals, such as a printer or portable operator terminal and a modem or serial device server.

.5 Watchdog timer. Failure of RCU shall automatically switch outputs to a pre-selected fail-safe condition and initiate a cold restart.

.6 Real Time Clock accurate to one minute per month and capable of maintaining accurate time through a 72 hour power failure. Clock to be synchronized to a master timekeeping RCU or the CCS real time at least every 24 hours.

.7 Network monitoring routines. Failure of primary network or sub-network shall be detected. RCU shall continue to control environment using last reliable setpoint or operating mode. A read-only indicator of this failure shall be available for use within the custom controls programming.

.8 Hardware monitoring routines. Failure of any RCU physical point shall be detected. RCU shall continue to control environment using last reliable information. A point attribute or other read-only indicator of this failure shall be available for use within the custom controls programming.

.9 Permanently marked removable terminal block for the wiring of all sensors, control devices, network and RCU power.

.10 Free standing or wall mounted robust metal or plastic cabinets with hinged and key-locked front door with common keying for all RCU and equipment cabinets.

2.3 MEMORY

.1 User Control Language program and data base memory shall be EEPROM or 72 hour battery or capacitor backed RAM.

.2 Data/stack memory space shall be 72 hour battery or capacitor backed RAM.

.3 System firmware shall be in non-volatile EEPROM memory.

.4 Provide sufficient memory:

1. to allow creation and execution of specified User Control Language programs. As a minimum, for each connected physical point, provide sufficient capacity to create programs containing the following:

.5 10 logical operators (eg. AND, OR, NOT)

.6 10 mathematical operators (+, -, /, *, ^)

.7 Five commands or functions (eg. START, STOP, MIN, MAX, SQRT)

1. to create one PID controller for every available analogue output.
2. to simultaneously maintain 256 trend samples for each physical point connected to the RCU.
3. to contain the data base for all physical points and for two virtual points for each physical point connected to RCU as well as at least one annual schedule and 2 daily schedules.

2.4 SIGNAL PROCESSING

.1 Analog Input Processing:

1. Each analog input shall be converted to digital format at a minimum frequency of 1 conversion per second.
2. Analog to digital conversion shall have sufficient resolution to provide the minimum end to end accuracy defined in Section 25 05 61 plus one bit, but shall not be less than 10 bits.
3. Relative errors between analog inputs shall not exceed 0.25% of span.
4. Each input shall be individually calibrated for zero and span in software.
5. On board circuitry shall protect each input from short circuit and have a 500 volt minimum isolation.
6. The following ranges are required:
   - .1 4 - 20 mA DC
   - .2 0 - 10 VDC
7. A special range for direct input resistance temperature sensors is allowed.

.2 Analog Output Processing:

1. Each analog output shall be converted to analog format at a minimum frequency of one conversion per second.
2. Digital to analog conversions shall have 8 bit resolution minimum. The output signal shall be linear.
3. Each output shall be individually calibrated for zero and span in software.
4. On board circuitry shall protect each output from short circuit and have 500 volt minimum isolation
5. The following ranges are required:
   - .1 4 - 20 mA DC
   - .2 0 - 10 VDC

.3 Digital Input Processing:

1. Inputs shall accept dry contacts.
2. Provide one pulse counter input per RCU which will accept pulse rates up to 1000 Hz.
3. Provide minimum 500 volt isolation for each point through use of optical isolators or equivalent on termination board.

.4 Digital Output Processing:

1. Provide outputs capable of switching a 120 VAC external power supply, or triac SCRs rated at 0.5 Amp 24 VAC minimum.
2. Provide full protection to hardware and software from switching transients.

2.5 POWER SUPPLY

.1 For each RCU, provide:

1. a line voltage isolation transformer.

2. a power supply with fused over current protection and power on indication.
3. transient surge suppression as part of the power supply or as a separate device.

.2 Transient surge suppression requirements:

1. Provide protection from both Normal and Common Mode transients. Response time to Common mode transients shall be less than 5 nanoseconds
2. Let-through voltages (L-N) when tested against ANSI/IEEE C62.41-1991 and C62.45, 1992 shall be as follows:

.3 Category A3 and B3 Ringwave (6000V, 200A) let-through less than 15V.

.4 Category B3/C1 Combination (Impulse) Ringwave (6000V, 300A) let-through less than 200V.

1. Separate devices shall use hybrid circuits. Circuits that rely solely on MOV's or avalanche diodes will not be accepted.
2. Separate devices shall have a minimum nominal capacity rating of 3 Amps at 120 VAC or three times the maximum current draw of the RCU and all connected components, whichever is greater. The device shall be either UL listed or CSA approved.
3. Provide documentation or test results that show that transient suppression meets the specified requirements.

2.6 DATA BASE

.1 Provide data base creation and modification at a CCS, a PCS connected to any RCU serial port or from a remote location via the system's serial interface device. The user shall have data base manipulation capability, while on line, to add, modify and delete points, alarms, schedules, trend logs, custom point groups, start/stop sequences, engineering units, spring ranges and point maps.

.2 Each physical and virtual point shall be tagged with a unique name according to the most recently available "Alberta Infrastructure EMCS Guideline for Logical Point Mnemonics". Specialty points or functions such as alarms, totalizers, point groups, etc., shall be assigned a unique name closely resembling the point mnemonic of the associated points.

.3 Provide:

1. virtual points which can store 32 bit floating point numbers and which can be manipulated in the same manner as analog or digital physical points.
2. custom units, minimum 6 characters in length, assignable to any point or state of point operation (examples: L/s, KWhrs, High, Slow, Off, mA, Jouls)
3. conversion tables or other mapping functions for analog input and output points that define how the input or output hardware values relate to the engineering units used. Accommodate non-linear relationships using a mathematical formula or a conversion table with a minimum of 10 individually definable segments.
4. mapping functions for digital input, output and virtual points for assigning any pair of engineering units to the active/inactive or energized/de-energized states of the points (examples: Start/Stop, On/Off, Open/Closed, Alarm/Normal, Yes/No, Enable/Disable, Lead/Lag).

5. totalization functions for digital input, output and virtual points capable of counting the accumulate hours or minutes of run time or contact status for at least 9999 minutes.

2.7 BASIC OPERATOR INTERFACE

.1 Provide a basic, RCU hosted, system/operator interface with:

1. interrogation via a text based command line, a succession of menus, or a graphical user interface.
2. basic creation and editing of physical and virtual point database.
3. software grouping of points for monitoring and system control functions.
4. dynamic data display of a selected grouping of points with all required functions to create or edit display data groups.
5. operator override capabilities that allow manually command/override of any physical or virtual point to a desired state or value, so that User Control Language programs cease to control that point.
6. at least three access security levels for a minimum of eight operators with hard copy reporting of all authorized and unauthorized sign-on or sign-off events.

.2 Provide software packages and interface cables for each PCS to access the EMCS through the RCU via the basic operator interface. A minimum of one package shall be provided.

2.8 ALARMS

.1 Provide RCU operating system alarms for the following malfunctions:

1. Communications failure with any connected TCU or adjacent RCU.
2. Watch-dog-timer activation.
3. Input or output point failure.
4. Control program execution error (divide by zero, etc.)
5. Power interruption restore or other cold start

.2 Provide change of state alarms for digital physical or virtual points with user selection of which digital contact state is the alarm.

.3 Provide high and low limit alarms for analogue physical or virtual points with user defined high and low alarm limits as well as relative alarm limits (differential) referenced to a virtual set-point such that the alarm limits automatically adjust with change in set point value.

.4 Alarms shall be able to be directed to the CCS and/or a peripheral device at any user-defined RCU serial port.

.5 Provide ability to automatically disable an alarm or group of alarms based upon the status of any selected digital physical or virtual point.

.6 Each non-system alarms shall have user adjustable time delay settable within a range of 5 seconds to 30 minutes.

.7 Alarms shall be able to be categorized as critical or non-critical. Critical alarms shall require operator acknowledgement.

.8 Each non-system alarm shall include a user defined alarm message, 30 characters minimum length.

.9 All alarms shall be logged with:

1. current time, date and initials of on-duty operator.
2. point mnemonic and description.
3. current value or status, including engineering units.
4. nature of alarm - high or low, on or off, open or closed, etc.
5. critical or non-critical alarm designation.
6. alarm message

2.9 TREND LOGGING

.1 The RCU shall be able to trend log all physical or virtual point, controller output, or schedule result defined in the RCU or any TCU connected on its sub-network . Required features:

1. User defined start and stop times or continuous sampling.
2. User adjustable sampling frequency from 5 seconds to 24 hours.
3. Number of samples per trend selectable from 1 to 128.
4. User selectable sample initiation by time interval or change of state.

.2 RCU shall be able to automatically dump trend data to the CCS hard drive at user specified intervals or to clear allocated RAM when full. Stored data shall be in ASCII format.

.3 Trend reports shall display and print a minimum of four logged points across the page. RCUs with graphic interface shall be able to display trend data graphically.

2.10 SCHEDULING

.1 Provide a minimum of two annual/holiday schedules as well as 20 start/stop schedules for designated points or groups of points.

.2 Start/stop schedules shall allow defining a minimum of 4 starts and 4 stops per day to a resolution of 15 minutes. Each schedule shall include weekend, holiday and annual schedule skip features.

.3 Provide:

1. time delays between successive commands (for groups of points).
2. operator override of the schedule for each point.
3. report of all time schedules and their associated commanded points.

2.11 REPORTING

.1 Reports and logs shall be able to be directed to the CCS and/or a peripheral device at any user-defined RCU serial port.

.2 Reports and logs shall:

1. be capable of manual or automatic (time and date or event) initiation.
2. include a header with a report title as well as the current time and date.

3. include sufficient English language description to allow the contents to be understood by anyone with modest controls familiarity.

.3 For the RCU and any TCU connected on its sub-network, provide:

1. summary reports with current list of:
   - .1 operator overridden points.
   - .2 points in alarm condition.
   - .3 points in trend logs.
   - .4 totalized points.
2. reports listing current point value or status for any building, system, or user-defined group of points.
3. database, alarm, trend and schedule reports that produce on-screen and hardcopy listings selectable by individual point, point type or database category. Listings to include current data and all information required to re-create the selected database elements.

.4 Provide operator access reports listing the operator's name, password, on-duty initials and system access level or access matrix.

.5 Provide security log reports listing at least the last 500 system transactions including operator initials, command performed and time and date. Include all sign-on, sign-off and invalid system access attempts.

.6 Provide system diagnostics reports that list current and past system hardware and software errors.

2.12 USER CONTROL LANGUAGE (UCL)

.1 The User Control Language (UCL) shall allow the user to develop and program custom operational sequences, unique control algorithms, interactive point relationships, custom calculations using any combination of mathematical, relational and logical operators. UCL custom control sequences shall be able to:

1. calculate flow rates, energy consumption, electrical demand and heating/cooling loads.
2. determine equipment run times and durations of events.
3. calculate operating setpoints.
4. start and stop equipment.
5. modulate or place dampers and valves in any calculated position.
6. enable/disable alarm functions.
7. enable/disable control loops and manipulate their bias values, gains and output ranges.

.2 The following UCL program formats are acceptable:

1. Traditional text based languages that are styled upon a line by line "high level" computer programming language such as C, Pascal, Fortran or BASIC. Low level assembler or macro style languages are NOT acceptable.
2. Block/object or graphic style languages that are formatted by linking predefined library modules, if and only if they allow the user to create and modify custom

blocks/objects using a richly featured line by line text based "high level" computer programming language such as C, Pascal, Fortran or BASIC.

3. Any block/object or graphic style language, if the total number of terminal boxes served by each air system is less than 20, OR, if the total number of connected physical points is less than 80. Terminal Control Unit points or simple alarm only points are not to be included for the purpose of this determination.

.3 The UCL shall be modular in construction allowing a minimum of one independent program or graphic programming screen page, for every 8 physical points connected to the RCU.

.4 The UCL shall allow comments to be embedded anywhere in the source code or on a graphic programming screen page.

.5 The traditional text based "high level" language, used to create the operational sequences or custom blocks or library routines, shall allow expressions (i.e. a program lines) :

1. containing 5 levels of parenthesis
2. containing at least 10 mathematical and/or logical and relational operators in any desired order and combination.
3. containing mixed mode mathematics (combined use of math and logic operators), using normal order of mathematical precedence, not simply left to right.
4. with a minimum line length of 128 characters.

.6 Provide mathematical operators for:

1. addition, subtraction
2. multiplication, division
3. square roots, exponents

.7 Provide logical and relational operators for:

1. and, or, not
2. equal to, not equal to
3. less than, greater than

.8 Provide branching features for:

1. unconditional branching to another line, label or graphic entry point in the same program module.
2. conditional branching in the form of IF...THEN...ELSE statements that can be nested to a minimum of 3 levels or graphic objects with similar capabilities.
3. calling a subroutine, program module or graphic block/object with return to calling routine.

.9 Provide functions, procedures or graphic blocks/objects which calculate or obtain:

1. current time, day of week and date in decimal or integer format.
2. operational status of RCU network communications.
3. operational status of TCU sub-network communications.
4. operational status of any connected point (in/out of service, failed, alarm)

5. minimum, average and maximum values of a minimum group of 5 variables, points or numeric expressions.
6. value of a variable, point or expression, limited to a set range between limiting values or numeric expressions representing allowable minimum and maximum values.
7. an interpolated value from a user defined set of coordinates defining at least 5 line segments. This is in addition to the spanning and ranging capabilities provided in analogue point database.
8. the current value of a programmable count up/down seconds timer that can be reset or initialized under UCL control. Timers to be capable of counting a minimum of 10,000 seconds and shall hold when timed out.
9. next scheduled ON or OFF time/date of any point, annual or holiday schedule
10. duration that any binary point or status has been in the ON or OFF state.
11. runtime or totalized value of any point thus configured.
12. alarm status of any defined alarm point.

.10 Provide a minimum of ten local variables per control program module for use as temporary storage of intermediate calculation results. Variables shall be able to store 32 bit floating point numbers and are not to be global virtual points created by the user.

2.13 CONTROL SEQUENCE INTEGRATED DEVELOPMENT ENVIRONMENT

.1 Provide an integrated development environment for creating, modifying, interpreting/compiling, testing, executing and trouble shooting custom control sequences:

1. in any RCU on the network from any CCS.
2. in any RCU on the network from off-site via the control system's serial interface device
3. in a particular RCU from a PCS locally connected to that RCU.

.2 For editing traditional text based UCL programs, provide a full screen editor with the ability to:

1. insert, delete, overtype characters in any displayed line.
2. copy or cut a line, or block of lines, and insert these before any displayed line in the current UCL program or another UCL program.
3. search for an alphanumeric string and replace with another string.
4. produce a hard copy of the edited program.

.3 For editing block/object or graphic style UCL programs, provide a full screen graphic editor with the ability to:

1. insert or delete a graphic object anywhere on the screen.
2. edit object names and all parameters within the graphic objects.
3. copy or cut a graphic object, group of objects, or comment text and place these anywhere else on the screen or onto another graphic programming screen.
4. connect graphic object inputs or outputs by simply drawing a line between them. Invalid connections shall not be allowed to be created.
5. connect information across programming screens.

6. produce a hard copy of the edited graphic including all object parameters.

.4 The integrated development environment shall:

1. automatically change all program occurrences of a point mnemonic, if that point mnemonic is changed in data base.
2. flag undefined point mnemonics if a point with that mnemonic has not yet been created or if the respective point has been removed from data base. Flag or indicator to be displayed in an easily visible location close to where the mnemonic is used whenever the program is viewed, modified or printed.
3. detect syntax errors or unexecutable sequences and provide detailed English language messages and code flagging that allows quick localization of these errors.
4. provide notification of runtime errors.
5. allow values of physical or virtual points as well as local or global variables to be displayed during runtime to assist in trouble shooting.

.5 The complete development environment shall be available at every CCS as well as at every PCS, whether it be locally connected to an RCU or located off-site and connected via the control system's serial interface device.

.6 Provide at least [two] complete development packages, if the development environment software is not RCU resident. Install these on CCSs/PCSs as directed by the owner. Provide all necessary interface hardware and cables to allow local or off-site connection.

2.14 CONTROL LOOPS

.1 Provide at least one, RCU resident, control loop for each available analogue output point or pair of digital outputs, plus one. All control loops shall be capable of three mode, proportional, integral and derivative, (PID) control.

.2 Provide the following parameters in each control loop:

1. Direct or reverse acting.
2. Output value
3. Set point
4. Proportional gain
5. Integral gain
6. Derivative gain
7. Sampling time – adjustable from 1 to 20 seconds.
8. Output low limit
9. Output high limit
10. Control loop bias

.3 Provide the ability to halt/resume loop calculation as well as change the set point, bias, gains and output limits in real time using custom control sequences created with the user control language (UCL).

.4 Provide a "bumpless" transfer between manual output override and automatic loop operation.

.5 Control loop algorithm shall be designed so as to limit integral windup. Internal integral offset value shall be manipulated so as to maintain calculated loop output value within bounds set by the output low and high limits.

Part 3 Execution

3.1 INSTALLATION

.1 Each RCU shall be mounted so as to allow easy access for maintenance. There shall be no less than 1 metre between the RCU door and any obstruction. Door must be able to swing open 180 degrees or be removable. Mount RCU near eye level on vibration free walls or rigidly support RCU on free standing supports away from vibrating equipment. Confirm all locations with Minister.

.2 At every RCU location, install a line voltage duplex receptacle for powering operator devices such as the PCS. An individual receptacle is not required for every RCU so long as one is available within 2 meters of any individual RCU. A new receptacle is not required if an existing outlet meets these requirements.

.3 RCU and equipment cabinets located in an area with a known leak hazard or under or near piping with nearby fittings shall be drip proof with rain-tight fittings on all connected conduit.

.4 Transformers serving power supplies shall be sized such that output voltage droop is no greater than 10% with all connected devices powered up and output devices in motion. One transformer per RCU.

END OF SECTION

Part 1 General

1.1 INTENT

.1 Read this Section in conjunction with Section 25 05 01 EMCS General Requirements and other related EMCS Sections.

.2 TCU's shall not be used to control major equipment such as boilers, chillers or air handling equipment over 1000 litres/sec

.3 Products

1.2 TERMINAL CONTROL UNITS GENERAL

.1 Each TCU shall:

.1 include a real time operating system that:

.2 executes control, timing and sequencing of all programs.

.3 performs multi-tasking to run programs and concurrently communicate with either RCU over sub-network or with RS 232C port, "intelligent" room temperature sensor or similar system/operator interface device.

.4 automatically restarts TCU when power is restored.

.5 has diagnostic software to test TCU integrity, and data transmissions.

.1 provide fully stand-alone operation by acquiring information from input points and locally processing this information to control output devices according to the User Control Language or configurable application-specific programmming.

.2 share information with the rest of the system via the local RCU as well as process and execute commands from RCU and from locally connected PCS or operator terminal.

.3 allow downloading of User Control Language strategies or configuration of application-specific programs and all related databases from the Central Control Station (CCS), or laptop computer (PCS) connected directly to the TCU or connected indirectly at the RCU.

.4 For TCU resident points, all trending, alarm reporting, runtime recording and all other reports and logs specified in Section 25 30 03, shall be supported in either the TCU or in the RCU that controls the sub-network on which the TCU resides.

.5 Only BACnet or Lon-Works compliant devices are allowed. Proprietary application-specific TCUs are not acceptable. Refer to Section 25 05 02 for additional network protocol requirements.

1.3 TERMINAL CONTROL UNITS FEATURES

.1 Minimum 32 bit full floating point mathematics.

.2 Onboard hardware, software and firmware as required to interface to the sub-network as defined in Section 25 05 02.

.3 Firmware upgradable over the sub-network or via the interface port on the intelligent space sensor. Products requiring replacement of chips or requiring direct access to the TCU controller are not acceptable.

.4 Point configuration to suit application plus one spare universal input and one spare digital output.

.5 Watchdog timer. Failure of TCU shall automatically switch outputs to a pre-selected fail-safe condition and initiate a cold restart.

.6 Real Time Clock function. Clock to be synchronized to RCU real time at least every 24 hours. For clocks without battery backup, time shall also be synchronized after every power interruption or watch dog event.

.7 Sub-network monitoring routine. On failure of sub-network, TCU shall continue to control environment using last reliable setpoint and operating mode data received from the RCU.

.8 Permanently marked removable terminal block for the wiring of all sensors, control devices, network and TCU power.

.9 Removable metal or robust plastic enclosure.

1.4 INTELIGENT SPACE SENSOR AND INTERFACE

.1 Provide an “intelligent” room temperature sensor, with the following features as a minimum:

.1 Three digit LCD or LED display.

.2 Four programmable buttons providing setpoint increase/decrease and occupied/unoccupied mode operation.

.3 Ability to set device to continuously display room setpoint or current room temperature.

.4 Interface port to allow a laptop IBM-PC compatible computer to interface to TCU. Provide cables and all necessary software to allow:

.5 reading of all input/output point data.

.6 changing of setpoints, limits and calibration values as applicable.

.7 manually override of control outputs.

.2 Space temperature sensing shall meet the accuracy requirements of Section 25 05 61 device type Tr.

.3 Enclosure shall be neutral colour, vented, metal or robust plastic, with base to cover wall opening. In public areas where device will be subject to damage, provide vented resilient clear plastic tamper proof cover.

1.5 SIGNAL PROCESSING

.1 Analogue Input Processing:

.1 Each analogue input shall be converted to digital format at a minimum frequency of 1 conversion per second.

.2 Analogue to digital conversion shall have sufficient resolution to provide the minimum end to end accuracy defined in Section 25 05 61 plus one bit, but shall not be less than 10 bits.

.3 Relative errors between analogue inputs shall not exceed 0.25% of span.

.4 Each input shall be individually calibrated for zero and span in software.

.5 On board circuitry shall protect each input from short circuit and have a 500 volt minimum isolation.

.6 The following ranges are required:

.2 4 - 20 mA DC

.3 0 - 10 VDC

.1 A special range for direct input resistance temperature sensors is allowed.

.4 Analogue Output Processing:

.1 Each analogue output shall be converted to analogue format at a minimum frequency of one conversion per second.

.2 Digital to analogue conversions shall have 8 bit resolution minimum. The output signal shall be linear.

.3 Each output shall be individually calibrated for zero and span in software.

.4 On board circuitry shall protect each output from short circuit and have 500 volt minimum isolation

.5 The following ranges are required:

.5 4 - 20 mA DC

.6 0 - 10 VDC

.7 Digital Input Processing:

.1 Inputs shall accept dry contacts.

.2 Provide minimum 500 volt isolation for each point through use of optical isolators or equivalent on termination board.

.8 Digital Output Processing:

.1 Provide outputs capable of switching a 120 VAC external relay, or triac SCRs rated at 0.5 Amp 24 VAC minimum.

.2 Provide full protection to hardware and software from switching transients.

1.6 POWER SUPPLY

.1 Each TCU shall have a power supply with fused over current protection and power on indication.

.2 Transient surge suppression shall be provided as part of the power supply or as a separate device. Let-through voltages (L-N), when tested against ANSI/IEEE C62.41-1991 and C62.45, 1992 category A3, B3 and B3/C1 ring-waves, shall not cause damage to the TCU or associated transmitters and output devices. Provide documentation proving compliance.

1.7 DATA BASE

.1 Provide data base creation and modification in accordance with Section 25 30 02 EMCS Remote Control Units.

1.8 ALARMS

.1 Provide TCU operating system alarms for the following malfunctions:

.1 Watch-dog-timer activation.

.2 Input or output point failure.

.3 Control program execution error (divide by zero, etc.)

.4 Power interruption restore or other cold start

.2 Provide other alarming features in accordance with Section 25 30 02 EMCS Remote Control Units.

1.9 SCHEDULING

.1 The TCU shall operate in accordance with the schedules defined in the RCU.

.2 Provide a default weekly schedule that defines at least one start time and one stop time per day to a resolution of 15 minutes. This schedule is to become active on loss of communication with the host RCU.

1.10 CONTROL LOOPS

.1 Provide point control loop creation and modification in accordance with Section 25 30 02 EMCS Remote Control Units.

1.11 PROGRAMMABLE TCU - USER CONTROL LANGUAGE (UCL)

.1 For UCL programmable TCUs, provide User Control Language program creation and modification in an integrated development environment in accordance with Section 230926 EMCS Remote Control Units.

.2 The identical User Control Language shall be used in both the RCU and TCUs.

.3 Provide all engineering/programming tools required for the complete integrated development environment. Include all disks/CDs and manuals.

1.12 APPLICATION-SPECIFIC TCU

.1 Application Specific TCUs shall be BACnet compliant and configurable to suit application.

.2 TCU shall be configured to allow the following data to be: a) displayed on CCS/PCS graphic screens, b) manually accessed from the CCS/PCS via operator command, c) automatically accessed by the RCU under control of operating sequences created with the User Control Language:

.1 Operating mode (read/write/override)

.2 Occupied mode heating/cooling setpoints and limits (read/write/override)

.3 Unoccupied mode heating/cooling setpoints and limits (read/write/override)

.4 Operating Space temperature setpoint (read/write/override)
.5 Space temperature (read)
.6 Space temperature calibration offset (read/write)
.7 Control loop output value (read/write/override)
.8 Control loop proportional band (read/write/override)
.9 Control loop bias value (read/write)
.10 Box supply air temperature (read)
.11 Box supply air temperature calibration offset (read/write)
.12 Flow rate (read)
.13 Flow rate zero and span calibration factors (read/write)
.14 Damper and/or valve positions (read/write/override)
.15 TCU Time (read/write)
.16 All parameters required to set up internal schedule
.17 Intelligent sensor communications failure flag (read)
.18 TCU system alarms as per 2.7 above (read)

.3 Provide all engineering/set-up tools required to configure or re-configure these devices. Include all disks/CDs and manuals.

Part 2 Execution

2.1 INSTALLATION

.1 Use one TCU for each terminal air volume/temperature control device.

.2 Terminal box TCUs shall be connected to the sub-network of the RCU that controls the air system serving the respective terminal boxes.

.3 Each TCU shall be mounted so as to allow easy access for maintenance. There shall be no less than 60 cm between the TCU cover and any obstruction.

.4 Each intelligent thermostat shall be securely fastened to wall in an easily accessible location not directly affected by supply air, radiant heat, sunlight, or heat from local equipment. Room furnishings shall not obscure device. Confirm all locations with owner.

.5 Transformers serving power supplies shall be sized such that output voltage droop is no greater than 10% with all connected devices powered up and output devices in motion. No more than 8 TCUs are allowed per transformer.

END OF SECTION

1. General

1.1 INTENT

.1 Read this section in conjunction with Sections 25 05 01 - Energy Management and Control Systems (EMCS) General Requirements, 25 01 11 EMCS Start-up and Testing and other related EMCS Sections.

1.2 RELATED REQUIREMENTS

.1 Commissioning

2. Products

Not Applicable.

3. Execution

3.1 GENERAL REQUIREMENTS

.1 Provide all programming required to implement the control sequences described in this section.

.2 Programming style is to be of a form that enables the control strategies to be easily followed. Clarity, simplicity and elegance are more important than program size.

.3 Programs shall be modular in nature and shall be as structured as the language will permit.

.4 All programs must include a sufficient number of comments to allow another person to make changes to the strategies at some later time.

.5 Additional programming may be provided by the Contractor as desired, so long as it does not affect the intended operation of the specified sequences. Ensure that all equipment will operate in a safe manner.

.6 All control loops shall be tuned such that they are stable through all seasons and operating conditions including startup.

.7 During the construction period through to the end of the warranty period, the Contractor shall be responsible for fine tuning the controls programming to ensure satisfactory operation.

3.2 MISCELLANEOUS REQUIREMENTS

.1 Staggered starting - Motors must not be allowed to start at the same time. Under all conditions of startup, return from power failure or panel reset, there must be at least a 15 second delay between the time one motor starts and another is allowed to start.

.2 Single phasing - If a phase monitor alarm contact has been provided in the main switch gear, provide routines to stop all 3-phase motors within 60 seconds of contact activation.

3.3 VERIFICATION OF CUSTOM CONTROL SOFTWARE

.1 Provide copies of trend logs that clearly indicate the:

.1 Stability of each control loop under various load conditions including modest step setpoint changes.

.2 Adequacy of system startup during summer and winter conditions.

.3 Proper operation of the outside air temperature prediction routines.

.4 Adequacy of space comfort conditions.

3.4 CONTROL SEQUENCES

.1 Primary Heating Water System

.1 The heating system consists of two wall mounted condensing boilers B-1 and B-2, each sized for 60% of the total heating load and boiler circulation pumps P-1 & P-2 each sized for 60% of the total heating load.

.2 The boilers have been specified to have firing rate controls and BACnet cards. Provide a BACnet connection to each boiler and allow for mapping of 8 points per pump to the EMCS graphics.

.3 The ECMS shall provide boiler staging control, boiler supply temperature reset and boiler circulation pump control.

.4 Provide all safety or operational interlocks to boiler control panels as required. Boiler low water cutoff switch, flow switch and temperature limit switches to be supplied by the boiler supplier.

.5 The boilers and their associated circulation pumps shall alternate lead/lag monthly (adjustable). If the outside air temperature is less than 15°C and any one of the terminal heating control valve is more than 15% open, the lead boiler shall be enabled. If the outside air temperature is less than 5°C (adjustable), the lead boiler shall always be enabled. Provide minimum on time of 60 minutes and a minimum off time of 5 minutes.

.6 The boiler supply water temperature setpoint shall be adjusted to maintain the secondary supply water temperature setpoint. The secondary supply water temperature setpoint shall be reset according to the outdoor air reset schedule and also be reset plus or minus 5°C (adjustable) according to average space heating demand.

.7 The boilers shall be operated on a lead/lag bases. When the heating system is enabled, the lead boiler circulation pump shall be started and shall operate continuously. Once the lead boiler circulation pump proves on, the lead boiler shall be enabled. When the system flow rate rises above 2.21l/s for more than 5 minutes, the lag boiler circulation pump shall be started. Once the lag boiler circulation pump proves on, the lag boiler shall be enabled. When the system flow rate falls below 1.58l/s for more than 5 minutes, the lag boiler shall be disabled. After a two minute delay to dissipate any residual heat in the boiler, the lag boiler circulation pump shall be commanded closed.

.8 On the failure of the lead boiler or the associated pump, an alarm shall be generated at the BMS graphics and the lead boiler and pump shall be alternated.

.9 Provide alarms for boiler ignition failure, low heating water temperature and pump failure. Disable heating alarms when outside air temperature is above the heating system shutdown setpoint.

.2 Secondary Heating Water System

.1 The secondary heating system consists of two secondary heating water circulation pumps P-3 & P-4 each sized for 100% of the total heating load.

.2 The pumps have been specified to have integral variable frequency drives (VFD) complete with BACnet cards. Provide a BACnet connection to each pump controller and allow for mapping of 8 points per pump to the EMCS graphics.

.3 The lead circulation pump speed shall be modulated to maintain the differential pressure setpoint as measured by a differential pressure sensor located on the supply and return lines at the end of the system. When the lead pump speed rises to 100% and the differential pressure setpoint is not being maintain for 5 minutes, the lag pump shall be enabled and it's speed modulated in unisons with the lead pump. When both pump speeds fall below 45% for 5 minutes, the lag pump shall be disabled.

.4 On the failure of the lead secondary pump, an alarm shall be generated at the BMS graphics and the lead pump shall be alternated.

.5 When the lead pump is alternated bases on run time, the new lead pump status will prove before the old lead pump is disabled.

.6 A heating system pressure sensor will monitor the heating water system pressure. Provide alarms if the pressure increases above 235 kPa or decreases below 35 kPa.

.7 The secondary heating water temperature setpoint shall be reset by the outside air temperature as follows:

O/A Temp.	HWS
-30°C or less	60°C
10°C or higher	40°C

.8 The secondary heating water supply temperature setpoint shall be further reset ±5°C by the average space heating demand. Should the system call for both pumps to operate and one of the pumps fails, the secondary heating water supply temperature setpoint shall be increased by 10°C.

.1 Provide an emergency disable red mushroom type latching push button at the exit of the boiler room and wire the dedicated switch contacts in series with the boiler safeties. Provide a dedicated contact for BMS monitoring and alarming.

.2 Domestic Hot Water System

.1 The system consists of two domestic hot water heaters DHW-1 and DHW-2 and a recirculation pump P-11.

.2 The on board controls for domestic water heater maintain the water supply temperature setpoint. EMCS sensor monitors the domestic supply water temperature and P-11 status. Alarms are generated if the temperature is above or below alarm limits or on P-11 failure.

.3 DHW-1 is connected to emergency power.

.3 Glycol Cooling System

.1 The glycol cooling system has been piped as a primary secondary system.

.2 The system consists of a roof mounted chiller CH-1 and two primary chilled glycol circulation pumps P-5 and P-6 each sized for 100%.

.3 CH-1 consists of one free cooler modules and two mechanical cooling modules each consisting of two compressors and an isolation valve.

.4 The chiller will come complete with a BACnet controller that performs all control functions for the chiller and free cooling modules.

.5 The EMCS shall enable the chiller, reset the chilled water temperature setpoint and monitor the number of modules that are operating via hard wiring points.

.6 The pumps have been specified to have integral variable frequency drives (VFD) complete with BACnet cards. Provide a BACnet connection to each pump controller and allow for mapping of 8 points per pump to the EMCS graphics.

.7 The glycol cooling system will normally be operated in either mechanical cooling mode or free cooling mode.

.8 When the ambient temperature allows, the chiller controls will enable the free cooling modules to precool the chilled glycol before mechanically cooling the glycol. During this mode of operation, the BMS will control the systems to meeting the mechanical cooling mode of operation.

.9 Mechanical Cooling Mode

.1 When the chiller is operating in mechanical cooling mode and at least 1 chiller isolation valve is open, the lead chilled glycol pump shall be enabled if not already operating.

.2 The lead chilled glycol pump speed shall be modulated to maintain the chilled glycol differential pressure setpoint.

.3 The two-way flow control valve shall be modulated to maintain the chilled glycol flow setpoint. The chilled glycol flow setpoint shall be set at 1.26 l/s when one chiller isolation valve is commanded open, at 2.52 l/s when two chiller isolation valves are commanded open, at 3.78 l/s when three chiller isolation valves are commanded open and at 5.04l/s

when four chiller isolation valves are commanded open. Control of the isolation valves is by the chiller controls. The valve shall be installed at 2/3 of the pipe length of the system.

.4 The differential pressure sensor shall be installed near the end of the line.

.5 The primary glycol supply temperature setpoint shall be reset by the outside air temperature according to the following schedule:

O/A Temp.	CHGS
10°C or less	10°C
28°C or higher	5°C

.6 The glycol supply temperature setpoint shall be further reset 2°C by the average fan coil cooling demand. The glycol supply temperature setpoint will have a low limit of 5°C.

.10 Free Cooling Mode

.1 When the chiller is operating in free cooling mode and any one of the fan coil valves is more than 20% open, the EMCS shall start the lead chilled glycol pump if not already operating.

.2 The lead pump speed shall be modulated to maintain the chilled glycol differential pressure setpoint.

.3 The flow control valve shall be modulated to maintain a minimum flow of 0.25 l/s.

.4 The EMCS shall modulate the cooling bypass three-way valve to limit the primary chilled glycol temperature to 5°C.

.5 The primary chilled glycol temperature setpoint shall be reset by the outside air temperature according to the following schedule:

O/A Temp.	HWS
-5°C or less	10°C
5°C or higher	7°C

.6 The primary chilled glycol temperature setpoint shall be further reset 2°C by the average fan coil cooling demand of the fan coils that are operating in the cooling mode. The glycol supply temperature setpoint will have a low limit of 5°C.

.11 The system is not connected to emergency power. When the emergency generator is operating and the normal power has failed, the system shall be disabled. On a return to normal power, the system shall be restarted as per the above sequence of operation.

.4 Energy Recovery Ventilator ERV-1

.1 Energy recovery ventilator ERV-1 is a variable volume, 100% outside air system providing ventilation air to the office and cell spaces.

.2 ERV-1 consists of an outside air damper, a filter section, a heat wheel section complete with VFD and exhaust bypass damper, an indirect gas heating section, a supply fan, an exhaust filter section, an exhaust fan and an exhaust air damper. BACnet compliant variable frequency drives (VFD) have been specified for both the supply and return fans.

.3 The exhaust for the washroom and janitors room air is ducted to exhaust fan EF-1. The discharge of EF-1 is ducted to the exhaust suction side of ERV-1's heat wheel so that the cell exhaust can be heat recovered.

.4 The exhaust for the secure area is ducted to exhaust fan EF-2. The discharge of EF-2 is ducted to the exhaust suction side of ERV-1's heat wheel so that the cell exhaust can be heat recovered.

.5 The exhaust for the cells is ducted to exhaust fan EF-3. The discharge of the EF-3 is ducted to the exhaust suction side of ERV-1's heat wheel so that the cell exhaust can be heat recovered. The exhaust fan has been specified to come with an EC motor.

.6 The exhaust for room 133 is ducted to exhaust fan EF-6. The discharge of the EF-6 is ducted to the outdoors. The exhaust fan has been specified to come with an EC motor. The BMS shall monitor a switch located in the room. When the switch is in the occupied position, EF-6 shall be enabled and the hard wired exhaust damper shall open. Once the damper end switch proves that the damper is open, EF-6 shall start.

.7 Heating and cooling for the individual zones is provided by fan coils or terminal heating units in each zone.

.8 Provide a BACnet connection to the fan VFDs and allow for mapping of points to the unit graphics.

.9 System Start/Stop

.1 ERV-1 will normally be energized via the Building Automation System when any one of the zones served by ERV-1 is operating in the occupied mode. Should the required design outside air volume of the occupied zones fall below the combined exhaust volumes of EF-1, EF-2, and EF-3, the VAV boxes serving occupied zones shall be commanded to 100% open. Should the supply air volume remain below 25% of the supply fan design volume, additional VAV boxes shall be commanded open until the supply fan volume rises above 25% (fan coils for these zones shall remain in the unoccupied mode).

.2 When the unit is enabled, the supply fan and exhaust fan VFD shall be enabled.

.3 The hardwired wired outside air damper and exhaust air damper shall open.

.4 Once the hardwired wired damper end-switches prove that the dampers are open, the respective fans shall start and shall ramp to their minimum speeds.

.5 When both fans are at or above EF-1 and EF-2 installed exhaust air volume, EF-1 and EF-2 shall be started.

.6 When both fans are at or above EF-1, EF-2 and EF-3 installed exhaust air volume and any one of the cell is in the occupied mode, EF-3 shall be started.

.7 On a failure of either of ERV-1's supply fan or the exhaust fan, the system shall be disabled and an alarm shall be sent to the EMCS graphics.

.8 On system start-up during the heating season, the reheat and preheat valve shall modulate to a starting position based on outside air temperature.

.10 Fan Speed Control

.1 The supply fan speed shall be modulated to maintain the end of line pressure setpoint as measured by a pressure sensor located at 2/3 of the duct length form the unit.

.2 The return fan speed shall be modulated to maintain the return air volume setpoint as measured by the unit supplied air flow station. The return air volume setpoint shall equal the supply air volume minus 5% minus the exhaust air volume of operating exhaust fans EF-1, EF-2, EF-3 and EF-6.

.3 Exhaust fan EF-3 speed shall be modulated to maintain the end of line pressure setpoint as measured by a pressure sensor located at 2/3 of the duct length form the unit.

.11 Low Temperature Freezestat

.1 Install an auto reset low temperature freezestat after the reheat coil.

.2 If the low temperature freezestat trips during unit startup, an alarm shall be generated on the EMCS graphics, the supply and exhaust fans shall be stopped and the preheat and reheat valves will be modulated to maintain the respective discharge temperatures at 15°C. Provide a software time delay on system startup.

.3 Once the freeze alarm has cleared, the heating valve start position shall be increased by 25% and the unit will be restarted. Should the freezestat trip twice within 1 occupied cycle, the software low temperature lockout

will prevent the unit from operating until the point is reset via the EMCS graphics.

.12 Temperature Control

.1 The unit supplied control shall control the heat wheel speed and gas burner firing rate.

.2 The BMS shall set the unit supply air temperature setpoint initially set at 13°C via a 0-10 volt signal.

.3 The BMS shall disable the heating when the outside air temperature rises above 13°C.

.13 Filter Monitoring

.1 Differential pressure sensors monitor the filters on the unit. When pressure drop exceeds the filter specification, a maintenance alarm is to be generated on the EMCS graphics.

.14 Alarms

.1 The EMCS shall provide alarms for fan failure, temperature outside of alarm limit and filter loading.

.15 The system is connected to emergency power. When the emergency generator is operating and the normal power has failed, the system shall operate as per the above sequence of operation and will be restarted as per the emergency power startup sequence. On a return to normal power, the system shall continue to operate as per the above sequence of operation.

.5 Vehicle Areas

.1 The systems consist of a unit heater and an exhaust fans EF-4 or EF-5.

.2 System Start/Stop

.1 Exhaust fans EF-4 and EF-5 will normally be energized via the Building Automation System when the CO level in the vehicle pass through rises above 30 ppm or when the NO2 level in the vehicle pass through rises above 0.7 ppm. A manual switch on the wall shall permit the system to be force on. The switch will not be wired in a manner that will allow the occupant of the space to disable the fans.

.2 On system startup, the exhaust fan shall be energized and both the outside air damper and the exhaust air damper shall open. Once both dampers prove open via hard wired damper end-switches, the exhaust fan shall start.

.3 Temperature Control

.1 The unit heater fan and valve shall be cycled to maintain the space temperature setpoint.

.4 The exhaust fans and unit heaters UH-1 through UH-3 are connected to emergency power. When the emergency generator is operating and the normal

power has failed, the equipment shall operate as per the above sequence of operation and will be restarted as per the emergency power startup sequence. On a return to normal power, the system shall continue to operate as per the above sequence of operation.

.6 Fan Coil Unit & VAV Box Zones

.1 The design intent of the VAV boxes is to have the ability to provide dedicated occupancy schedules for the different occupancy hours throughout the building.

.2 The VAV box will normally be enabled via the Building Automation System on a scheduled occupied/unoccupied basis or when any one of the occupancy switches located on the connected fan coil space temperature sensors is pressed. Provide an occupancy schedule for each VAV box. During occupied hours, the VAV box damper shall be modulated to maintain the design outside air volume to the connected fan coil units. During unoccupied hours, the VAV box damper shall remain closed.

.3 When the connected VAV box is operating in the occupied mode, the connected fan coil fan shall operate continuously and the heating and cooling valves shall be modulated in sequence to maintain the supply air temperature setpoint. The supply air temperature setpoint shall be reset between 21°C and 13°C by the space cooling demand and between 22°C and 27°C by the space heating demand to maintain the space heating and cooling occupied setpoints.

.4 When the connected VAV box is operating in the unoccupied mode, the connected fan coil fan shall operate when the space temperature rises above the night setup setpoint or falls below the night setback setpoint and will be stopped when the space temperature returns to the occupied heating or cooling setpoints. When the fan is operating, the heating and cooling valves shall be modulated in sequence to maintain the supply air temperature setpoint. The supply air temperature setpoint shall be set to 13°C by for night cooling and to 27°C for night heating. Provide minimum on/off times to prevent excessive cycling of the unit.

.5 Provide alarms for fan failure, low or high zone temperature.

.6 Implement optimum start heating and cooling for room temperature control. The program is self-adapting and starts equipment based on the calculated warm-up/cool-down time for the current indoor and outdoor temperatures.

.7 All of the fan coils with the exception of FC-117 and FC-213 are connected to emergency power. When the emergency generator is operating and the normal power has failed, the fan coils shall operate as per the above sequence of operation and will be restarted as per the emergency power startup sequence. On a return to normal power, the fan coils shall continue to operate as per the above sequence of operation.

.7 Mixed Air Fans

.1 Each system consists of an outside air damper, a return air damper, a relief air damper and a supply fan.

.2 The supply fan shall be enabled when the space temperature rises above the space temperature setpoint initially set at 25°C and the outside air temperature is below the space temperature setpoint. When the occupancy switch located on the space temperature sensor is manually pressed, the space temperature setpoint shall be reduced to 21°C.

.3 When the fan is operating, the dampers shall be modulated to maintain a supply air temperature setpoint of 13°C.

.4 The fans are connected to emergency power. When the emergency generator is operating and normal power has failed, the fan shall operate as per the above sequence of operation and will be restarted as per the emergency power startup sequence. On a return to normal power, the fan shall continue to operate as per the above sequence of operation.

.8 Cell Zone Ventilation

.1 The fourteen cells have been divided into three ventilation/heating zones.

.2 Each zone consists of an fan coil, an outside air VAV box, an exhaust VAV box and an unoccupied return air damper that are controlled by the BMS.

.3 The fan coils consist of a supply fan complete with EC motor, and heating coil and a cooling coil.

.4 The BMS shall control the occupancy of each zone based on the position of a toggle switch mounted on the face of a control panel located in the guard station.

.5 When an occupancy switch is set to Occupied Mode and the associated fan coil is operating, the associated outside air VAV box damper and exhaust air VAV box damper shall be modulated to maintain their design volumes. During unoccupied hours, the VAV box dampers shall remain closed.

.6 When an occupancy switch is set to Occupied Mode, the associated fan coil fan shall operate continuously at design speed, the return air damper will be commanded closed once the VAV boxes are at design volumes and the heating and cooling valves shall be modulated in sequence to maintain the supply air temperature setpoint. The supply air temperature setpoint shall be reset between 21°C and 13°C to maintain the return air cooling setpoint initially set at 24°C and between 22°C and 27°C to maintain the return air heating setpoint initially set at 21°C.

.7 When an occupancy switch is set to Unoccupied Mode, the associated return air damper will be commanded closed. Once the damper proves open, the fan coil fan shall operate at low speed and the heating and cooling valves shall be modulated in sequence to maintain the supply air temperature setpoint. The

supply air temperature setpoint shall be set at between 21°C and 13°C to maintain the unoccupied return air cooling setpoint initially set at 27°C and between 22°C and 27°C to maintain the unoccupied return air heating setpoint initially set at 17°C. Should the supply air temperature setpoint rise to 27°C or fall to 13°C and the return air temperature setpoints cannot be maintained, the supply fan speed shall be increased to the design volume.

.8 All of the fan coils are connected to emergency power. When the emergency generator is operating and the normal power has failed, the fan coils shall operate as per the above sequence of operation and will be restarted as per the emergency power startup sequence. On a return to normal power, the fan coils shall continue to operate as per the above sequence of operation.

.9 Cell Domestic Water Isolation Valves

.1 Provide a control panel in the guard station and isolation solenoid valves in the domestic water supply to each cell. Install a switch for each cell on the face of the control panel and hard wire the switch to the associated isolation solenoid valves. Refer to mechanical drawing for panel layout. The isolation solenoid valves will be rated for domestic water uses.

.10 Terminal Heating Units

.1 The zone shall operate in the occupied mode whenever the fan coil serving the space is in the occupied mode.

.2 During occupied hours, the control valve shall be modulated to maintain the space occupied temperature setpoint.

.3 During unoccupied hours, the control valve shall be modulated to maintain the space night setback temperature setpoint.

.4 Implement optimum start heating for room temperature control. The program is self-adapting and starts equipment based on the calculated warm-up time for the current indoor and outdoor temperatures.

.11 Transfer Fans

.1 The transfer fans shall operate continuously. The BMS shall monitor the fan operation and generate and alarm on fan failure.

.12 Unit Heaters and Force Flow heaters

.1 The unit heaters and force flows shall be controlled by the EMCS system. A space temperature sensor shall provide the signal to cycle the fan and two-way control valve to maintain the desired space temperature setpoint initially set at 15°C.

.2 An aquastat located on the return heating water line of entrance force flows shall stop the fan and open the 2-way control valve 100% upon sensing a low return water temperature.

.3 Should the heating system call for both heating water pumps to operate and one of the pumps fails, the unit heaters and force flows space temperature setpoint shall be reduced by 3°C.

.13 Server Room Ductless Split Air Conditioning Unit

.1 Provide a space temperature sensor for the server room. Provide high/low temperature alarms.

.14 Oil Separator

.1 The EMCS shall monitor the oil separator high oil level alarm provided with control panel.

.15 Power Monitoring

.1 The EMCS shall monitor the normal power and emergency power. On a return to normal power, all systems that have been disabled due to a loss of power shall be restarted as per their occupancy schedules and in a manner that reduces.

.2 When the generator is operating and the normal power has failed, the equipment connected to emergency power will be stager started in the following manner:

.1 Heating water pumps.
.2 Boilers.
.3 Glycol pumps.
.4 AHU-1, the fan speed shall be ramped up over 3 minute.
.5 Exhaust fans, the fan speed shall be ramped up over 1 minute.
.6 Fan coils, the fan shall be ramped up over 1 minute. Provide a global ramp time for the fan coils.
.7 UHs and FFs, the space setpoints shall be reduced by 2C°.

.16 Fire Alarm

.1 The EMCS shall monitor the fire alarm. Whenever a fire alarm has cleared, all systems that have been disabled by the fire alarm shall be restarted as per their occupancy schedules.

.17 OUTSIDE AIR TEMPERATURE

.1 An outside air temperature calculated value will be used for all control references. The calculated value will be determined from the two (2) outside air temperature sensors. Coordinate the final locations of the sensors with the mechanical consultant.

END OF SECTION

Part 1 General

1.1 INTENT

.1 Read this Section in conjunction with Section 25 05 01 - EMCS General Requirements and other related EMCS Sections.

1.2 DEFINITIONS

.1 A point is a specific software address which is resident in either the RCU or TCU and which is identified with a particular field sensor, instrument, relay or actuator.

.2 The point schedule contains a list and description of the points to be connected.

.3 The relationships between the points, systems and building are described in the control sequences, Section 25 90 01.

1.3 SCHEDULES

.1 Following is appended to and forms part of this Section:

.2 Energy Management Control System - Point Database Schedule.

Part 2 ProductsExecutionPOINT SCHEDULES

.1 Digital Inputs; refer to Section 25 05 61, "Digital Input Devices Schedule" and input type designation in schedule.

.2 Digital Outputs; refer to Section 25 05 61, "Digital Output Devices Schedule" and output type designation in schedule.

.3 Analog Inputs; refer to Section 25 05 61, "Analog Input Sensors Schedule" and input type designation in schedule. Consult with minister's representative during the system start-up for limits and alarm values to be entered.

.4 Analog Outputs; refer to Section 25 05 61, "Analog Output Devices Schedule" and output type designation in schedule.

.5 Use Alberta Infrastructure “EMCS Guideline for Logical Point Mnemonics” to identify each physical and virtual point in data base and User Control Language software in each panel.

.6 All points included under the same group letter must reside within the same panel. Any form of inter panel communications link to accomplish this is not allowed except as explicity stated under Section 25 05 02 “Control Loop Configuration”.

.7 Consult with the Minister during the shop drawing stage to finalize the physical terminal address of each point within each RCU or TCU.

3.2 POINT INSTALLATION

.1 When two outdoor air temperature sensors are specified, locate the sensors so that the sun cannot shine on both sensors at once, and airborne waste heat cannot simultaneously affect both sensors.

.2 Locate duct temperature and humidity sensors a minimum of three metres downstream of humidifiers.

.3 Use averaging sensors for all mixed air temperature sensing applications.

.4 Use averaging temperature sensors for applications where the duct area is greater than 0.5 m2 AND the sensor is located downstream of a coil by a distance less than 4 times the diagional measurement of the coil.

.5 For all sensors in piping, use thermal conducting compound to ensure proper thermal coupling of sensor to well body.

1. Heating Water System									
Point Description	**Point Type**	**Digital**			**Analog**			**Mapped Points**	**Remarks**
		Output	**Input**	**Alarm**	**Output**	**Input**	**Alarm**		
Typical for Boilers B-1 & B-2									
Enable	Ry	1							
Status	St							X	Note #1
Flame Failure	St							X	Note #1
Supply Wtr Temp.	Tw						H/L	X	Note #1
Setpt Reset	Ao				1				
Typical for Pumps P-1 & P-2									
Enable	Ry	X							
Status	CT				X				
Field Points									
Return Water Temp	Tw					X	H/L		
Supply WaterTemp	Tw					X	H/L		
Note #1: Mapped point to BMS graphic via unit supplied BACnet card.									

2. Secondary Heating Water System									
Point Description	**Point Type**	**Digital**			**Analog**			**Mapped Points**	**Remarks**
		Output	**Input**	**Alarm**	**Output**	**Input**	**Alarm**		
Typical for Pumps P-3 & P-4									
Enable	Ry	X							
Speed	VFD				X				
Speed	VFD					X			
Alarm	Dc		X						
KW	VFD							X	Note #1
Field Points									
Return Water Temp	Tw					X	H/L		
Supply Water Temp	Tw					X	H/L		
System Pressure	Ps					X	H/L		
Differental Pressure	Dp					X	H/L		
System Flow	Fm					X	H/L		
Minimum Flow Control Valve	Ry				X				
Note #1: Mapped point to BMS graphic via unit supplied BACnet card.									

3. Domestic Hot Water									
Point Description	**Point Type**	**Digital**			**Analog**			**Mapped Points**	**Remarks**
		Output	**Input**	**Alarm**	**Output**	**Input**	**Alarm**		
Return Water Pump									
Status	Ct					X			
Field Points									
Supply Water Temp	Tw					X	H/L		

4. Glycol Cooling System

Point Description	Point Type	Digital			Analog			Mapped Points	Remarks
		Output	Input	Alarm	Output	Input	Alarm		
Chillers CH-1									
Enable	Ry	1							
Status	St							X	Note #1
Failure	St							X	Note #1
Supply Wtr Temp.	Tw						H/L	X	Note #1
Setpt Reset	Ao				1				
Cooling Stages	St		4						
Free Cooling	St		1						
Typical for Pumps P-5 & P-6									
Enable	Ry	X							
Speed	VFD				X				
Speed	VFD					X			
Alarm	Dc		X						
KW	VFD							X	Note #1
Field Points									
Return Glycol Temp	Tw					X	H/L		
Supply Glycol Temp	Tw					X	H/L		
Glycol Three-way Bypass Valve	Ry				X				
Two-way Flow Control Valve	Ry				X				
Cooling System Pressure	Ps					X	H/L		
System Flow	Fm					X	H/L		
Differental Pressure	Dp					X	H/L		

Note #1: Mapped point to BMS graphic via unit supplied BACnet card.

5. Energy Recovery Ventilator ERV-1									
Point Description	**Point Type**	**Digital**			**Analog**			**Mapped Points**	**Remarks**
		Output	**Input**	**Alarm**	**Output**	**Input**	**Alarm**		
Supply Fan									
Enable	Ry	X							
Speed Command	VFD				X				
Speed	VFD					X			
Alarm	Dc		X						
Air Flow						X			
KW								X	**Note #1**
Exhaust Fan									
Enable	Ry	X							
Speed Command	VFD				X				
Speed	VFD					X			
Alarm	Dc		X						
Air Flow						X			
KW								X	**Note #1**
Heat Wheel									
Status	Ct					X			
Field Points									
Filter	Ps					X	H		
Heat Wheel Discharge Temp	Ta					X	H/L		
Supply Air Temp	Ta					X	H/L		
Supplt Air Temperature Setpoint	Vm				X				
Heat Enable	Ry	X							
Freezestat (Low temp Alarm)	Fz		X	X					
Return Air Filter	Ps					X	H		
Building Relief Air Temp	Tp					X	H/L		
Heat Wheel Exhaust Air Temp	Ta					X	H/L		
Washroom Exhaust Fan EF-1									
Start/Stop	Ry	X							
Status	Ct					X			
Class 2 Exhaust Fan EF-2									

5. Energy Recovery Ventilator ERV-1									
Point Description	**Point Type**	**Digital**			**Analog**			**Mapped Points**	**Remarks**
		Output	**Input**	**Alarm**	**Output**	**Input**	**Alarm**		
Start/Stop	Ry	X							
Status	Ct					X			
Cell Exhaust Fan EF-3									
Start/Stop	Ry	X							
Status	Ct					X			
Room 133 Exhaust Fan EF-6									
Start/Stop	Ry	X							
Status	Ct					X			
Manual Occupancy Switch	Sw		X						
Note #1: Mapped point to BMS graphic via unit supplied BACnet card.									

6. Typical Vehicle Pass Through

Point Description	Point Type	Digital			Analog			Mapped Points	Remarks
		Output	Input	Alarm	Output	Input	Alarm		
Exhaust Fan EF-4 and EF-5									
Start/Stop	Ry	2							
Status	Ct					2			
Unit Heaters									
Start/Stop & Valve	Ry	2							
Field Points									
Space Temp	Ts					2	H/L		
Space CO	Co					2	H/L		
Space NO2	Cn2					2	H/L		
Note #1: Mapped point to BMS graphic via unit supplied BACnet card.									

7. Zone Controls

Point Description	Point Type	Digital			Analog			Mapped Points	Remarks
		Output	Input	Alarm	Output	Input	Alarm		
Fan Coil Units & VAV Box Zones									Note #1
Fan Start/Stop	Ry	X							
Fan Status	CT					X			
Supply Air Temp	Ts					X	H/L		
Space Temp	Ts					X	H/L		
Space Temp Setpoint	Ts					X			
Occupancy Switch On Sensor	St		X						
Heating Valve	Vm				X				
Cooling Valve	Vm				X				
VAV Box Volume	Ps					X	H/L		
VAV Box Damper	Dm				X		H/L		
VAV Box Zones									Note #1
VAV Box Volume	Ps					X	H/L		
VAV Box Damper	Dm				X		H/L		
Radiant Panel and Radiation									Note #1
Space Temp	Ts					X	H/L		
Space Temp Setpoint	Ts					X			
Heating Valve	Vm				X				
Force Flow and Unit Heater									Note #1
Fan/Valve Enable	Ry	X							
Space Temp	Ts					X	H/L		
Space Temp Setpoint	Ts					X			
Cell Fan Coil Units & VAV Box Zones									Note #1
Fan Start/Stop	Ry	X							
Fan Status	CT					X			
Supply Air Temp	Ts					X	H/L		
Space Temp	Ts					X	H/L		
Space Temp Setpoint	Ts					X			
Occupancy Switch On Guard Panel	St		X						
Heating Valve	Vm				X				

7. Zone Controls

Point Description	Point Type	Digital			Analog			Mapped Points	Remarks
		Output	Input	Alarm	Output	Input	Alarm		
Cooling Valve	Vm				X				
Outside Air VAV Box Volume	Ps					X	H/L		
Outside Air VAV Box Damper	Dm				X		H/L		
Exhaust Air VAV Box Volume	Ps					X	H/L		
Exhaust Air VAV Box Damper	Dm				X		H/L		
Ductless Air Conditioner									Note #1
Space Temp	Ts					X	H/L		
Unit Alarm	Dc			X					
Transfer Fans TF-1 & TF-2									
Fan Status	CT					X			
Mixed Air Fans									Note #1
Fan Start/Stop	Ry	X							
Fan Status	CT					X			
Supply Air Temp	Ts					X	H/L		
Space Temp	Ts					X	H/L		
Space Temp Setpoint	Ts					X			
Occupancy Switch On Guard Panel	St		X						
Mixed Air Dampers	Dm				X				
Relief Air Damper	Dm				X				

Note #1: Refer to mechanical drawings for quantities.

8. Miscellaneous Points

Point Description	Point Type	Digital			Analog			Mapped Points	Remarks
		Output	Input	Alarm	Output	Input	Alarm		
OAT - 1	To					X			
OAH - 1	Ho					X			
OAT - 2	To					X			
OAH - 2	Ho					X			
Normal Power	Dc	X							
Emergency Power	Dc	X							
Fire Alarm	Dc	X							
Oil Separator	Dc	X							Note #1
Cell Domestic Water Isolation Valves	Ry	X							Note #1

Note #1: Refer to mechanical drawings for quantities.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements that are common to National Master Specification sections found in Division 26.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.

.2 CSA C282-09, Emergency Electrical Power Supply for Buildings.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates and labels for control items in English.

1.4 SUBMITTALS

.1 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Canada.

.2 If changes are required, notify Departmental Representative and Consultant of these changes before they are made.

.3 Provide CSA certified equipment and material.

.4 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction inspection authorities for special approval before delivery to site.

.5 Submit test results of installed electrical systems and instrumentation.

.6 Permits and fees: in accordance with General Conditions of contract.

.7 Submit, upon completion of Work, load balance report as described in PART 3 - Load Balance.

.8 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

1.5 QUALITY ASSURANCE

.1 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction.

.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.2 Supervise the work at all times through a full time competent electrical superintendent, who could coordinate with other trades.

.3 The installation shall be completely tested and obtain a letter of compliance from the electrical safety inspection authority.

1.6 WARRANTY

.1 The work shall be guaranteed for a period of twelve calendar months after final acceptance.

1.7 SYSTEM STARTUP

.1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant will aspects of its care and operation.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - Submittals.

.2 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring and conduit, wiring and connections below 50 V which are related to control systems and specified in mechanical sections and as shown on mechanical drawings.

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction inspection authorities Departmental Representative Consultant.

2.4 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for copper conductors.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: Lamicoid, black finish face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

.2 Label of circuits on wiring devices (e.g. receptacles) shall be Brother Labels black letters on clear tape in occupied spaces. White tape in other areas.

.3 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Consultant prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

2.7 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.

.3 Colours: 25mm wide prime colour and 20mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green

2.8 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish.

.2 Paint indoor switchboard and distribution enclosures ANSI 61grey to EEMAC 2Y-1.

2.9 FIRE-STOPPING

.1 Fire-stop all pipe, duct, conduit, and wire penetrations through floors and walls designated as fire and/or smoke separations.

.2 Fire-stopping materials to meet ULC CAN 2S115.

.3 Preparation of surfaces and installation of fire-stopping materials shall be carried out as per manufacturer’s instructions.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

.2 Label circuits on wiring devices. Brothers labels black letters on clear tape in occupied space; white tape in other space.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: schedule 40 steel pipe sized for free passage of conduit, and protruding 50mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

3.4 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm, and information is given before installation.

3.5 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1400mm.

.2 Wall receptacles:

.1 General: 300mm.

.2 In mechanical rooms: 1400mm.

.3 Counter top and barrier free: refer to architectural elevation drawings.

.3 Panelboards: as required by Code or as indicated.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.7 FIELD QUALITY CONTROL

.1 Load Balance:

.1 The load of any three-phase service shall be reasonably balanced between phases. Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes; 10% to 15% in phase unbalance shall be considered reasonable.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - Submittals: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests:

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.4 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.3 Carry out tests in presence of Departmental Representative.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.8 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2No.65-93(R1999), Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Divert unused wiring materials from landfill to metal recycling facility as approved by Engineer Consultant.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 NEMA to consist of:

.1 Connector body and stud clamp for stranded copper conductors.

.2 Clamp for stranded copper conductors bar.

.3 Stud clamp bolts.

.4 Bolts for copper conductors.

.5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, flexible conduit, as required to:

CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

.3 Install bushing stud connectors in accordance with EEMAC 1Y-2 NEMA.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

.1 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.2 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

.3 VFD cables: size as indicated, to be used between VFD and motors. Coordinate with mechanical contractor for equipment with VFDs provided by mechanical. VFD rated cable to be minimum 1000 V rated.

Part 3 Execution

3.1 GENERAL CABLE INSTALLATION

.1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.2 Cable Colour Coding: to Section 26 05 00 Common Work Results for Electrical.

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.2 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34.

.2 In ducts in accordance with Section 26 05 43.01.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for connectors and terminations.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 65-03. Wire Connectors.

.2 CSA C22.2 No.41-M1987(R1999), Grounding and Bonding Equipment.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Copper compression connectors to CSA C22.2No.65-03 as required sized for conductors.

.2 2 way joint boxes dry location type in accordance with Section 26 05 32.

.3 Use VFD connectors between VFDs and motor connections.

Part 3 Execution

3.1 INSTALLATION

.1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.

.2 Install VFD connectors between VFDs and motor connections.

.3 Bond and ground as required to CSA C22.2 No.41.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Divert unused metal materials from landfill to metal recycling facility as approved by Engineer.

.4 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.

.3 Insulated grounding conductors: green.

.4 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by CEC:

i. Feeders and branch circuits
ii. Lighting circuits

iii. Receptacle circuits
iv. Single-phase motor and appliance branch circuits
v. Three-phase motor and appliance branch circuits
vi. Flexible raceway runs
vii. Metal clad cable runs

.2 Install complete permanent, continuous grounding system including, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.3 Install connectors in accordance with manufacturer's instructions.

.4 Protect exposed grounding conductors from mechanical injury.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.9 Connect building structural steel and metal siding to ground by welding copper to steel.

.10 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end and load end.

.11 Ground secondary service pedestals.

.12 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.2 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary 600V system.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, distribution panels.

3.4 GROUNDING BUS

.1 Ground items of electrical equipment in electrical room to existing ground bus with individual bare stranded copper connections size 2/0AWG.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

Part 1 General

1.1 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Divert unused metal materials from landfill to metal recycling facility as approved by Engineer.

.4 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted.

.2 All threaded rods shall be galvanized.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits use channels at 3000mm on centre spacing.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.2 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

Part 3 Execution

3.1 JUNCTION AND PULL BOXES INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CAN/CSA C22.2 No. 18-98, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

2.3 CONDUIT BOXES

.1 Cast FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.4 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.5 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International), the latest version

- .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
- .2 CSA C22.2 No. 45, Rigid Metal Conduit.
- .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
- .5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.
- .6 CAN/CSA C22.2 No. 227.3, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.2 SUBMITTALS

.1 Product data: submit manufacturer's printed product literature, specifications and datasheets.

- .1 Submit cable manufacturing data.

.2 Quality assurance submittals:

- .1 Test reports: submit certified test reports.
- .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Place materials defined as hazardous or toxic waste in designated containers.

.2 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

- .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Identify cables for exclusively dc applications.

2.2 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.

.2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.3 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.3 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller.

.1 Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 3 m on centre.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms, and in unfinished areas.

.3 Use rigid galvanized steel threaded conduit in main electrical service from outside, to outdoor chillers/generator, and subject to mechanical injury.

.4 Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical injury.

.5 Use rigid pvc conduit underground in corrosive areas.

.6 Final connections to all mechanical and electrical equipment to be with liquid tight flex and approved liquid tight flex connectors. Drops to luminaires are to be with AC90 wire. Hook up all surface mounted fixtures with electrical metallic conduit.

.7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in all locations.

.8 Minimum conduit size for lighting and power circuits: 21 mm.

.9 Install EMT conduit from computer room branch circuit panel to outlet boxes located in sub floor.

.10 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.11 Mechanically bend steel conduit over 19 mm diameter.

.12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.13 Install fish cord in empty conduits.

.14 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.15 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended or surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel.

.1 Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.

.1 Use cold mastic between sleeve and conduit.

.5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 25 mm and larger below slab and encase in 75 mm concrete envelope.

.1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.8 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.1 No.126.1-02, Metal Cable Tray Systems.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA FG 1-1993, Fibreglass and Cable Tray Systems.

.2 NEMA VE 1-2002, Metal Cable Tray Systems.

.3 NEMA VE 2-2001, Cable Tray Installation Guidelines.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data: submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including classifications and certifications.

.2 Shop Drawings: submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details.

.3 Cablofil or approved equal cable tray shall be used.

.4 Show actual cabletrough installation details and suspension system.

Part 2 Products

2.1 CABLETROUGH

.1 Cabletroughs and fittings: to CAN/CSA C22.1 No. 126.1.

.2 Wire mesh type, Class A, C1, D1 or E as per data cabling quantities installed in that tray to CAN/CSA C22.2 No.126.1.

.3 Trays: extruded aluminum, 600 mm wide with depth of 150 mm.

.4 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cabletrough supplied.

.1 Radii on fittings: 600 mm minimum.

.5 Solid covers for complete cabletrough system including fittings.

.6 Barriers where different voltage systems are in same cabletrough.

.7 Ground cable trays with #2 AWG bare copper conductor attached to each tray section in accordance with CEC requirements.

.8 Provide fire stop material at firewall penetrations.

2.2 SUPPORTS

.1 Provide splices, supports for a continuously grounded system as required.

Part 3 Execution

3.1 INSTALLATION

.1 Install complete cabletrough system in accordance with NEMA VE 2.

.2 Support cabletrough on both sides.

.3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

.4 Grounding bushing shall be used on EMT bonded to cable tray for grounding.

3.2 CABLES IN CABLETROUGH

.1 Install cables individually.

.2 Lay cables into cabletrough. Use rollers when necessary to pull cables.

.3 Secure cables in cabletrough at 6 m centres, with nylon ties.

.4 Identify cables every 30 m with size 2 nameplates in accordance with Section 26 05 00.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No.26-1952(R2009), Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wireways and auxiliary gutters and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: submit operation and maintenance data for wireways and auxiliary gutters for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wireways and auxiliary gutters from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 WIREWAYS

.1 Wireways and fittings: to CSA C22.2 No.26.

.2 Sheet steel with hinged cover to give uninterrupted access.

.3 Finish: baked grey enamel in accordance with Section 26 05 00 - Common Work Results for Electrical.

.4 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wireways and auxiliary gutters installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install wireways and auxiliary gutters in accordance with manufacturer's written recommendations.

.2 Keep number of elbows, offsets, connections to minimum.

.3 Install supports, elbows, tees, connectors, fittings.

.4 Install barriers where required.

.5 Install gutter to full length of equipment.

.6 Ground metallic wireways and gutters as required.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse & recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association, (CSA International)

.2 Insulated Cable Engineers Association, Inc. (ICEA)

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.

.5 Do not dispose of preservative treated wood through incineration.

.6 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.

.7 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Engineer.

.8 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Execution

2.1 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.1 Do not pull spliced cables inside ducts.

.2 Install multiple cables in duct simultaneously.

.3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.6 After installation of cables, seal duct ends with duct sealing compound.

2.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance tests.

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.3 High Potential (Hipot) Testing.

.1 Conduct hipot testing in accordance with manufacturer's ICEA recommendations.

.4 Leakage Current Testing.

.1 Raise voltage in steps from zero to maximum values as specified by ICEA for type of cable being tested.

.2 Hold maximum voltage for specified time period by ICEA manufacturer.

.3 Record leakage current at each step.

.7 Provide Consultant with list of test results showing location at which each test was made, circuit tested and result of each test.

.8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C39.1-1981, Requirements, Electrical Analog Indicating Instruments.

.2 CSA International

.1 CAN3-C17-M84(R2008), Alternating - Current Electricity Metering.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 00 10 – General Requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metering and switchboard instruments and includes product characteristics, performance criteria, physical size, finish and limitations.

.2 Include meter, instrument, outline dimensions, panel drilling dimensions and installation cutout template.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metering and switchboard instruments from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 METER

.1 Main customer meter in new main switchboard refers to drawing E600 Single Line Diagram for exact model number and make. Main customer meter needs to be networked with U of C main campus for monitoring.

.2 Polyphase, element kilowatt, kilovar, demand, thermally lagged, integrating, indicating, recording meter: to CAN3-C17.

.3 Combination energy and demand meter: to CAN3-C17.

.4 Accuracy: 1%.

.5 Ratings: match switchboard.

.6 Register: instrument transformer operated, clock range, pulse contacts for transmitting signal.

.7 Allow for remote sensing.

2.2 METER SOCKET

.1 Meter sockets to suit meters with automatic current transformer shorting devices when meter removed.

2.3 METERING INSTRUMENT TRANSFORMER CABINET

.1 Sheet steel CSA enclosure to accommodate potential and current transformers.

2.4 TEST TERMINAL BLOCKS

.1 Test terminal blocks: as required.

2.5 INDICATING INSTRUMENTS

.1 Indicating instruments: ANSI C39.1, 1% accuracy, switchboard mounting, flush.

.1 Ammeter: average reading range as indicated.

.2 Voltmeter: average reading range as indicated.

.3 Wattmeter: range as indicated.

.4 Varmeter: range as indicated.

.5 Frequency meter: range as indicated.

.6 Power factor meter: range as indicated.

.7 Synchroscope: range as indicated.

2.6 INSTRUMENT SELECTOR SWITCHES

.1 Voltmeter Ammeter selector switches: rotary, multi-position, maintained contacts, panel mounting, round notched handle, rated to suit instruments, nameplate marked as indicated to coincide with each rotary position. Ammeter selector switches designed to preclude opening of current circuits.

.2 Four position ammeter selector switches identified "off-A-B-C".

.3 Four position voltmeter selector switches identified "A-B, B-C, C-A, off".

.4 Seven position voltmeter selector switches identified "A-B, B-C, C-A, off, A-N, B-N, C-N".

2.7 SHOP INSTALLATION

.1 Install meters and instrument transformers in separate compartment of switchboard.

.2 Install instruments on switchboard.

.3 Ensure adequate spacing between current transformers installed on each phase.

.4 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources, electrical supplies.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metering and switchboard instruments installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 METERING INSTALLATION

.1 Install meters instruments in location free from vibration and shock.

.2 Make connections in accordance with diagrams.

.3 If applicable, ensure power factor corrective equipment connected on load side of meter.

.4 Connect meter and instrument transformer cabinets to ground.

.5 Locate meters within 9 m of instrument transformers.

.1 Use 32 mm conduit for interconnections.

.2 Use separate conduit for each set of current transformer connections, exclusive for metering.

3.3 FIELD QUALITY CONTROL

.1 Conduct tests in accordance with Section 26 05 00 - Common Work Results for Electrical and in accordance with manufacturer's recommendations.

.2 Perform simulated operation tests with metering, instruments disconnected from permanent signal and other electrical sources.

.3 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources and electrical supplies.

.4 Perform tests to obtain correct calibration.

.5 Do not dismantle meters and instruments.

3.4 CLEANING

.1 Progress Cleaning: leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 – General Requirements.

.3 Waste Management: separate waste materials for reuse recycling in accordance with 01 35 21 - LEED Requirements.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metering and switchboard instrument installation.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 The work covered in this section is subject to all of the requirements in the General Conditions of the Specifications. Contractor shall coordinate all of the work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system. All Labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section.

1.2 DESCRIPTION OF WORK

.1 Furnish and install a complete system for the control of lighting and other equipment as indicated on the plans, detailed in the manufacturer submittal and as further defined herein. Contractor is solely responsible to verify quantity, installation locations and wiring requirements for this project. Specific manufacturer's catalog numbers, when listed in this section are for reference only. It is the responsibility of the contractor to verify with lighting control manufacturer all catalog information and specific product acceptability.

.2 The system shall include but not be limited by the following list: Pre-wired, microprocessor controlled relay or dimming panels with latching relays controlled via a complete list of communication based accessories including digital switches, digital photocells, Digital Time Clock (DTC) and interface cards to dimming systems, building automation systems, thermostats, and other devices. The type of lighting control equipment and wiring specified in this section is covered by the description: Microprocessor Controlled Digital Lighting Control system with RS 485 Bus communications. Requirements are indicated elsewhere in these specifications for work including, but not limited to, raceways and electrical boxes and fittings required for installation of control equipment and wiring. They are not the work of this section.

1.3 SUBMITTALS

.1 Shop Drawings: Submit dimensioned drawings of lighting control system and accessories including, but not necessarily limited to, relay panels, switches, DTC, photocells and other interfaces. Shop drawings shall indicate exact location of each device or a RFI to confirm location. Plans are diagrammatical. EC to verify all lighting control material requirements from approved shop drawings. "Cut Sheet" submittal not acceptable.

.2 Product Data: Submit for approval manufacturer's data on the specific lighting control system and components. Submittal shall be electronic format with hard copy available. To prevent departures from approved system operation, electronic files submitted shall be able to be directly downloaded to the specified system at manufacturer facility. Submit a complete bill of materials with part numbers, description and voltage specifications.

.3 Manufacturer shall provide free software that can be used to specify the system, detail all programming and generate a single line in a format that can be dropped into industry standard CAD packages.

.4 One Line Diagram: Submit a one-line diagram of the system configuration indicating the type, size and number of conductors between each component. Diagram is to include lighting control system showing the location of each zone and associated switches. Submittals that show typical riser diagrams are not acceptable.

1.4 QUALITY ASSURANCE

.1 Control wiring shall be in accordance with the CSA C22.1 requirements for Class 2 remote control systems and manufacturer specification.

.2 A licensed electrician shall functionally test each system component after installation, verify proper operation and confirm that all relay and dimming panels and switch wiring conform to the wiring documentation.

.3 Comply with CSA C22.1 and all local and provincial codes as applicable to electrical wiring work.

.4 Lighting control panels shall be UL 916 Listed. LCPs controlling emergency circuits shall be listed to C22.2 Nos. 250, 107.1, 141, 250. Relay panels shall also be listed to comply with CSA C22.2#205 Emergency source circuits controlled in normal operation by a relay panel shall fully comply with CSA C22.1. Electrical contractor is responsible for verifying compliance.

.5 The lighting control system shall be listed, approved and comply as required with all national, provincial and local energy codes.

1.5 MAINTENANCE MATERIALS

.1 Division 1 - Execution Requirements: Spare parts and maintenance products.

.2 Provide 10% spare relays per LCP, up to the maximum capacity of the LCP.

.3 Provide CD version of manufacturers operating software to include graphical interface software.

.4 Provide 2 extra sets of as-built and operating manuals.

1.6 SYSTEM DESCRIPTION

.1 The lighting control system is a networked system that communicates via RS485. The system must be able to communicate with fully digital centralized relay panels, small distributed relay panels (Available with 0-10Volt dimming outputs, Fully distributed fixture level control by bus connected relays or dimmers, digital switches, photocells, various interfaces and operational software. The intent of the specification is to integrate all lighting control into one system. Distributed lighting control shall be provided using networked micro relay panels or bus connected fixture level control. Lighting control

system shall include all hardware and software. Software shall be resident within the lighting control system. System shall provide local access to all programming functions at the master LCP and remote access to all programming functions via dial up modem and through any standard computer workstation. Lighting control system shall have the capability to be remotely controlled via the internet or building wide Ethernet LAN. Desktop computers are not part of this section and will be provided by others.

.2 System software shall provide real time status of each relay, each zone and each group.

.3 Lighting control system shall be able to be monitored by and take commands from a remote PC. At any time, should the remote PC go off-line all system programming uploaded to the lighting control system shall continue to operate as intended. Systems requiring an on line PC or server for normal operation are not acceptable

.4 All devices shall be pre-addressed at the factory. If required by the client the system may be specified without pre-addressing and simple software is to be provided to simplify addressing in place. This particularly applies to fixture level control where controls may be factory mounted on the fixture in advance to speed installation.

.5 All programs, schedules, time of day, etc, shall be held in non-volatile memory for an indefinite time exceeding ten years in the event of power failure. At restoration of power, lighting control system shall implement programs required by current time and date. Time of day shall be battery backed for at least ten years.

.6 System shall be capable of warning of an impending off sweep by flashing lights Off/On once or twice (programmable) by relay or by zone prior to the lights being turned off. The warning interval times between the flash and the final lights off signal shall be definable for each zone. Additionally an audible signal shall be able to be programmed that gives a mild note on the first flash and a more insistent signal on the second one. Occupant shall be able to override any scheduled Off sweep using local wall switches within the occupied space. Occupant override time shall be locally and remotely programmable and not exceed 2-hours.

.7 The system shall be capable of implementing On commands, Off commands, Raise (dimming) commands, Lower (dimming) commands for any relay, group or zone by means of digital wall switches, contact closure switches, time clock schedules including offsets from dusk and dawn by up to ten hours, photocell, pc software or other devices connected to programmable inputs in a lighting control panel.

.8 The lighting control system shall provide the ability to control each relay and each relay group per this specifications requirement. All programming and scheduling shall be able to be done locally at the master LCP and remotely via dial up modem or via the Internet. Remote connection to the lighting control system shall provide real time control and real time feedback.

.9 Micro relay panels shall be capable of taking inputs from contact closure switches and outputting up to 8 independent 0v to 10v dimming signals. All micro relay panels and all devices connected to micro relay panels (switches, photocells and occupancy sensors, etc) shall be wired per lighting control manufacturer’s instructions.

.10 Networked relays or dimming modules shall be fed from a router. Individual modules are fed from the LCP panel on a separate bus. Each router may feed two strings of up to 64 modules on a 2000ft string. Each Module may be a single relay, a dual relay or a dimming (0-10Volt) module. Relays in the modules are to be capable of being separately controlled in the same manner as an individual relay or dimmer in a relay or dimmer panel. Additionally multiple relays may be collected together to act together as a single multi-pole load or dimmer for ease of programming. Graphical software shall be available that does these assignments and reassignments in a straightforward and logical manner. Relays shall have the same specifications as laid out in 2.1.3. Modules with reduced current ratings may be supplied with Quick Connect connectors for more rapid installation.

Part 2 Products

1.1 MATERIAL AND COMPONENTS

.1 Relay Panels:

.1 All LCP's shall be in CSA Type 1 rated enclosure with screw cover or hinged Locking door. Other CSA rated types optional.

.2 A barrier shall separate the high voltage and low voltage compartments of the panel.

.3 LCP input power shall be capable of accepting 120Vac.

.4 Control electronics in the low voltage section shall be capable of driving 2 to 48 relays (rated as per Section 2.1.3), control any individual or group of relays, provide individual relay overrides, provide a master override for each panel, store all programming in non-volatile memory, after power is restored return system to the correct state for time of day, provide programmable dual blink warn timers for each relay or zone of relays, and be able to control Normally Open Latching (NOL) or Normally Closed Latching (NCL) relays.

.5 Lighting control system shall be digital and consist of a Master LCP, Remote LCPs, Micro LCPs with up to 8 individual relays, Router and associated relays or dimmers emulating standard or Micro LCPs, digital switches, digital interface cards and if required. All system components shall connect and be controlled via Category 5, 4 twisted pair cable with RJ45 connectors, providing real time two-way communication with each system component. All Micro LCP's shall provide multiple inputs for photocells and occupancy sensors. Analog systems are not acceptable.

.2 Micro Relay Panels

.1 Micro relay panels shall have from 2 to 8 relays (rated as per Section 2.1.3) and shall control all lighting in the designated area indicated on the plans and be part of the lighting control network. Each micro relay panel shall provide minimum 300ma at 12/24vdc for powering occupancy sensors. Micro relay panels that require a separate occupancy sensor power pack are not acceptable.

.2 Micro relay panel shall provide a minimum of 4-programmable photocell inputs, a minimum of 8-programmable occupancy sensor contact closure inputs. This

requirement is to insure integration of entire lighting system into one networked, lighting control system.

.3 Micro relay panels shall be capable of outputting a minimum of 4 and up to 8 independent 0v to 10v dimming signals, one independent dimming signal per relay for each of 8 relays. In order to maximize daylight harvesting and minimize disruption to occupants, each dimming output shall provide adjustment for baseline, start point, midpoint, end point, trim, fade up rate, fade down rate, time delay and enable/disable masking. All photocell settings must be remotely accessible. Systems providing On, Off with Time Delay only, and system that do not provide remote access are not acceptable.

.4 MicroPanels shall have built in capability to take commands from a fully compatible wireless switch. Wireless switch shall contain no battery; have 32-bit unique ID and a minimum 90-foot range line of sight.

.3 Standard Output relays

.1 ULC Listed 30 Amp at 120VAC fluorescent and HID and 20 Amp at 120 Vac LED.

.2 Relays shall be individually replaceable. Relay terminal blocks shall be capable of accepting two (2) #8AWG wires on both the line and the load side. Systems that do not allow for individual relay replacement or additions are not acceptable. Relays to be rated for 250,000 operations minimum at a full 30a lighting load. Standard relay shall default to closed at normal power loss, Normally Closed Latching (NCL).

.3 Optional relay types available shall include: Normally Open Latching (NOL) relay rated for 250,000 operations, a 600v 2-pole NO and NC and a Single Pole, Double Throw (SPDT) relay.

.4 Low Voltage Switches

.1 All switches shall be digital and communicate via RS 485. Contact closure style switches, except as specified for connection to the micro relay panel programmable contact closure inputs, shall not be acceptable. The programming for a digital switch shall reside in the switch itself, via double EPROM memory. Any digital switch button function shall be able to be changed locally (at the DTC or a PC) or remotely, via modem, Internet or Ethernet.

.2 Digital low voltage switch shall be a device that sits on the lighting control system bus. Digital switch shall connect to the system bus using the same cable and connection method required for relay panels. Each button shall be capable of being programmed for On only, Off only, Mix (Some on some off), On/Off (toggle), Raise (Dim up) and Lower (Dim down). Further each button shall be able to be enabled or disabled over the bus. An audible alarm shall be available on all switches that can be programmed to beep on button push or with warning light blinks.

.3 Keyed switches shall be similarly programmable and connect to the lighting control system bus.

.4 Digital switches for high abuse areas (common areas, etc.) shall be vandal resistant, contain no moving parts, and be touch sensitive and available with up to two buttons in a single gang. Multi gang versions shall also be available.

Touch pads shall be Stainless Steel and capable of handling both high abuse and wash down locations. High abuse switches shall connect to the lighting control system digital bus. Each high abuse touch button shall be able to be programmed in the same way as other digital switch buttons. Switches must be capable of handling electrostatic discharges of at least 30,000 volts (1cmspark) without any interruption or failure in operation.

.5 Wireless Switches-System shall have the capability to accept inputs from 32-bit unique ID wireless switches. Wireless switches shall have no battery and be capable of On, Off, Raise and Lower commands. Wireless switches shall have a minimum 90 foot line of sight range

.6 DTC - Digital Electronic Time Clock

.1 A Digital Time Clock (DTC) shall control and program the entire lighting control system and supply all time functions and accept modem (RS232) inputs.

.2 DTC shall be capable of up to 32 schedules. Each schedule shall consist of one set of On and Off times per day for each day of the week and for each of two holiday lists. The schedules shall apply to any individual relay or group of relays.

.3 The DTC shall be capable of controlling digital devices at up to 127 addresses on a single bus and capable of interfacing digitally with other buses using manufacturer supplied interface cards.

.4 The DTC shall accept control locally using built in button prompts and use of an 8 line 21-space display or from a computer or modem via an on-board RS 232 port. All commands shall be in plain English. The DTC shall be run from non-volatile memory so that all system programming is retained indefinitely and time of day is battery backed for up to 10 years.

.5 Lighting control software shall provide via local or remote PC a visual representation of each device on the bus, show real time status and the ability to change the status of any individual device, relay or zone. Lighting control software shall provide for importing vector based graphics and a simple interface that allows users or a factory programmer to overlay color “controls” that are associated with relays or collections of relays. Clicking on the overlays changes the color and the status of the relays for visual display of large systems.

.6 System shall come with a pre-Installed modem that allows for remote programming from any location using a PC and free remote control software.

.7 DTC shall provide system wide timed overrides. Any relay, group or zone that is overridden ON, before or after hours, shall automatically be swept OFF by the DTC a maximum of 2 hours later.

.7 PHOTOCELL: Photocells to be mounted in location indicated on the plans. Photocells used for exterior lights shall provide multiple trip points from 1 roof mounted unit. All trip points shall be able to be changed remotely via Internet or dial up modem. Photocells requiring manual trip point adjustment are not acceptable. Photocell used for interior lighting control shall have multiple settings such as start-point, mid-point, off-point, fade-up, fade-down, etc. All settings shall be remotely accessible and adjustable. Systems providing local adjustment only are not acceptable. Photocells to be certified to comply with the current energy code covering this project at time of submittal of plans for building permit.

.8 Interfaces: For future expansion capability, systems are to have available all of the following interfaces. Verify and install only those interfaces indicated on the plans.

.1 A dry contact input interface card that provides 14 programmable dry contact closure inputs. Use shielded cable to connect input devices to interface card on runs over 200ft.

.2 Uplink Interface card that allows a single bus to be part of a greater system connected together by a Back Bone Bus. The back Bone bus requires a server for the Modem and Ethernet connections to such a large system.

.3 When Lighting control software is specified full graphic pages shall be designed to the owner's specifications. Owner is to provide to manufacturer all necessary files and criteria.

.4 Direct digital interface to DMX 512 based systems. DMX interface shall provide 14 global commands, each of which can be modified locally or remotely using lighting controls manufacturer supplied software. DMX interface shall be integral to the system bus and shall connect and be controlled via a single Category 5, 4 twisted pair cable, providing real time response from the lighting control system to DMX commands.

.5 Direct digital interface to building automation systems using DDC protocols such as BACnet that accept on/off commands, time schedules and report status of all relays in all panels in real time. Interface cards shall "self populate" each individual relay and each group to the BAS. All BAS system programming required shall be the responsibility of the BAS system provider.

Part 3 Execution

1.1 EQUIPMENT INSTALLATION

.1 Mount relay control cabinets adjacent to respective lighting panel board. Cabinet shall be surface or flush mount, per plans. Wiring between relay control cabinets and panelboards shall be in accordance with local codes and acceptable industry standards. Under no circumstances will any extra payment be authorized for the EC or GC due to the EC's lack of knowledge or understanding of any and all prevailing codes or specified manufacturer's installation requirements. Neatly lace and rack wiring in cabinets. During construction process, protect all interior components of each relay panel and each digital switch from dust and debris. Any damage done to electronic components due to failure to protect them shall be the sole responsibility of the installing contractor.

.2 Switches: Provide outlet boxes, single or multi-gang, as shown on the plans for the low voltage digital switches. Mount switches as per plans. Supply faceplates per plans and specifications. EC is specifically responsible to supply and install the required low voltage cable, Category 5, 4 twisted pair, with RJ45 connectors (commonly referred to as Cat 5 patch cable) between all switches and panels. Field-test all Cat 5 patch cable with a recognized cable tester. All low voltage wire to be run in conduit, per local codes.

.3 Lighting control system manufacturer to provide on all systems of more than 2 panels a crimping kit with sufficient approved EZ Brand RJ 45 connectors to populate the whole system. A simple manual that shows all the pitfalls of crimping RJ 45s and how to do it right must be both provided and read by the installing contractor.

.4 Wiring

.1 Do not mix low voltage and high voltage conductors in the same conduit.

.2 Ensure low voltage conduits or control wires do not run parallel to current carrying conduits.

.3 Place manufacturer supplied “terminators” at each end of the system bus per manufacturer’s instructions.

.4 Plug in Category 5 patch cable with RJ45 end connector that has been field-tested with a recognized cable tester, at the indicated RJ45 connector provided at each lighting control device, per manufacturer’s instructions.

.5 Use Category 5 patch cable for all system low voltage connections. Additional conductors may be required to compensate for voltage drop with specific system designs. Use shielded cable for dry contact inputs on runs over 200ft.

.6 Do not exceed 4000ft-wire length for the system bus.

.7 All items on the bus shall be connected in sequence (daisy chained). Star and spur topologies are not acceptable.

.8 The specified lighting control system shall be installed by the electrical contractor who shall make all necessary wiring connections to external devices and equipment, to include photocell. EC to wire per manufacturer instructions.

1.2 INSTALLATION AND SET-UP

.1 Verify that conduit for line voltage wires enters panel in line voltage areas and conduit for low-voltage control wires enters panel in low-voltage areas. Refer to manufacturer's plans and approved shop drawings for location of line and low-voltage areas. This is especially applicable in jobs where back boxes are shipped in advance. It is the responsibility of the contractor to verify with lighting control manufacturer all catalog information and specific product acceptability.

.2 For approved contact closure switches, use #18 AWG stranded conductors. For all other digital switches, provide wiring required by system manufacturer.

.3 For classroom digital switches provide wiring required by system manufacturer

.4 Contractor to test all low voltage cable for integrity and proper operation prior to turn over. Verify with system manufacturer all wiring and testing requirements.

.5 Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, commissioning of the lighting control system and Owner instruction includes:

.1 Confirmation of entire system operation and communication to each device

.2 Confirmation of operation of individual relays, switches, occupancy sensors and daylight sensors

.3 Confirmation of system Programming, photocell settings, override settings, etc.

.4 Provide training to cover installation, maintenance, troubleshooting, programming, and repair and operation of the lighting control system.

.6 Panels shall be located so that they are readily accessible and not exposed to physical damage.

.7 Panel locations shall be furnished with sufficient working space around panels to comply with the Canadian Electric Electrical Code.

.8 Panels shall be securely fastened to the mounting surface by at least 4 points.

.9 Unused openings in the cabinet shall be effectively closed.

.10 Cabinets shall be grounded as specified in the Canadian Electrical Code.

.11 Lugs shall be suitable and listed for installation with the conductor being connected

.12 Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.

.13 Maintain the required bending radius of conductors inside cabinets.

.14 Clean cabinets of foreign material such as cement, plaster and paint.

.15 Distribute and arrange conductors neatly in the wiring gutters.

.16 Follow the manufacturer's torque values to tighten lugs.

.17 Before energizing a panel, the following steps shall be taken:

.1 Retighten relay connections to the manufacturer's torque specifications. Verify that required connections have been furnished.

.2 Remove shipping blocks from component devices and the panel interior.

.3 Remove debris from panel interior.

.18 Follow manufacturer’s instructions for installation and all low voltage wiring.

.19 Service and Operation Manuals:

.1 Submit operation and service manuals. Complete manuals shall be bound in flexible binders and data shall be typewritten or drafted.

.2 Manuals shall include instructions necessary for proper operation and servicing of system and shall include complete wiring circuit diagrams of system, wiring destination schedules for circuits and replacement part numbers. Manuals shall include as-built cable Project site plot plans and floor plans indicating cables, both underground and in each building with conduit, and as-built color coding used on cables. Programming forms of systems shall be submitted with complete information.

.20 Comply with energy code lighting control system “Acceptance Requirements”. Acceptance tests are used to verify that lighting controls were installed and calibrated correctly. These tests may require that a responsible party certify that controls are

installed and calibrated properly. This is the installing contractor's responsibility. Verify requirements with building authority.

1.3 DOCUMENTATION

.1 Each relay shall have an identification label indicating the originating branch circuit number and panelboard name as indicated on the drawings. Each line side branch circuit conductor shall have an identification tag indicating the branch circuit number.

.2 Provide a point-to-point wiring diagram for the entire lighting control system. Diagram must indicate exact mounting location of each system device. This accurate "as built" shall indicate the loads controlled by each relay and the identification number for that relay, placement of switches and location of photocell. Original to be given to owner, copies placed inside the door of each LCP.

1.4 SERVICE AND SUPPORT

.1 Start Up: EC shall contact lighting control system manufacturer at least 7 days before turnover of project. The manufacturer will remotely dial into the lighting control system, run diagnostics and confirm system programming. EC shall be available at the time of dial in to perform any corrections required by manufacturer. EC is responsible for coordinating with GC and the owner the installation of a dedicated telephone line or a shared phone line with an automatic Fax/Modem switch. Phone jack to be mounted within 12" of Master LCP. Label jack with phone number. EC to connect phone line from jack to Master LCP.

.2 Telephone factory support shall be available at no additional cost to the EC or Owner both during and after the warranty period. Factory to pre-program the lighting control system per plans and approved submittal, to the extent data is available. The specified lighting control system manufacturer, at no added cost, shall provide additional remote programming via modem as required by the EC or Owner for as long as a phone line is available for the life of the system. Upon request manufacturer to provide remote dial up software at no added cost to system owner. No exceptions.

.3 Provide a factory technician for on-site training of the owners' representatives and maintenance personnel. Coordinate timing with General Contractor. Provide one day of factory on-site training.

1.5 CLEANING

.1 Division 1 - Execution Requirements: Final cleaning.

.2 Clean photocell lens as recommended by manufacturer.

.3 Clean all switch faceplates.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 CSA International

.1 CAN/CSA-C22.2 No.47-M90(R2007), Air-Cooled Transformers (Dry Type).

.2 CSA C9-02(R2007), Dry-Type Transformers.

.3 CAN/CSA-C802.2-06, Minimum Efficiency Values for Dry Type Transformers.

.2 National Electrical Manufacturers Association (NEMA)

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for dry type transformers and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: submit operation and maintenance data for dry type transformers for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect dry type transformers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESIGN DESCRIPTION

.1 Use transformers of one manufacturer throughout project and in accordance with CAN/CSA-C22.2No.47, CSA-C9.

.2 Design:

.1 Type: Dry Type; energy efficient Harmonic Mitigating distribution transformer with zero sequence flux cancellation technology.

.2 3 phase, 225 kVA, 600 V input, 208/120 V output, 60 Hz.

.3 Voltage taps: standard.

.4 Insulation: Class 150, 80 degrees C temperature rise.

.5 Basic Impulse Level (BIL): 10 kV BIL.

.6 Hipot: standard.

.7 Average sound level: standard

.8 Impedance at 17 degrees C: standard

.9 Enclosure: CSA, removable metal front panel.

.10 Finish: in accordance with Section 26 05 00 - Common Work Results for Electrical.

.11 Copper windings.

.12 Winding configuration to be as noted on drawings.

.13 Voltage Regulation to be 4% or better.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Label size: 7.

Part 3 Execution

3.1 INSTALLATION

.1 Transformer exceeds 45kVA shall be floor mounted.

.2 Ensure adequate clearance around transformer for ventilation.

.3 Install transformers in level upright position.

.4 Remove shipping supports only after transformer is installed and just before putting into service.

.5 Loosen isolation pad bolts until no compression is visible.

.6 Make primary and secondary connections in accordance with wiring diagram.

.7 Energize transformers after installation is complete.

3.2 EXAMINATION

.1 Verify that delivered transformers is free of physical defects and visible damage:

3.3 CLEANING

.1 Upon completion remove surplus materials, rubbish, tools and equipment.

.2 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect delivered products and components from damage during transportation.

.2 Repair damage to adjacent materials caused by dry type transformers transportation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1	Common Work Results – For Electrical:	Section 26 05 00
.2	Service Entrance Board:	Section 26 24 02
.3	Panelboards Breaker Type:	Section 26 24 16.01
.4	Moulded Case Circuit Breakers	Section 26 28 16.02

1.2 REFERENCE DOCUMENTS

.1 CSA C22.1 – 15 (C.E.C.).

.2 IEEE 1584-2002 Guidelines for Performing Arc-Flash Hazard Calculations.

.3 ANSI Z535.4-2002 Product Safety Signs and Labels.

.4 CSA Z462.

.5 IEEE 519.

1.3 PRODUCT DATA

.1 Provide coordination study documents. Documents to include all graphs, data, breaker trip settings chart, etc.

.2 Documents to be signed and sealed by a Professional Electrical Engineer registered in the province of Alberta.

1.4 POWER DISTRIBUTION TO INCLUDE BUT NOT LIMITED TO:

.1 New normal and emergency power distribution system; existing power distribution system.

.2 Short circuit coordination.

.3 Overcurrent trip coordination.

.4 Ground fault trip coordination.

.5 Arc fault level coordination.

.6 Harmonic level confirmation.

Part 2 Product

.1 Signed coordination study document by professional engineer.

.2 Power distribution breakers short circuit interrupting capacity start (RMS symmetrical) for power distribution breaker panels for both 600V and 208V systems.

.3 Power distribution breakers recommended trip setting.

.4 Power distribution breakers ground fault trip settings.

.5 Power distribution equipment Arc Flash calculation with chart indicating available Arc-Flash levels for each power distribution enclosure.

Part 3 Execution

.1 Coordination study shall be done prior to submitting power distribution system shop drawings. Interrupting capacity ratings of all distribution equipment, brace buswork, and breakers will be based on coordination study results.

.2 Overcurrent devices trip settings will be based on the coordination study results.

.3 Ground fault devices trip setting will be based on the coordination study results.

.4 Electrical equipment "Arc Flash" signs will be based on the coordination study results. Supply and install “Arc Flash” labels.

.5 Manufacture to supplier detailed arc flash hazard analysis label as per CSA Z462-12 Figure Q.3. Contractor to install as required.

.6 Insert all Coordination reports in the “O & M” manual.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for service entrance board.

1.2 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results – For Electrical.

1.3 REFERENCES

.1 CAN/CSA-C22.2 No.31-M89(R2000), Switchgear Assemblies.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate on shop drawings.

- .1 Floor anchoring method and foundation template.
- .2 Dimensioned cable entry and exit locations.
- .3 Dimensioned position and size of bus.
- .4 Overall length, height and depth.
- .5 Dimensioned layout of internal and front panel mounted components.

.3 Include time-current characteristic curves for circuit breakers and fuses.

1.5 QUALITY ASSURANCE

.1 Submit electronic copy of certified test results.

1.6 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for service entrance board for incorporation into manual.

.2 Submit electronic copy of maintenance data for complete assembly including components.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

Part 2 Products

2.1 SERVICE ENTRANCE BOARD

.1 Service Entrance Board: to CAN/CSA-C22.2 No.31.

.2 Rating: 208/120 V, 3 phase, 4 wire, 600 A, short circuit current (rms symmetrical) as per short circuit study.

.3 Cubicles: free standing, size as indicated.

.4 Barrier metering section from adjoining sections.

.5 Provision for installation of owner metering in barriered section.

.6 Owners metering.

.7 Distribution section.

.8 Hinged access panels with captive knurled thumb screws.

.9 Bus bars and main connections: copper.

.10 Bus from load terminals of main breaker via metering section to main lugs of distribution section.

.11 Identify phases with colour coding.

2.2 GROUNDING

.1 Copper ground bus extending full width of cubicles and located at bottom.

.2 Lugs at each end for size #4/0 AWG grounding cable.

2.3 GROUND FAULT UNIT

.1 Main Circuit Breaker is to complete with ground fault protection.

2.4 POWER SUPPLY AUTHORITY METERING

.1 Provide power supply authority metering as per ATCO requirements.

.2 Mounting accessories and wiring for owner metering:

.1 Owner meters to match existing owner meters on site. If existing owner meters were obsolete, new meters should be compatible with and able to communicate with existing owner meters.

.2 potential transformers.

.3 current transformers.

.4 Watthour meter.

.5 Demand meter with kW.h register.

2.5 FINISHES

.1 Apply finishes in accordance with Section 26 05 00 - Common Work Results – Electrical.

.1 Service entrance board exterior: match existing.

2.6 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results – Electrical.

.2 Nameplates:

.1 Style, text, size is to match existing.

.2 Complete board labelled as per Single Line Diagram.

2.7 SOURCE QUALITY CONTROL

.1 Departmental Representative to witness final factory tests if required.

.2 Notify Departmental Representative in writing 5 days in advance that service entrance board is ready for testing.

Part 3 Execution

3.1 INSTALLATION

.1 Locate service entrance board as shown on the drawings.

.2 Connect main secondary service to line terminals of main breaker.

.3 Connect load terminals of distribution breaker's to feeders.

.4 Check factory made connections for mechanical security and electrical continuity.

.5 Run one grounding conductor #4/0 AWG bare copper in 25 mm conduit from ground bus to building ground bar.

.6 Check trip unit settings against co-ordination study to ensure proper working and protection of components.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No.29-11, Panelboards and Enclosed Panelboards.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:

.1 Submit drawings stamped and signed by manufacturer and contractors.

.2 Include on drawings:

.1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.3 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect panelboards from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer, EATON, to match existing.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 250, 600 V panelboards: bus and breakers symmetrical interrupting capacity as indicated.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Minimum of 2 flush locks for each panel board.

.6 Two keys for each panelboard and key panelboards alike.

.7 Copper bus with neutral of same ampere rating of mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked enamel, ANSI 61 Grey.

.11 Isolated ground bus.

.12 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.

2.2 BREAKERS

.1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.

.2 Panelboards breakers shall be “bolt-on” type, plug-in breakers are not acceptable.

.3 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.4 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.5 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to U of C facility maintenance personnel.

.6 Lock-on devices for fire alarm, door supervisory, intercom, and exit light circuits.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Nameplate for each panelboard size 4 engraved.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards in accordance with Section 06 10 00 - Rough Carpentry. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus [with respective neutral identified].

3.3 CLEANING

.1 Progress Cleaning: leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by panelboards installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CAN/CSA C22.2 No.94.1-07, Enclosures for Electrical Equipment, Non Environment Considerations.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA 250-2008, Enclosures for Electrical Equipment (1000 Volts Maximum).

.3 The Munsell System of Colour Notation

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for electrical cabinets and enclosures and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:

.1 Submit drawings stamped and signed by manufacturer and contractors.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for electrical cabinets and enclosures for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect electrical cabinets and enclosures from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish to CAN/CSA C22.2, Munsell Notation 7.5GY3.5/1.5, size as indicated.

.2 Entire enclosure to be capable of withstanding maximum impact force of 86 MN/m^2 area without rupture of material.

.3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.

.4 Equip enclosure with hot dipped galvanized mounting rails 1 m adjustable horizontally and vertically to enable mounting of equipment at any location within housing.

- .1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.
- .2 Holes in side panel flanges in 60 mm increments for vertical adjustment.

.5 Cover: tamperproof, bolt-on, domed to shed water.

.6 Door: 3 point latching, with padlocking means.

.7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, and vermin.

.8 Enclosure construction such as to allow configuration of single or ganged enclosures.

.9 Enclosure capable of being shipped in knocked-down condition.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electrical cabinet and enclosure installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Assemble enclosure in accordance with manufacturer's instructions and securely mount on building structure with channels, supports and fastenings.

.2 Mount equipment in enclosure.

.3 Label electrical cabinets and enclosure to Section 26 05 00 - Common Work Results for Electrical.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Requirements.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CAN/CSA C22.2 No.42.1-00(R2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA C22.2 No.55-M1986(R2008), Special Use Switches.

.4 CSA C22.2 No.111-10, General-Use Snap Switches (Bi-national standard, with UL 20).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by manufacturer and contractors.

1.3 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wiring devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

.1 15, 20 A, 120 V, 347 V, single pole switches to: CSA C22.2 No.55, CSA C22.2 No.111.

.2 Manually-operated general purpose AC switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Ivory toggle.

.3 Toggle operated locking fully rated for up to 80% of rated capacity of motor loads & heating loads.

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R/5-20R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:

.1 Ivory urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Ivory urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated:

.1 Emergency receptacles shall be red.

.2 Isolated ground receptacles in Audiovisual Preservation room 149/149A shall be orange.

.3 Special purpose receptacles shall be brown.

.4 The color of standard receptacles and switches shall be coordinated with the architectural color scheme; for example, white, not ivory, devices shall be used if walls are white or light gray.

.4 Receptacles of one manufacturer throughout project.

2.3 FLOOR RECEPTACLES

.1 Refer to drawings for floor receptacle types and models.

2.4 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Stainless steel thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.

.3 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.4 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.5 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

2.5 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height as indicated in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height as indicated in accordance with Section 26 05 00 - Common Work Results for Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Install GFI type receptacles as indicated.

.3 Cover plates:

.1 All cover plates are to be stainless steel.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.3 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse & recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers and ground-fault circuit-interrupters.

1.2 RELATED SECTIONS

.1 Section 26 24 02 - Service Entrance Board.

.2 Section 26 28 18 - Ground Fault Equipment Protection.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

.1 Include time-current characteristic curves for breakers with ampacity of 1000 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.2 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers and Ground-fault circuit-interrupters: to CSA C22.2 No. 5

.2 Bolt-on, quick- make, quick-break type, for manual and automatic operation.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have minimum symmetrical rms interrupting capacity rating as per manufacturer conducted short circuit coordination study results.

2.2 SOLID STATE TRIP BREAKERS

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous tripping for phase and ground fault short circuit protection.

2.3 OPTIONAL FEATURES

.1 Include:

.1 Shunt trip.
.2 Auxiliary switch.
.3 Motor-operated mechanism c/w time delay unit.
.4 Under-voltage release.
.5 On-off locking device.
.6 Handle mechanism.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Equipment, fabrication and installation for ground fault protection.

.2 Text to complete Section 26 24 02 - Service Entrance Board.

1.2 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.3 PAYMENT PROCEDURES

.1 Payment for field testing of ground fault equipment performed by contractor and/or equipment manufacturer.

1.4 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No. 144-M91(R2001), Ground Fault Circuit Interrupters.

1.5 SUBMITTALS

.1 Submit product data and shop drawings.

.2 Submit test report for field testing of ground fault equipment to Consultant and certificate that system as installed meets criteria specified.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

.4 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 EQUIPMENT

.1 Ground fault protective equipment: components of one manufacturer.

.2 Ground fault unit to contain:

.1 Ground sensing relay suitable for operation at factory set.

.2 Three position sensitivity control switch to select value of leakage current at which relay will operate.

.3 Switch:

.1 SPDT contacts for alarm and trip.

.2 Mechanical target indication.

.3 Manually reset.

.4 Reset button for contacts and target.

.5 Suitable for panel surface mounting.

.3 Zero sequence transformer rectangular type with 300 - 3000 mA range.

.4 Neutral:

.1 For Delta ungrounded systems, use an artificial neutral and grounding resistor.

.5 System to operate instantaneously at ground current setting.

2.2 FABRICATION

.1 Install following components in equipment specified in other Sections and as indicated.

.1 Zero sequence transformer.

.2 Ground fault relay.

.3 Ground resistor unit.

2.3 RELATED EQUIPMENT

.1 Shunt trip breakers.

Part 3 Execution

3.1 INSTALLATION

.1 Do not ground neutral on load side of sensor.

.2 Install phase conductors including neutral through zero sequence transformer.

.3 Install ground fault protection system.

.4 Make connections as indicated and in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results – Electrical.

.2 Arrange for field testing of ground fault equipment by contractor and/or equipment manufacturer before commissioning service.

.3 Demonstrate simulated ground fault tests.

END OF SECTION

Part 1 General

1.1 PAYMENT

.1 Payment for field testing of ground fault equipment performed by Contractor.

1.2 REFERENCES

.1 CSA International

.1 CAN/CSA C22.2 No.144-M91(R2006), Ground Fault Circuit Interrupters.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA PG 2.2-1999(R2009), Application Guide for Ground Fault Protection Devices for Equipment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for [ground fault circuit interrupters] and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:

.1 Submit drawings stamped and signed by manufacturer and contractors.

.3 Test and Evaluation Reports: submit test report for field testing of ground fault equipment to Departmental Representative and certificate that system as installed meets criteria specified.

1.4 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: submit operation and maintenance data for ground fault circuit interrupters for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect ground fault circuit interrupters from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials as specified in accordance with Section 01 74 19 - Construction Waste Management.

Part 2 Products

2.1 MATERIALS

.1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA C22.2 No.144.

.2 Components comprising ground fault protective system to be of same manufacturer.

2.2 BREAKER TYPE GROUND FAULT INTERRUPTER

.1 Refer to panelboard schedule for breaker ratings, 1 phase circuit c/w test and reset facilities.

2.3 GROUND FAULT PROTECTOR UNIT

.1 Self-contained with 15 A, 120 V circuit interrupter and duplex receptacle complete with:

.1 Solid state ground sensing device.

.2 Indication lamp for circuit status shall be integrated in the GFI receptacles.

.3 Facility for testing and reset.

.4 CSA Enclosure 1, flush mounted with stainless steel face plate.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for ground fault circuit interrupters installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Do not ground neutral on load side of ground fault relay.

.2 Pass phase conductors including neutral through zero sequence transformers.

.3 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and co-ordinate with Section 01 45 00 - Quality Control.

.2 Arrange for field testing of ground fault equipment by Contractor before commissioning service.

.3 Demonstrate simulated ground fault tests.

3.4 CLEANING

.1 Progress Cleaning: leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse & recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for non-fused disconnect switches.

1.2 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.

.2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Separate for reuse and recycling and place in designated containers Steel Metal Plastic waste in accordance with Waste Management Plan.

.4 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Non-fusible, horsepower rated disconnect switch in CSA Enclosure, to CAN/CSA C22.2 No.4 size as required.

.2 Provision for padlocking in on-off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Quick-make, quick-break action.

.5 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 International Electrotechnical Commission (IEC)

.1 IEC 947-4-1-2002, Part 4: Contactors and motor-starters.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings.

.2 Indicate:

.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout of identified internal and front panel components.
.4 Enclosure types.
.5 Wiring diagram for each type of starter.
.6 Interconnection diagrams.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor starters for incorporation into manual.

.2 Include operation and maintenance data for each type and style of starter.

1.5 EXTRA MATERIALS

.1 Provide listed spare parts for each different size and type of starter:

.1 3 contacts, stationary.
.2 3 contacts, movable.
.3 1 contacts, auxiliary.
.4 1 control transformer.
.5 1 operating coil.
.6 2 fuses.
.7 10% indicating lamp bulbs used.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Place materials defined as hazardous or toxic waste in designated containers.

.2 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 MATERIALS

.1 Starters: to NEMA rating; all starters are to be complete with 2 NO & 2 NC auxiliary contacts.

2.2 MANUAL MOTOR STARTERS

.1 Single /Three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.

.2 One /Three overload heater s, manual reset, trip indicating handle.

.2 Accessories:

.1 Toggle switch pushbutton: heavy duty labelled as indicated.

.2 Indicating light: heavy duty type and colour as indicated.

.3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.4 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results - Electrical.

2.5 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Ensure correct overload devices elements installed.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Provide complete factory assembled generator set equipment with digital (microprocessor-based) electronic controls.

.2 Provide factory test, startup by a supplier authorized by the manufacturer, and on-site testing of the system.

.3 The generator set manufacturer shall warrant all equipment provided under this section, whether or not is manufactured by the generator set manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.

.4 Generator warranty to be 5 years.

1.2 CODES AND STANDARDS

.1 The generator set installation and on-site testing shall conform to the requirements of the following codes and standards, as applicable. The generator set shall include necessary features to meet the requirements of these standards.

.2 CSA 282, (Latest Edition) Emergency Electrical Power Supply for Buildings

.3 IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

.4 The generator set and supplied accessories shall meet the requirements of the following standards:

.1 NEMA MG1-1998 part 32. Alternator shall comply with the requirements of this standard.

.2 UL142 – Sub-base Tanks

.3 UL1236 – Battery Chargers

.4 UL2200. The generator set shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed.

.5 The control system for the generator set shall comply with the following requirements.

.1 CSA C22.2, No. 14 – M91 Industrial Control Equipment

.2 EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial

.3 EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.

.4 FCC Part 15, Subpart B.

.5 IEC8528 part 4. Control Systems for Generator Sets

.6 IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions

.6 The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.3 ACCEPTABLE MANUFACTURER

.1 Kohler

.2 Finning /Caterpillar

.3 Cummins / Onan

1.4 RELATED SECTIONS

.1 . Automatic Transfer Switch

1.5 WORK BY OTHER SECTIONS

.1 Fuel tank supply piping to exterior for fuel fill.

.2 Installation of muffler including piping from engine manifold to muffler and to outside vent

.3 Insulation of Insulation of piping and muffler

1.6 STANDARDS AND QUALIFICATIONS:

.1 The emergency power equipment shall comply with all applicable ANSI specifications and shall be constructed to NEMA/EEMAC standards with CSA/UL/ULC approved panel components.

.2 The Diesel engine generator set shall comply, unless otherwise noted herein, with the Requirement of the Provincial/ National Environmental Authority with jurisdiction.

.3 CSA C282.09 Emergency electrical power supplies for Buildings.

1.7 SHOP DRAWINGS AND PRODUCT SUBMITTAL

.1 Submit electronic pdf shop drawings for all relevant items in this Specification. Include:

.1 Outline dimensions, configuration and identifications of components, floor anchoring method, details and dimensions of foundations, cable entry and exits locations, power and control diagram, panel layout, identification of panel components.

.2 Generator Nameplate Drawing including plan and elevation views with certified overall dimensions, as well as wiring interconnection details.

.3 Generator decrement curves.

.4 Generator capability curve.

.5 Generator damage curve for 3 phase, 2 phase and 1 phase fault.

.6 Detailed technical data for the governor.

.7 Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.

.8 Manufacturer's installation instructions.

1.8 QUALITY ASSURANCE:

.1 Qualified personnel shall be present at all times to supervise the work and shall be thoroughly familiar with the materials, standards, and specific requirements of this section.

.1 Codes and Standards:

.1 Comply with the Codes and Standards specified herein.

.2 Where provisions of pertinent codes and standards conflict with these specifications and drawings or each other, comply with the more stringent provisions.

1.9 OPERATION

.1 Sequence of Operation

.1 Generator set shall start on receipt of a start signal from remote equipment. The start signal shall be via hardwired connection to the generator set control and a redundant signal over the required network connection.

.2 The generator set shall complete a time delay start period as programmed into the control.

.3 The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:

.1 The control system shall verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two attempts, the control system shall shut down and lock out the generator set, and indicate “fail to crank” shutdown.

.2 The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate “fail to start”.

.3 The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.

.4 On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous, synchronize, load share, load demand, or load govern state.

.5 When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.

.6 On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.

.7 Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

1.10 OTHER REQUIREMENTS

.1 Factory Testing.

.1 The generator set supplier shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.

.2 Factory testing may be witnessed by the owner and consulting engineer. Costs for travel expenses will be the responsibility of the owner and consulting engineer. Supplier is responsible to provide two weeks of notice for testing.

.3 Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

Part 2 Products

2.1 GENERATOR SET

.1 Rating

.1 The generator set shall operate at 1800 rpm and at a voltage of: 208 Volts AC, Three phase, 4-wire, and 60 hertz.

.2 The generator set shall be rated at 350kW at 0.8 PF, based on site conditions of: Altitude 64 meters, ambient temperatures up to 40 degrees C.

.3 The generator set rating shall be based on emergency/standby service.

2.2 PERFORMANCE

.1 Voltage regulation shall be plus or minus 1.0 percent for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 1.0 percent.

.2 Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.5%.

.3 The engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.

.4 Motor starting capability shall be a minimum of 995 kVA. The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near

zero power factor applied to the generator set.

.5 The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic. Telephone influence factor shall be less than 40.

2.3 CONSTRUCTION

.1 The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails

.2 All switches, lamps, and meters in the control system shall be oil-tight and dust-tight, and the enclosure door shall be gasketted. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.

.3 Provide spring type vibration isolation between the base and the floor support structure.

.4 Provide Sub Base Fuel Tank.

.5 Provide Sound attenuated weather proof Enclosure.

2.4 CONNECTION

.1 The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.

.2 Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel.

.3 Generator set control interfaces to other system components shall be made on a common, permanently labeled terminal block assembly.

2.5 ENGINE AND ENGINE EQUIPMENT

.1 The engine shall be diesel fueled, radiator and fan cooled. Minimum displacement shall be 8.3 liters, with 6 cylinders. The horsepower rating of the engine at it's minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Engine accessories and features shall include:

.2 An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous or parallel states.

.3 Skid-mounted radiator and cooling system rated for full load operation in 104 degrees F (40 degrees C) ambient as measured at the generator air inlet, based on 0.5 in H2O external static head. Radiator shall be sized based on a core temperature that is 20F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture, or as required to prevent freezing at minimum ambient temperature of -45Degree Celcius. Rotating parts shall be guarded against accidental contact.

.4 Positive displacement, mechanical, full pressure, lubrication oil pump.

.5 Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.

.6 Replaceable dry element air cleaner.

.7 Flexible fuel lines.

.8 Engine mounted battery charging alternator, 40-ampere minimum, and solid-state voltage regulator.

.9 Coolant heater

.1 Engine mounted, thermostatically controlled, coolant heater. Heater voltage shall 208 VAC, single phase. The coolant heater shall be UL499 listed and labeled. The heater shall be sized to maintain proper coolant starting temperature at -40C ambient temperature.

.2 The coolant heater shall be installed on the engine with high temperature silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using quick disconnect couplers to isolate the heater for replacement of the heater element. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

.3 The coolant heater(s) shall be sized as recommended by the generator set manufacturer to warm the engine to a minimum of 100F (40C) in a -40C/F ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification.

.10 Oil Pan Heater

.1 Engine mounted, thermostatically controlled, oil pan heater. Heater voltage shall be 120 VAC. Oil heater shall be sized by generator set manufacturer.

.11 Provide vibration isolators.

.1 Spring/pad type or as recommended by the manufacturer, quantity as recommended by the generator set manufacturer.

.12 Provide exhaust silencer for engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer.

.1 The silencer shall be hospital grade.

.2 Exhaust system shall be installed inside of the generator set enclosure by the generator set manufacturer.

.3 Provide fire proof and heat resistant insulation on silencer, exhaust piping located within the enclosure and on the manifold flex hose.

.13 Starting System

.1 Starting system shall be 12V. DC or 24V. DC as recommended by the engine manufacturer

.2 Starting batteries should be heavy duty, maintenance free type capable of cranking the engine for 60 seconds continuously at 10 degrees C without the voltage dropping below 75% of nominal.

.3 Electric starter(s) capable of three complete 15 second automatic cranking cycles without overheating.

.4 Provide a minimum 12 amp battery charger for each generator set battery bank. Generator sets incorporating two battery banks shall be provided with two chargers connected together and operating in parallel, with alarm output(s) connected in parallel. The charger(s) shall include the following capabilities:

.1 Chargers shall be UL 1236-BBHH listed and CSA or CUL certified for use in emergency applications.

.2 The charger shall be compliant with UL991 requirements for vibration resistance.

.3 The charger shall comply with the requirements of EN61000-4-5 for voltage surge resistance; EN50082-2 for immunity; EN61000-4-2 for ESD; EN61000-4-3 for radiated immunity; ANSI/IEEE C62.41 category B and IN61000-4-4 for electrically fast transient; EN61000-4-6 for conducted emissions; and FCC Part 15 Class A for radiated emissions.

.5 The charger shall be capable of charging a fully discharged battery without damage to the charger. It shall be capable of returning a fully discharged battery to fully charged condition within 24 hours. The charger shall be UL-labeled with the maximum battery amp-hour rating that can be recharged within 24 hours.

.6 The charger shall incorporate a 4-state charging algorithm, to provide trickle charge rate to restore fully discharged batteries, a bulk charge rate to provide fastest possible recharge after normal discharge, an absorption state to return the battery to 100 percent of charge, and a float stage to maintain a fully charge battery and supply battery loads when the generator set is not operating. In addition, the charger shall include an equalization timer. Charge rates shall be temperature compensated based on the temperature directly sensed at the battery.

.7 The DC output voltage regulation shall be within plus or minus 1%. The DC output ripple current shall not exceed 1 amp at rated output current level.

.8 The charger shall include the following features:

.1 Two line alphanumeric display with programming keys to allow display of DC output ammeter and voltmeters (5% accuracy or better), display alarm messages, and perform programming;

.2 LED indicating lamp(s) to indicating normal charging condition (green),

equalize charge state (amber), and fault condition (red);

.3 AC input overcurrent, over voltage, and undervoltage protection;

.4 DC output overcurrent protection;

.5 Alarm output relay

.6 Corrosion resistant aluminum enclosure

.9 Battery charger input voltage shall be 120 VAC.

2.6 AC GENERATOR

.1 The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 125 degrees Centigrade.

.2 The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

.3 The subtransient reactance of the alternator shall not exceed 15 percent, based on the standby rating of the generator set.

.4 The alternator shall be capable of operation with reverse kVAR of 0.15 per unit.

.5 A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

.6 Alternator Anti-Condensation Heater

.1 Alternator shall come with a thermostatically controlled anti-condensation heater. Anti-condensation heater voltage shall be 120 VAC. Alternator heater shall be sized by generator set manufacturer.

2.7 GENERATOR SET CONTROL

.1 The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

.2 The control shall be mounted on the generator set, or may be mounted in a free-standing panel next to the generator set if adequate space and accessibility is available. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

.3 The generator set mounted control shall include the following features and functions:

.1 Control Switches

.1 Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or MANUAL position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. A separate push-button to initiate starting is acceptable. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

.2 EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.

.3 RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

.4 PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

.2 Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

.1 Digital metering set, 1% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.

.2 The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.

.3 The control system shall log total number of operating hours, total kWH, and total control on hours, as well as total values since reset.

2.8 GENERATOR ALARM AND STATUS DISPLAY

.1 The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:

.1 The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for any status, warning, or shutdown function monitored by the genset. They shall also be configurable for color, and control action (status, warning, or shutdown).

.2 The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be based on actual sensed voltage and frequency on the output terminals of the generator set.

.3 The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.

.4 The control shall include an amber common warning indication lamp.

.2 The generator set control shall indicate the existence of the warning and shutdown conditions on the control panel. All conditions indicated below for warning shall be field-configurable for shutdown. Conditions required to be annunciated shall include:

- ♦ low oil pressure (warning)
- ♦ low oil pressure (shutdown)
- ♦ oil pressure sender failure (warning)
- ♦ low coolant temperature (warning)
- ♦ high coolant temperature (warning)
- ♦ high coolant temperature (shutdown)
- ♦ low coolant level (warning)
- ♦ fail to crank (shutdown)
- ♦ fail to start/overcrank (shutdown)
- ♦ overspeed (shutdown)
- ♦ low DC voltage (warning)
- ♦ high DC voltage (warning)
- ♦ weak battery (warning)
- ♦ high AC voltage (shutdown)
- ♦ low AC voltage (shutdown)
- ♦ under frequency (shutdown)
- ♦ over current (warning)
- ♦ over current (shutdown)
- ♦ short circuit (shutdown)
- ♦ over load (warning)
- ♦ emergency stop (shutdown)
- ♦ Fuel Leak (warning)
- ♦ (4) configurable conditions

.3 Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

.4 Provisions shall be made to allow for monitoring output to a remote annunciator.

.5 Engine Status Monitoring.

.6 The following information shall be available from a digital status panel on the generator set control :

- ♦ engine oil pressure (psi or kPA)
- ♦ engine coolant temperature (degrees F or C)
- ♦ engine speed (rpm)
- ♦ number of hours of operation (hours)
- ♦ number of start attempts
- ♦ battery voltage (DC volts)

.7 The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

2.9 ENGINE CONTROL FUNCTIONS

.1 The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods. After completion of 3 unsuccessful crank cycles, an alarm will be sent to indicate “Generator Crank Fail”.

.2 The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.

.3 The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.

.4 The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

2.10 ALTERNATOR CONTROL FUNCTION

.1 The generator set shall include a full wave rectified automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase line to neutral RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.

.2 Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445. The protection for this function shall be 3rd party certified to very performance.

.3 Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445. The protection for this function shall be 3rd party certified to very performance.

.4 Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

.5 A line to neutral sensing AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

.6 The generator set control cabinet shall include a 120VAC heater.

.7 Other Control Functions

.1 A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage. During engine cranking (starter engaged), the low

voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

.2 Control Interfaces for Remote Monitoring:

.1 The control system shall provide three programmable output relays. These relay outputs shall be configurable for any alarm, shutdown, or status condition monitored by the control. The relays shall be configured to indicate: (1) generator set operating at rated voltage and frequency, (2) common warning, (3) common shutdown.

.3 A fused 10 amp switched 12VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

.4 A fused 10 amp 12VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.

.8 Other equipment to be provided with the generator set

.1 The generator set shall be provided with a 450amp mounted main line circuit breaker, sized to carry the rated output current of the generator set. The circuit breaker shall incorporate an electronic trip unit that operates to protect the alternator under all overcurrent conditions, or a thermal-magnetic trip with other overcurrent protection devices that positively protect the alternator under overcurrent conditions. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided.

2.11 OUTDOOR WEATHER-PROTECTIVE SOUND ATTUNUATED ENCLOSURE

.1 The generator set shall be provided with an outdoor enclosure, with the entire package listed under UL2200. The package shall comply with the requirements of the National Electrical Code for all wiring materials and component spacing. The total assembly of generator set, enclosure, and sub-base fuel tank (when used) shall be designed to be lifted into place using spreader bars. Housing shall provide ample airflow for generator set operation at rated load in an ambient temperature of 38C. The housing shall have hinged access doors as required to maintain easy access for all operating and service functions. All doors shall be lockable, and include retainers to hold the door open during service. Enclosure roof shall be cambered to prevent rainwater accumulation. Openings shall be screened to limit access of rodents into the enclosure. All electrical power and control interconnections shall be made within the perimeter of the enclosure.

.2 All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color using a two-step electrocoating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating that meets the following requirements:

.1 Gloss, per ASTM D523-89, 80% plus or minus 5%.

.2 Crosshatch adhesion, per ASTM D3359-93, 4B-5B.

.3 Impact resistance, per ASTM D2794-93, 120-160 inch-pounds.

.4 Humidity, per ASTM D2247-92, 1000+ hours.

.5 Water Soak, per ASTM D2247-92, 1000+ hours.

.6 Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.

.3 Enclosure shall be constructed of minimum 12 gauge steel for framework and 14 gauge steel for panels. All hardware and hinges shall be stainless steel.

.4 A factory-mounted exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections. Silencer and exhaust pipe shall be insulated with silver lined high temperature insulation.

.5 The enclosure shall include the following maintenance provisions:

.1 Flexible coolant and lubricating oil drain lines, that extend to the exterior of the enclosure, with internal drain valves

.2 External radiator fill provision.

.3 Exterior Fuel Tank fill provision

.6 The enclosure shall include hinged weather proof locking access doors to allow for full access to all the generator set components.

.7 Generator set supplier is to install a battery charger inside of the enclosure**.**

.8 Provide a factory mounted and wired single electrical connection for all of the enclosure heaters and battery charger in order to reduce time required on site to complete connection**.**

.9 The enclosure is to be ventilated which allows the generator set to operate at full rated load in an ambient temperature of up to 40C.

.10 The enclosure is to be sound insulate and shall reduce the sound level of the generator set while operating at full rated load to an average of 92 dBA at 7 meters from the generator set in a free field environment**.**

.11 The enclosure shall be insulated with non-hydroscopic materials.

2.12 FUEL TANK

.1 Skid mounted double wall diesel fuel tank mounted under the genset.

.2 Tank to conform to all safety standards and construction standards including UL142.

.3 Provide built-in fuel leak detector in the outer tank. Connect to the control panel. See section 2.04 (c)

.4 Size to a minimum 24 hours fuel supply at full load.

.5 Provide the following level switches on the main tank

.1 Fuel full

.2 Low fuel

.3 Low fuel alarm for Emergency engine shutdown

.4 Main tank leak

2.13 REMOTE ANNUNCIATOR

.1 Provide Remote Annunciator Panel capable of displaying system status indication for emergency and other power systems. Locate at front desk.

.2 Visual indication of network conditions, generator alarm and network function status.

.3 Audible indication of any network condition – annunciator also includes pushbutton switch to silence the audible alarm.

.4 UL Listed and labeled; CSA certified; CE marked.

.5 Wall surface mount NEMA 1 enclosure.

2.14 REMOTE ALARM OFF BUTTON

.1 Red mushroom type “Emergency Shutdown” push button (push in to shut down / pull out to reset), push button may be provided independently of remote annunciator.

2.15 AUTOMATIC TRANSFER SWITCH

.1 To be included in the “Emergency Generator Set” tender package

.2 Refer to Section 26 32 12.

Part 3 Execution

3.1 INSTALLATION

.1 Installation to CSA C 282 (latest edition) requirements and standards

.2 Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable provincial and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of ULc listed products.

.3 Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier. Provide complete wiring diagrams and wiring instructions to the contractor. Include recommendations for wiring types.

.4 Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer’s instructions and seismic requirements

of the site.

.5 Equipment shall be initially started and operated by representatives of the manufacturer.

.6 All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to final testing of the system.

3.2 TESTING AND COMMISSIONING

.1 Provide fuel required for testing of the generator. After test, fill the fuel tank to its rated time capacity

.2 Provide portable Load bank

.3 Conform to CSA C282.09 requirements and standards

.4 After installation of the above equipment has been finalized, the Contractor shall arrange with the supplier for the provision of services of a qualified and experienced specialist who shall check the correctness of the installation, perform load test and calibrate the system before it is operated by others. Within 10 days thereafter, a complete report of this load test and inspection shall be submitted to the Engineer. All costs associated with this service shall be included in the Contract.

.5 For the purpose of determining if the electrical and mechanical equipment of a diesel generator set will function as expected, a minimum of 4 hours load test conducted by the supplier shall be performed.

.6 The load test shall be performed at 50% of rated load for 30 minutes and at 100% of rated load for the remaining time. Reading shall be taken every 15 minutes. Part of the load test shall be “No load to instantaneous full load” test.

.7 As a minimum, the following information shall be documented on load test sheet of each diesel generator set:

- .1 Engine serial no.
- .2 Engine model and manufacturer
- .3 Generator serial no.
- .4 Generator model and manufacturer
- .5 Generator rating in KW and KVA and power factor
- .6 Diesel generator set serial no.
- .7 Jots name and location
- .8 Safety switch setting for low pressure, cooling temperature, overspeed, overcrank
- .9 Name of person conducting test
- .10 Name of person witnessing the test

.8 As a minimum, the following reading shall be taken every 15 minutes during the load test:

.1 Date and time
.2 Volts and amps for all phases
.3 RPM, frequency
.4 Load in KVA and KW
.5 Oil temperature and pressure
.6 Fuel pressure
.7 Jacket water temperature
.8 Ambient temperature

.9 All alarm and shutdown functions are to be tested by shorting out contacts at the alarm sensors, or by other acceptable methods.

.10 Perform sound level test, to confirm compliance with specified maximum db levels

.11 Test All functions of the transfer switch.

3.3 OPERATION AND MAINTENANCE INSTRUCTIONS:

.1 Conform to CSA C282 requirements and standards

.2 The Contractor shall obtain the service of a technical representative of the equipment supplier to provide one day of instruction to the owner's representative. This instruction may be provided as an additional day during the same visit as the inspection work described above.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED:

.1 Supply, delivery, installation, testing and commissioning of automatic transfer equipment as shown on the drawings and in compliance with these specifications.

1.2 RELATED WORK

.1 Emergency Generator Section 26 32 11

1.3 DESIGN CRITERIA:

.1 Conform to CSA C282 (latest edition).

.2 Wall-mounted automatic load transfer equipment to:

1. Monitor voltage of normal power supply (120/208 VAC, 3 Phase, 4 wire system)
2. Current rating as shown on drawings.
3. Initiate cranking of standby generator unit on normal power failure after a time delay
4. Transfer load from normal supply to alternate supply when alternate supply reaches rated frequency and voltage.
5. Transfer load from alternate supply to normal power supply after a time delay, when normal power is restored.
6. Shut down standby unit.

1.4 ISOLATION BYPASS SWITCH:

.1 Manually isolate the automatic transfer switch to allow for full maintenance of the automatic transfer switch.

.2 Common enclosure with the automatic transfer switch, barrier between enclosures.

.3 Manual transfer switch on door mechanically interlocked to prevent energizing both sources at the same time.

.4 Two source (utility/generator) by pass.

1.5 SHOP DRAWINGS:

.1 Submit shop drawings for all relevant items in this specification. Include, but not limited to:

1. Make, model and type.

.2 Certify in writing number of operations on-off, off-on under continuously normal load and rated voltage

.3 Certify in writing maximum withstand current in rms symmetrical kA and time in seconds, for the switch device alone, without association of any other upstream protection device.

.4 Certify in writing maximum turn off current at 208 V, as specified

.2 Single line diagram showing controls and relays.

1. Automatic starting and transfer to standby unit and back to normal power.
1. Test control.
2. Manual control.
3. Automatic shutdown.

.3 Complete installation instructions

1.6 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into a manual.

.2 Detailed instructions to permit effective operation, maintenance and repair.

.3 Technical data:

1. Schematic diagram of components, controls and relays.
2. Illustrated parts lists with parts catalogue numbers.\
3. Certified copy of factory test results.

1.7 SOURCE QUALITY CONTROL

.1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested in presence of Worldwide Fibre at manufacturer site.

.2 Tests:

1. Conform to CSA C282 (latest edition).
2. Operate equipment both mechanically and electrically to ensure proper performance.
3. Check selector switch, in 4 positions (Test, Auto, Manual, Engine Start) and record results.
4. Check voltage sensing and time delay relay settings.

.3 Check:

1. Automatic starting and transfer of load on failure of normal power.

2. Retransfer of load when normal power supply resumed.
3. Automatic shutdown.
4. Manual by pass, both sources.

1.8 QUALITY ASSURANCE

.1 Qualified personnel shall be present at all times to supervise the work and shall be thoroughly familiar with the materials, standards, and specific requirements of this section.

.2 Codes and Standards

1. Comply with CSA C282 (latest edition).
2. Comply with the Codes and Standards specified herein.
3. Where provisions of pertinent codes and standards conflict with these specifications and drawings or each other, comply with the more stringent provisions.

Part 2 Products

2.1 MATERIALS

.1 Conform to CSA C282 (latest edition).

.2 Meters: to CAN3-C17-M84.

.3 Instrument transformers: to CAN3-C17-M83.

.4 Contactors: to NEMA ICS-1970

2.2 ACCESSORIES

.1 Pilot lights to indicate switch position, green for normal, red for standby, mounted in the front face of the panel.

.2 Plant exerciser: 168 h timer to start standby unit once each week for selected interval. Timer adjustable 0-168 h in 15 min intervals. Load transfer option site settable. Factory set on “no transfer”.

.3 Solid neutral bar, rated to the capacity of the switch.

.4 Auxiliary relay to provide 2 N.O. and 2 N.C. contacts for remote controls/indication; contacts to switch before connecting to standby and to switch back after connecting to normal supply.

.5 Six dry contacts form “C” for remote indication of each of the following conditions shall be provided.

1. ATS fail to transfer.
2. ATS on emergency.

3. Commercial AC power fail.
4. ATS on bypass.
5. The contacts for commercial AC power fail shall be time delay to overcome momentary degradation or loss of power due to electric discharges in the atmosphere, etc.

.6 Control points for the following remote control and indication with two form "C" dry contacts:

1. Engine start on load.
2. Engine start off load.
3. Engine stop.
4. Engine start on load with timer. (time out)
5. Engine start off load with timer. (time out)

.7 Solid State Electronic Monitors

6. Voltage sensing, three phase with time delay and circuit closing arrangement.
7. Voltage sensing relays (solid state) to be or to have:

.1 Monitor all three phases or both phases on 120/240 V, 1 phase system (normal & alternate source).

.2 Separate adjustable pick-up control for each phase. Minimum range at 85% to 105% of nominal voltage (set at 90%).

.3 Separate adjustable drop-out control for each phase. Minimum range 80% to 100% of nominal voltage or 80% to 90% of pick-up level (set at 90% of nominal voltage level).

.4 Alternative to (b) and (c): For each line, a fixed differential of up to 12% (between pick-up and drop-out) and a separate adjustable drop-out control with minimum range 80% to 100% of nominal voltage (set at 87%).

8. Under / Over frequency sensing, with adjustable differential for nominal frequency of 60 Hz with adjustable time delay on trip for nominal frequency of 60 Hz, with circuit closing arrangement, with 2 N.O. and 2 N.C. contacts, repetitive accuracy plus or minus 0.2 0.5 Hz.
9. Time Delay Relays:

.1 Provide relays of the pneumatic or electronic type, adjustable to the following ranges:

.1 Normal to emergency (alternate) (delay of engine start after hydro failure). Adjustable, minimum range 0-50 seconds (set at 15 seconds).

.2 Emergency (alternate) to normal (delay of retransfer of switch after hydro return). Adjustable, minimum range 0.5-3 minutes (set at 3 minutes).

.3 Engine cool off (delay of engine shutdown after retransfer). Adjustable, minimum range 0.5-5 minutes (set at 5 minutes).

.4 Inherent time delay during transfer sufficient to cause drop-out of motor starter, i.e. load bus disconnected for 12 cycles minimum.

10. Phase sequence monitoring relay with indication LED on face of A75 auxiliary contact for remote monitoring. Connect relay to emergency generator side.

11. Fully automatic in operation.

12. Permanently held (latch type) main switches without automatic trips, single electric operator, energized only during the transfer operation (in both directions).

13. Manual transfer facility for emergency and maintenance tests. Insulated shrouds for operator protection.

14. Control transformers for normal and emergency supplies.

15. One set of contacts, for external connection, to close after the failure of the hydro supply to initiate the engine start sequence.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification.

2.4 FABRICATION:

.1 Shop assemble transfer equipment including:

1. Wall mounting enclosure with double door or ATS section size to be maximum 355 mm (14”) deep x 915 mm (36”) maximum.

2. Transfer switched and operating mechanisms.

3. Control transformers, relays and instruments.

4. Accessories.

2.5 MANUFACTURERS:

.1 TTI - Thomson Technology Inc.

.2 Cutler Hammer (Robonic).

.3 ASCO.

.4 Approved equal.

Part 3 Execution

3.1 INSTALLATION:

.1 Locate, install and connect transfer equipment.

.2 Check solid state monitors and adjust as required.

3.2 FIELD QUALITY CONTROL:

.1 Factory tests shall include, but not limited to, the following:

1. CSA C282 and as follows
2. Energize transfer equipment from normal power supply.
3. Set mode selector in "Test" position to ensure proper standby start, running, transfer, retransfer. Return mode selector to "Auto" position to ensure standby shuts down.
4. Set mode selector in "Manual" position and check to ensure proper performance.
5. Set mode selector in "Engine start" position and check to ensure proper performance. Return selector to "Auto" to stop engine.
6. Set mode selector in "Auto" position and open normal power supply disconnect. Standby should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 10 min, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.
7. Repeat, at 1 h intervals, 3 times, complete test with mode selector in each position, for each test.
8. Put isolation switch on bypass mode. Check that ATS is completely isolated.
9. Check proper function of all auxiliary contacts.

END OF SECTION

Part 1 General

1.1 SAFETY AND PRECAUTIONS

.1 All parties involved must be cognizant of industry-standard safety procedures. This document does not include any procedures, including specific safety procedures. It is recognized that the installations, tests and inspections recommended in these specifications are potentially hazardous. Individuals conducting the replacement and performing these tests shall be capable of conducting in a safe manner and with complete knowledge of the hazards involved.

.2 A safety lead person shall be identified prior to commencement of work.

.3 A safety briefing shall be conducted prior to the commencement of work.

.4 The contractor shall have a designated safety representative on the project to supervise operations with respect to safety.

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No.178.1-2007, Automatic Transfer Switches.

.2 CAN/CSA C60044-1-07, Instrument Transformers.

.2 National Electrical Manufacturers Association (NEMA) ICS 2-1996(R2009), Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC, Part 8: Disconnect Devices for Use in Industrial Control Equipment.

.3 UL 1008 - Standard for Transfer Switch Equipment

.4 IEC 947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Automatic Transfer Switching Equipment

.5 IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

.6 UL 508 Industrial Control Equipment

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for new transfer switch; include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:

.1 Indicate on drawings:

.1 Make, model and type.

.2 Single line diagram showing controls and relays.

.3 Description of equipment operation including:

.1 Automatic starting and transfer to standby unit and back to normal power.

.2 Test control.

.3 Manual control.

.4 Automatic shutdown.

1.4 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: submit operation and maintenance data for new transfer switch for incorporation into manual.

.2 Detailed instructions to permit effective operation, maintenance and repair.

.3 Technical data:

.1 Schematic diagram of components, controls and relays.

.2 Illustrated parts lists with parts catalogue numbers.

.3 Certified copy of factory test results.

.4 Manufacturer on-site commissioning report.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect transfer switches from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials.

1.6 ACCEPTABLE MANUFACTURERS

.1 Automatic transfer switches shall be ASCO 7000 Series. Any alternate shall be submitted for approval to the engineer at least 7 days prior to bid. Alternate bids must list any deviations from this specification.

.2 The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout Canada. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

.3 The manufacturer shall maintain records of each switch, by serial number, for a minimum of 30 years.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Automatic load transfer equipment to:

.1 Monitor voltage on phases of normal power supply.

.2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase below preset adjustable limits for adjustable period of time.

.3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.

.4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on phases above adjustable pre-set limit for adjustable time period.

.5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.

2.2 MATERIALS

.1 Instrument transformers: to CAN/CSA C60044-1.

.2 Contactors: to NEMA ICS2.

2.3 CONTACTOR TYPE TRANSFER EQUIPMENT

.1 Mechanically Held Transfer Switch.

.1 The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized, single-solenoid mechanism. The switch shall be mechanically interlocked to ensure only two possible positions: Normal or Emergency.

.2 All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.

.3 The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.

.4 All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.

.5 Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 600 amps and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.

.6 Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

.7 ATS shall be provided with fully rated overlapping neutral transfer contacts. The neutrals of the normal and emergency power sources shall be connected together only during the transfer and retransfer operation and remain connected together until power source contacts close on the source to which the transfer is being made. The overlapping neutral contacts shall not overlap for a period greater than 100 milliseconds. Neutral switching contacts which do not overlap are not acceptable.

.8 A neutral conductor plate with fully rated AL-CU pressure connectors shall be provided.

.2 Microprocessor Controller.

.1 The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module.

.2 A single controller shall provide twelve selectable nominal voltages for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to ± 1% of nominal voltage. Frequency sensing shall be accurate to ± 0.2%. The panel shall be capable of operating over a temperature range of -20 to +60 degrees C and storage from -55 to +85 degrees C.

.3 The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Sensing and control logic shall be provided on multi-layer printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator’s manuals.

.4 All customer connections shall be wired to a common terminal block to simplify field-wiring connections.

.5 The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

.1 EN 55011:1991: Emission standard - Group 1, Class A

.2 EN 50082-2:1995: Generic immunity standard, from which:

.1 EN 61000-4-2:1995: Electrostatic discharge (ESD) immunity

.2 ENV 50140:1993: Radiated Electro-Magnetic field immunity

.3 EN 61000-4-4:1995: Electrical fast transient (EFT) immunity

.4 EN 61000-4-5:1995: Surge transient immunity

.5 EN 61000-4-6:1996: Conducted Radio-Frequency field immunity

.3 IEEE472 (ANSI C37.90A): Ring Wave Test.

.3 Fault withstand rating: 75kA RMS symmetrical short circuit current. The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1½ and 3 cycle, long-time ratings. ATSs which are not tested and labeled with 1½ and 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable.

2.4 ENCLOSURE

.1 The ATS shall be furnished in a Type 1 enclosure c/w sprinkler drip hood.

.2 All standard and optional door-mounted switches and pilot lights shall be 16-mm industrial grade type or equivalent for easy viewing & replacement. Door controls shall be provided on a separate removable plate, which can be supplied loose for open type units.

2.5 CONTROLLER DISPLAY AND KEYPAD

.1 A four line, 20 character LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the serial communications input port. The following parameters shall only be adjustable via DIP switches on the controlller:

.1 Nominal line voltage and frequency

.2 Single or three phase sensing

.3 Operating parameter protection

.4 Transfer operating mode configuration (Open transition, Closed transition, or Delayed transition)

.2 All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.

2.6 VOLTAGE, FREQUENCY AND PHASE ROTATION SENSING

.1 Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

Parameter	Sources	Dropout / Trip	Pickup / Reset
Undervoltage	N&E, 3ϕ	70 to 98%	85 to 100%
Overvoltage	N&E, 3ϕ	102 to 115%	2% below trip
Under frequency	N&E	85 to 98%	90 to 100%
Over frequency trip	N&E	102 to 110%	2% below
Voltage unbalance dropout	N&E	5 to 20%	1% below

.2 Repetitive accuracy of all settings shall be within ± 0.5% over an operating temperature range of -20°C to 60°C.

.3 Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.

.4 The controller shall be capable (when activated by the keypad or through the serial port) of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or CBA).

.5 Source status screens shall be provided for both normal & emergency to pro-vide digital readout of voltage on all 3 phases, frequency, and phase rotation.

2.7 TIME DELAYS

.1 An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 24 VDC power supply.

.2 A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.

.3 Two time delay modes (which are independently adjustable) shall be provided on re-transfer to normal. One time delay shall be for actual normal power failures and the other for the test mode function. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.

.4 A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.

.5 A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 5 minute time delay in any of the following modes:

.1 Prior to transfer only.

.2 Prior to and after transfer.

.3 Normal to emergency only.

.4 Emergency to normal only.

.5 Normal to emergency and emergency to normal.

.6 All transfer conditions or only when both sources are available.

.6 The controller shall also include the following built-in time delays for optional Closed Transition and Delayed Transition operation:

.1 1 to 5 minute time delay on failure to synchronize normal and emergency sources prior to closed transition transfer.

.2 0.1 to 9.99 second time delay on an extended parallel condition of both power sources during closed transition operation.

.3 0 to 5 minute time delay for the load disconnect position for delayed transition operation.

.7 All time delays shall be adjustable in 1 second increments, except the extended parallel time, which shall be adjustable in .01 second increments.

.8 All time delays shall be adjustable by using the LCD display and keypad or with a remote device connected to the serial communications port.

2.8 ADDITIONAL FEATURES

.1 A three position momentary-type test switch shall be provided for the test / automatic / reset modes. The test position will simulate a normal source failure. The reset position shall bypass the time delays on either transfer to emergency or retransfer to normal.

.2 A SPDT contact, rated 5 amps at 30 VDC, shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.

.3 Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed, when the ATS is connected to the emergency source.

.4 LED indicating lights (16 mm industrial grade, type 12) shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).

.5 LED indicating lights (16 mm industrial grade, type 12) shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.

The following features shall be built-in to the controller, but capable of being activated through keypad programming or the serial port only when required by

the user:

.6 Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.

.7 Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad or serial port.

.8 An Inphase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer. The inphase monitor shall be equal to ASCO Feature 27.

.9 The controller shall be capable of accepting a normally open contact that will allow the transfer switch to function in a non-automatic mode using an external control device.

.10 Engine Exerciser - The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to seven different exercise routines. For each routine, the user shall be able to:

.1 Enable or disable the routine.

.2 Enable or disable transfer of the load during routine.

.3 Set the start time,

- time of day
- day of week
- week of month (1st, 2nd, 3rd, 4th, alternate or every)

.4 Set the duration of the run.

At the end of the specified duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. A 10-year life battery that supplies power to the real time clock in the event of a power loss will maintain all time and date information.

.11 **System Status** - The controller LCD display shall include a "System Status" screen which shall be readily accessible from any point in the menu by depressing the "ESC" key a maximum of two times. This screen shall display a clear description of the active operating sequence and switch position. For example,

Normal Failed

Load on Normal

TD Normal to Emerg

2min15s

Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual, are not permissible.

.12 **Self Diagnostics** - The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.

.13 **Communications Interface** – The controller shall be capable of interfacing, through an optional serial communication module, with a network of transfer switches, locally (up to 4000 ft.) or remotely through modem serial communications. Standard software specific for transfer switch applications shall be available by the transfer switch manufacturer. This software shall allow for the monitoring, control and setup of parameters.

.14 **Data Logging** – The controller shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory:

.1 Event Logging
- .1 Data and time and reason for transfer normal to emergency.
- .2 Data and time and reason for transfer emergency to normal.
- .3 Data and time and reason for engine start.
- .4 Data and time engine stopped.
- .5 Data and time emergency source available.
- .6 Data and time emergency source not available.

.2 Statistical Data
- .1 Total number of transfers.
- .2 Total number of transfers due to source failure.
- .3 Total number of days controller is energized.
- .4 Total number of hours both normal and emergency sources are available.

.15 **Communications Module** - A full duplex RS485 interface shall be installed in the ATS controller to enable serial communications. The serial communications shall be capable of a direct connect or multi-drop configured network. This module shall allow for the seamless integration of existing or new communication transfer devices. The serial communication interface shall be equal to ASCO Accessory 72.

.16 **External DC Power Supply** – An optional provision shall be available to connect an external 24 VDC power supply to allow the LCD and the door mounted control indicators to remain functional when both power sources are dead. This option shall be equivalent to ASCO accessory 1G.

2.9 EQUIPMENT IDENTIFICATION

.1 Identify equipment in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Control panel:

.1 For selector switch and manual switch: size 4 nameplates.

.2 For meters, indicating lights, minor controls: use size 2 nameplates.

.3 Nameplates to match existing.

2.10 TESTS AND CERTIFICATION

.1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested.

.2 The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

.3 Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

.4 The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001.

.5 Tests:

.1 Operate equipment both mechanically and electrically to ensure proper performance.

.2 Check selector switch, in modes of operation and record results.

.3 Check voltage sensing and time delay relay settings.

.4 Check:

.1 Automatic starting and transfer of load on failure of normal power.

.2 Retransfer of load when normal power supply resumed.

.3 Automatic shutdown.

Part 3 Execution

3.1 INSTALLATION

.1 Locate, install and connect transfer equipment as described in 1.1 “Scope”.

.2 Install and connect battery remote alarms.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and with manufacturer required commissioning procedures.

.2 Energize transfer equipment from normal power supply.

.3 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.

.4 Set selector switch in "Manual" position and check to ensure proper performance.

.5 Set selector switch in "Engine start" position and check to ensure proper performance. Return switch to "Auto" to stop engine.

.6 Set selector switch in "Auto" position and open normal power supply disconnect. Standby should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 10 minutes, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.

.7 Repeat, at 1 hour intervals, 2 times, complete test with selector switch in each position, for each test.

.8 Submit manufacturer commissioning report in PDF format within 5 days after new transfer switches commissioning.

3.3 CLEANING

.1 Progress Cleaning: leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41-1991, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

.2 ASTM International Inc.

.1 ASTM F1137-[00(2006)], Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.3 Canadian Standards Association (CSA International)

.4 ICES-005-07, Radio Frequency Lighting Devices.

.5 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by Consultant.

.2 Quality assurance submittals:

.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging materials.

.4 Divert unused metal materials from landfill to metal recycling facility.

Part 2 Products

2.1 LAMPS

.1 As indicated in luminaire schedule.

2.2 BALLASTS/DRIVERS

.1 As indicated in luminaire schedule.

2.3 FINISHES

.1 Light fixture finish and construction to meet ULC listing and CSA certification related to intended installation.

2.4 OPTICAL CONTROL DEVICES

.1 As indicated in luminaire schedule.

2.5 LUMINAIRES

.1 As indicated in luminaire schedule.

.2 Luminaires used in High Bay areas must have minimum of 10 years manufacturer material and labor warranty.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Provide adequate support to suit ceiling system.

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.1 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires independently of ceiling.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141-02, Unit Equipment for Emergency Lighting.

.2 CSA C860-01(December 2002), Performance of Internally-Lighted Exit Signs.

.2 National Fire Protection Association (NFPA)

.1 NFPA 101-2006, Life Safety Code.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

.4 Quality Assurance Submittals:

.1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

Part 2 Products

2.1 STANDARD UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 New Exit Lights to be green running man pictogram sign.

.3 Refer to luminaire schedule on the design drawing.

.4 Face plate to remain captive for re-lamping.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.

.2 Connect fixtures to exit light circuits.

.3 Ensure that exit light circuit breaker is locked in on position.

3.3 CLEANING

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SCOPE OF SERVICES

.1 **Electrical contractor** is to provide and install:

.1 Rack, patch panels, voice and data cabling, raceway and voice/data outlets related to communication services. Room 139-7’ patch, cables, Room 111, 112, 114, 116, 117, 119 and 140-14’ patch cables to be provided.

.2 Cabling testing and commissioning.

.3 Two port data outlets (unless shown otherwise) and raceway related to Wireless Access Point (WAP).

.4 Phones in contract: Exterior phone by front door 101-Model ACR41. Phone in room 142-Model CIT-41.

.5 Service cable into building to be 100 pair copper.

.2 **Government of Canada IT** is to provide and install:

.1 Switching hardware, rack mounted UPS.

.2 Wireless Access Point (WAP) hardware including mounting accessories.

.3 Telephone service provider to provide copper telephone service to building.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for racks, patch panels, cabling and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect communications equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging materials.

Part 2 Products

2.1 TELEPHONE WIRE

.1 Cat 6A copper cables.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communications equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative and Consultant.

.2 Inform Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative and Consultant.

3.2 INSTALLATION

.1 Install VoIP telephone cabling as per data cabling.

3.3 CLEANING

.1 Progress Cleaning: leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by communications equipment installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute

.1 ANSI J-STD-607-A-2002, Joint Standard - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

.2 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA)

.1 TIA/EIA-606-2002, Administration Standard for the Commercial Telecommunications Infrastructure.

.3 U.S. Department of Labor/Occupational Safety and Health Administration (OSHA)

.1 Nationally Recognized Testing Laboratory (NRTL).

1.2 SYSTEM DESCRIPTION

.1 Telecommunications grounding and bonding system consist of grounding busbars, bonding backbones, and other bonding conductors.

.2 Provides ground reference for telecommunications systems within building and bonding to it of telecommunications rooms.

.3 Metallic pathways, cable shields, conductors, and hardware within telecommunications spaces are bonded to telecommunications grounding and bonding system.

Part 2 Products

2.1 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

.1 Predrilled copper busbar, approved by NRTL, electrotin plated with holes 8 mm diameter for use with standard-sized lugs to: ANSI J-STD-607-A.

.2 Dimensions 6 mm thick, 50 mm wide, 450 mm long to: ANSI J-STD-607-A.

2.2 BONDING CONDUCTOR FOR TELECOMMUNICATIONS

.1 4/0 AWG copper conductor, green insulated to: ANSI J-STD-607-A.

2.3 WARNING LABELS

.1 Non-metallic warning labels in English to: ANSI J-STD-607-A.

.2 Identify labels with wording "If this connector is loose or must be removed, please call the building telecommunications manager".

Part 3 Execution

3.1 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

.1 Install TGB in main terminal/equipment room and each telecommunications room.

.2 Install #4/0 AWG copper bonding conductor from TGB to alternating current equipment ground (ACEG) enclosure of serving electrical power panel (panelboard).

3.2 BONDING CONDUCTORS GENERAL

.1 When placed in ferrous metallic conduit or EMT longer than 1 m, bond to each end of conduit or EMT using #6 AWG copper conductor.

3.3 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

.1 Install TBBs from TMGB to each TGB as indicated on drawing grounding detail.

.2 Use exothermic welding, approved 2 hole compression lugs for connection to TMGB and TGBs.

3.4 BONDING TO TGB

.1 Bond metallic raceways in telecommunications room to TGB using #2/0 AWG green insulated copper conductor.

.2 For cables within telecommunications room having shield or metallic member, bond shield or metallic member to TGB as per cable manufacturer instructions.

.3 Bond equipment rack located in telecommunications room to TGB using #4/0 AWG green insulated copper conductor.

3.5 LABELLING

.1 Apply warning labels to telecommunications bonding and grounding conductors.

.2 Apply additional administrative labels to: TIA/EIA-606.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for communication raceway systems and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect communications equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging materials.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Empty telecommunications raceways system consists of outlet boxes, cover plates, distribution racks, conduits, cable trays, pull boxes, sleeves and caps, fish wires, service poles, service fittings, concrete encased ducts.

.2 Overhead and wall cable tray distribution system.

2.2 MATERIAL

.1 Conduits: EMT type, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Cable trays: Cablofil wire mesh type, in accordance with Section 26 05 36 - Cable Trays for Electrical Systems.

.3 Overhead distribution system: in accordance with Section 26 27 23 - Indoor Service

.4 Junction boxes: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.5 Outlet boxes, and fittings: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.6 Outlet boxes and fittings in workstation furniture: provided as part of workstation furniture.

.7 Fish wire: polypropylene type.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communication raceway systems installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative and Consultant.
.2 Inform Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative and Consultant.

3.2 INSTALLATION

.1 Install empty raceway system, including sleeves between floors, overhead distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cable tray, miscellaneous and positioning material to constitute complete system.

3.3 CLEANING

.1 Progress Cleaning: leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by pathways for communications systems installation.

END OF SECTION

Part 1 General

1.1 SUMMARY OF WORK

.1 The work includes: Supply and installation of fibre optic and copper backbone cabling, supply and installation of Augmented Category 6 (Category 6A) Voice and Data Horizontal Distribution Cabling; Supply and installation of associated passive network equipment.

.2 The voice/data communication systems shall comprise all components specified, implied or otherwise necessary to constitute a fully operational system. The work includes, but is not necessarily limited to, the following:

- .1 Provision of fibre optic and copper backbone cables interconnecting the Room 139 and other rooms, etc.
- .2 Provision of cable termination panels, patch panels, and patch cords to support the system. Provision of equipment racks.
- .3 Provision of Voice/data outlets indicated in various locations. Required hardware includes, but is not limited to, cross-connection system, termination blocks, fastening devices, system patch cords and all required accessories to comply with this Specification.
- .4 Provision of direct horizontal runs of unshielded twisted pair (UTP) Category 6A cables in star configuration from Room 139 to the outlets for all data and voice circuits identified on drawings.
- .5 Termination of all fibre optic and UTP cables at panels, outlets and Communications closets. Termination and hardware are defined as all labour and materials required to terminate all cables.
- .6 Provision of all cable supports and ties required to support the cabling system for this installation.
- .7 Testing certification and warranty of all cabling and components which are within the scope of this Contract.
- .8 Provision of as-built AutoCAD drawings fully documenting the cabling.

1.2 WORK NOT INCLUDED

.1 The work not included in this contract is the supply of communications hub and switching equipment. Testing and energization of hub equipment and communications to be carried out by others.

1.3 REFERENCES

A. All workmanship and materials supplied shall be in full conformance with applicable building, electrical, and other codes, as determined by the authority having jurisdiction.

B. All cabling system components shall be Underwriters Laboratories (UL) Listed and shall be marked as such. In cases where UL has no published standards for a component, any

equivalent national independent testing standard shall apply and the item shall be appropriately marked.

C. The product specifications, design considerations, and installation guidelines provided in this document are in part derived from recommendations found in recognized telecommunications industry standards. The following are used as reference:

1. Spaces and Pathways
   TIA-569-B (2004) – *Commercial Building Standard for Telecommunications Pathways and Spaces*

2. Grounding
   ANSI-J-STD-607-A (2002) – *Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications*

3. Cabling Systems
   TIA/EIA-568-B.1 (2002) – *Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements*
   TIA/EIA-568-B.2 (2001) – *Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components*
   ANSI/TIA-568-B.2-10-2008 – *Transmission Performance Specifications for 4-pair 100 Ω Augmented Category 6 Cabling*ANSI/TIA/EIA-568-B.3-2000 - Optical Fiber Cabling Components Standard

   ANSI/TIA/EIA-568-B.3-1-2002 - Optical Fiber Cabling Components Standard Addendum 1 – Additional Transmission Performance Specifications for 50/125 μm Optical Fiber Cables

   TIA/EIA-862 (2002) – *Building Automation Systems Cabling Standard for Commercial Buildings*

4. Cabling Administration
   TIA/EIA-606-A (2002) – *Administration Standard for Commercial Telecommunications Infrastructure*

5. Networking
   IEEE Standard 802.3an (2006) – *10GBASE-T* (10 Gb/s Ethernet operations over balanced twisted-pair cabling)

6. Design
   BICSI *Telecommunications Distribution Methods Manual (TDMM)* – 11th edition

7. Installation
   BICSI *Information Transport Systems Installation Manual (ITSIM)* – 4th edition (2004)

1.4 SYSTEM DESCRIPTION

.1 Structured system of communication cables, copper Augmented Category 6 UTP and 850 nm laser-optimized 50/125 µm optical fibre, installed within the building for distributing voice and data.

.2 Connect each communication outlet in physical star configuration to communications closet.

.3 Installed in physical star configuration with separate horizontal and backbone sub-systems.

.4 To avoid network problems caused by impedance balance, and attenuation differences, all passive equipment being installed in the horizontal network shall be of the same type and from the same manufacturer.

1.5 QUALIFICATIONS

.1 The Contractor shall be a Belden Certified System Vendor (CSV) experienced and trained by the manufacturing company, in all aspects of the placement, terminating, connecting and testing of products described herein and provide certificate of proof prior to start of work.

.2 The Contractor shall have a minimum of one (1) RCDD "Registered Communications Distribution Designer" recognized by BICSI "Building Industry Consulting Services International" on staff at local offices (the term "Local offices" as applied to RCDD, Registered Communications Distribution Designers, refers to anywhere in the Province of Alberta) and provide certificate of proof prior to start of work.

.3 Communications contractor shall supply and install a complete system for voice and data.

.4 The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall demonstrate proven expertise in the implementation of network cabling. Expertise can be illustrated through the inclusion of details of at least three projects involving the design and installation of a Category 5e, Category 6, or Augmented Category 6 (Cat 6A) balanced twisted-pair cabling system within the past two-year period. Names and contact information for each of the three projects shall be included.The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and proposed Augmented Category 6A metallic premise distribution systems and have personnel who are adequately trained in the uses of such tools and equipment.

.5 The communications installer shall be a Communications Cabling Specialist certified by the Dept. Of Labour and obtain all required permits.

1.6 SHOP DRAWINGS

1 Submit shop drawings and product data, for:

.1	Fibre optic cable
.2	UTP communication cable
.3	Communications Equipment Racks, Cable management
.4	Patch panels and patch cords
.5	Communication Outlets
.6	Bix mounts, connectors, adapters.

1.7 WARRANTY

.1 The warranty period with regard to the project is for 25 years from the date of Substantial Performance of the Work or those periods specified in the Contract Documents for certain portions of the Work of Products.

.2 The Contractor shall be responsible for the proper performance of the Work.

.3 The Contractor shall correct promptly, at the Contractor's expense, defects or deficiencies in the Work which appear prior to and during the warranty periods specified in the Contract Documents.

.4 The Owner, shall promptly give the Contractor notice in writing of observed defects and deficiencies that occur during the warranty period.

.5 The Contractor shall correct or pay for damages resulting from corrections made under the requirements of paragraph 1.8.3.

.6 The Contractor shall be responsible for obtaining Product warranties in excess of one year on behalf of the Owner from the manufacturer. These product warranties shall be issued by the manufacturer to the benefit of the Owner.

.7 The Contractor shall provide a twenty-five (25) year Extended Product Warranty and Lifetime Application Assurance Warranty for the Communications Network. This warranty shall be backed up by the manufacturer and taken over by the manufacturer or his representative if the Contractor fails to follow through with the requirements of the warranty.

.8 The Communications Network is defined as all required passive equipment and cabling, including hardware, terminations, and jacks, configured to provide data and voice connectivity from each data or voice outlet provided by the Contractor in this Contract.

.9 The System Assurance shall cover the applications that the installed system is designed to support for a twenty-five (25) year period.

.10 The copper system shall be constructed to conform to ANSI/TIA-568-B.2-10-2008 – *Transmission Performance Specifications for 4-pair 100* Ω *Augmented Category 6 Cabling* Commercial Building Telecommunications Cabling Standards.

.11 The fiber system shall be constructed to conform to ANSI/TIA/EIA-568-B.3-2000 - *Optical Fiber Cabling Components Standard* and ANSI/TIA/EIA-568-B.3-1-2002 - *Optical Fiber Cabling Components Standard Addendum 1 – Additional Transmission Performance Specifications for 50/125 (m Optical Fiber Cables*

.12 The Extended Product Warranty and the Systems Assurance together comprise the Structured Cabling System Quality Assurance Program.

.13 Upon successful completion of the Structured Cabling System installation and subsequent testing by certified technical personnel the Contractor shall provide to the Owner a numbered certificate registering the installation.

PART 2 Products

2.1 GENERAL DESCRIPTION

.1 The Government of Canada Building will be served by a Fibre Optic Data and Augmented Category 6 Data Riser System. This tender includes provision of all fibre optic and copper systems for the building.

.2 All Horizontal Augmented Category 6 UTP Cable will be installed in conduit and cable tray as indicated. The principal cross-connection point for the riser system and for the voice network will be the LAN/Tel room.

.3 All horizontal voice and data distribution cables shall be terminated at the user end on a communications (single, dual or quad, as specified in drawings) outlet. The Data RJ-45 jack shall be appropriately numbered and identified with a Belden or equal computer label; the voice RJ-45 jack shall be appropriately numbered and identified with a Belden or equal telephone label.

.4 All products must be accompanied with 3rd party test results stating that each component is Augmented Category 6 compliant, and 3rd party test results that show the components when tested in a worst case channel configuration will exceed Category 6A channel requirements with additional margin (Clause 3.2.2,2) at both maximum length of 100 meters and minimum length of 12 meters as per ANSI/TIA-568-B.2-10-2008 – *Transmission Performance Specifications for 4-pair 100* Ω *Augmented Category 6 Cabling*

2.2 MAIN COMMUNICATIONS ROOM

.1 General Equipment Installation:

.1 **NSS Racks**

- Supply and install 2-post 19" steel distribution floor mount racks with vertical cable management on both sides of the rack in locations as identified on drawings for voice and data systems.
- Minimum of two racks required in Room 139, (1 rack for data and 1 rack for voice)
- Racks are anchored to floor with four bolts in concrete
- Rack specification is minimum 44U, maximum 47U or 84 inches in height, black color.
- Rack features:
    - Constructed with minimum 11ga. "U" steel welded together and to rack base 10-32 holes on the front and rear of the vertical rails with reference U-spacing markings for standard 19" TIA/EIA mounting
    - Post sides require a minimum of 3 holes for mounting VCM or ganging racks together
- Vertical Cable Management features:
    - 16 ga. steel with a minimum of 4 fabricated 13 ga. stiffeners inside for strength
    - Channel Cable Management, deep style (9" deep)
    - Minimum of 3 mounting holes to rack with fabricated 11 ga. reducers for strength
    - Hinged front doors with minimum 3 magnetic catches
    - Lance projections at rear for external cable ties
    - Minimum of 20 opening on each sides for wire distribution
    - Minimum of 8 larger opening on rear for wire distribution
- 1x flush mount shelf for each rack, cantilevered, 2 U high
- Equipped with horizontal cable management guide for each jack strip installed
- Equipped with 1x 6 to 8 outlet power bar, horizontally mounted at top of each rack, equipped with a 5 meter cord and 115 VAC 20 Amp plug.
- Power outlets for racks and cabinets in the Room 139 are to be mounted on the cable tray. Conduit and outlets should be isolated from cable tray. If mounted to overhead cable tray, they should be mounted facing horizontally and be insulated from tray by ¾ " or 19mm plywood offsets. NSS racks require (2) 115V 20A services within 3ft or 1 meter of rack. The server/network cabinet requires a 115V 30A service within 3ft or 1 meter of server cabinet and the PTSS cabinet requires a 115V 30A service within 3ft or 1 meter of the PTSS cabinet. Additional courtesy 15A 120V outlets to be mounted on walls of Room 139 every 8ft or 2.5 lineal meters and on every wall 7ft or 2400 mm and longer.
- Outdoor Weatherproof Telephone – Backboard to be 350mm X 400mm X 25mm all-weather aluminum clad GIS spruce plywood or equivalent. Double sheeted 19mm would be acceptable. The mounting height is +1250mm on-center above finished sidewalk. The flush-mount jack box is to be mounted behind the board, with oversize full clearance hole in center of board for maintenance afterwards. The telephone unit is a Guardian Telecom # ACR-41 (formerly model # WP61HD) from Anixter Canada. The unit is to be supplied and installed by the data/telecom contractor.

.2 **NSS cabinets**

- NSS cabinet should have the following specification; Basis of design – CableTalk:
  - 30" x 42" x 83" (Width x Depth x Height) with cable trough roof
  - Tapped style mounting angles
  - Solid side panels
  - Perforated doors with flush mount locks
  - Key/ Dial combo lock
  - Channel Cable Management, deep style (9" deep)
  - Horizontal cable management 4U x 3" deep
  - 2x 6 - 8 outlet 20A powerbar
  - 2 fans
  - 1x 2-position mount shelf for vented platform with 17' depth, 2U high

.3 Install racks and cabinets as detailed on drawing.

.2 Fibre Optic Cable Installation and Termination:

.1 Supply and install 1 (one) 24-port rack-mount Fibre Patch panel in each Data Rack as shown on drawings, for termination of fibre backbone cables being installed to interconnect Room 139 to the MTR. All ST adapters, connectors, patch cords and terminations shall be provided. All fibre pairs to be labelled corresponding to Patch Panel ports, using consistent numbering schemes. Horizontal Cable Management to be installed in rack as indicated in drawings. Patch Panel shall be Belden Fiber Express or approved equal. (Not Required)

.3 Data Cable Installation and Termination

.1 Supply and install adequate number of 24 or 48-port patch panel*s* in data racks to service all data distribution, plus 25% spare capacity (see drawing).

.2 Supply, install and terminate the horizontal (DATA) 4pr Augmented Category 6 UTP copper Cables from Data Distribution Patch Panels in Data Rack to each Data and Data/Voice Outlet defined by the drawings. Each data jack and patch cables at the device end shall be identified with the corresponding data patch panel port. Supply and install patch cords for all terminated data ports for both ends of each run.

.3 Supply and install horizontal and vertical cable management Guides as per drawing.

.4 Data patch panels shall meet Augmented Category 6 requirements/standards. Connectors shall be Belden 10GX MDVO Style Modules or approved equal.

.4 Voice/Riser Cabling Installation and Termination

.1 Supply and install 24/48 port patch panels for termination of incoming Telco cable.

.2 Supply and install adequate number of 24/48-port patch panels in voice racks to service all voice distribution, plus 25% spare capacity (see drawing).

.3 Supply, install and terminate the horizontal (VOICE), 4pr Augmented Category 6 UTP copper Cables from Voice Distribution Patch Panels in voice rack to each Voice and Data/Voice Outlet defined by the drawings. Each voice jack shall be identified with the corresponding number on the Voice Distribution Field.

Supply and install patch cords for all terminated voice ports, both ends of each run.

.4 Supply and install horizontal and vertical cable management guides as per drawing.

.5 Voice patch panels shall meet Augmented Category 6 requirements/standards.
Connectors shall be Belden 10GX MDVO Style Modules or approved equal.

2.3 HORIZONTAL COMMUNICATIONS CABLE

.1 4 pair, Augmented Category 6 , #23 AWG insulated copper conductor, 100 ohm, Unshielded Twisted Pair (UTP) riser cable (CMR) in separate outer jacket for voice/data service distribution to communications cabinets and all outlets. All cable to have a minimum FT-6 fire rated jacket, white colour for voice & data.

.2 Provide Belden 10GX 4-pair Augmented Category 6 cable

.3 Augmented Category 6 cable shall be installed for all horizontal communications data and voice requirements. The balanced twisted-pair cabling system shall support 10 Gb/s networking and shall provide guaranteed performance up to 625 MHz for a 4-connector, 100 m (328 ft) channel.

.4 All Augmented Category 6 cables shall conform to ANSI/TIA-568-B.2-10-2008 – *Transmission Performance Specifications for 4-pair 100* Ω *Augmented Category 6 Cabling*, CAN/CSA T529-95 Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section.

.5 Distance limitations – cabling system distances shall not exceed 295ft or 90m (not including patch cables) in any situation. Where a "MUTO" (multiple unit telecommunications outlet) assembly is utilized, the horizontal cable distance should follow Belden specifications. Since 50ft or 15m patch cables are being utilized at the terminal end for MUTO, and up to a 10ft or 3m patch cable at the patch panel end, the total horizontal cable distance shall not exceed 260ft or 79m.

2.4 COMMUNICATIONS OUTLETS

.1 Voice/Data Outlets to be: Augmented Category 6, modular, 8 pin for voice and data; single, dual or four port c/w SS face plates and mounting frame. Spare ports to be blanked off.
Flush mounted. Belden 10GX or approved equal.

.2 Provide labelling as specified.

.3 Where telephone outlets are indicated to be wall mounted (1000mm or higher AFF) provide stainless steel cover plates with 2 stud mounting system for wall telephone equipment. For locations showing + 1500mm Tel outlets, the jack needs to be in a

stainless steel 2 pin wall plate for hanging phone on jack. A 2 pin Stainless jack plate is Belden #AX102005, plus white keystone jack #AX101320.

2.5 PATCH CABLES

.1 Patch cables shall be provided for all terminated voice and data ports, for both ends of each line. The cordage shall use 23 AWG solid copper conductors in a bonded pair configuration for reliable long-term channel performance to 625 MHz. The transmission characteristics of the cordage will be guaranteed to 625 MHz. The patch cables shall support 10 Gb/s, FT-4, 23 AWG copper, Belden 10GX or approved equal.

.2 The quantity of patch cables for connection between switches and patch panel in Room 139 is to be at least the same amount as the number of ports on the horizontal patch panels. Length of the patch cables is as per section 27 05 13.

.3 The quantity of patch cables for connection at the workstation end is to be at least the same amount as the number of ports on the horizontal patch panels. Length of the patch cables should be 15ft or 4.5 m. Include patch cable from ceiling or wall jack to exit point in work area. Ensure cable is 8 ft or 2.5 m from exit point in cubicle/work area to end device. Patch cable for network should be sky blue in color. Patch cable for municipality shall be black in color.

2.6 STANDARD OF ACCEPTANCE

.1 Belden IBDN Certified Structured Cabling System is specified as Standard of Acceptance.

2.7 POWER BARS

.1 All communication racks shall have a 6 outlet, surge suppression, power bar mounted at the top of the rack.

2.8 COMMUNICATIONS CABINETS

.1 19” steel Distribution Racks and NSS cabinets are required. (See section 2.2. above)

PART 3 Execution

3.1 INSTALLATION OF CABLES

.1 General
- .1 Install communication cables in accordance with Manufacturer’s recommendations and guidelines.
- .2 Place all communication cables in conduits or cable tray as required, except within closets use conduits as available.

.3 Cable Labels:
.1 Electrovert Type "Z" cable markers sized to fit cables snugly.
.2 Self laminating, heat-shrink, one-piece, custom printed cable labels.
Cable labels can be self laminating embossed type in lieu of heat shrink.

.4 EMT type conduit "wall-stub" c/w flush installed device box shall be located in walls/partitions. Stubs shall be turned out into accessible ceiling space.

.5 Single and multi-gang type raised 4" square "tile" rings are also acceptable for use in new dry-wall type construction. Secure directly to face of metal studs. Multi-gang "tile" rings are to be adequately secured within partitions, on "both" left and right hand sides of same.

.6 Where the "grouping" of various systems outlets or multi type outlets in dry-wall type construction is desirable, the use of "box mounting brackets" are to be installed between, and secured to, both metal studs. To install suitably sized 4" square and/or 4 11/16" boxes c/w raised tile rings as may be required.

.2 Installation of Unshielded Twisted Pair (UTP) Cable

.1 Connect each outlet directly to a communications closets by a continuous UTP cable. There shall be no connector in the cable run between the communication outlet and the cable termination in the closet. Transition points between the communications closet and the communications outlet are disallowed.

.2 Horizontal cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundles, which will degrade the performance of those cables

.3 The maximum horizontal cable distance for data and voice circuits to be 90 m (295 ft.). This is the cable length from the mechanical termination of the UTP cable in the communications closet to the communications outlet. In establishing maximum distance, an allowance to be made for 3 additional meters (9.8 ft.) from the communications outlet to computer and 2 meters for patch cords at the closet.

.4 The following applies to cables installed in return air plenums without the use of tray.
.1 Where air plenum is accessible, adjustable cable straps may be used. Routing shall follow building grid lines.
.2 Where air plenum in not accessible, conduit raceway shall be provided to span inaccessible ceiling space.
.3 Cables crossing power cables or fluorescent light fixtures (outside conduit) must do so at right angles.

.5 Install coaxial cables and outlets in accordance with manufacturer's recommendations.

.6 When installing UTP cable, follow the separation distances from EMI sources detailed in the table:

Source of Electro-Magnetic	Minimum Separation

Interference (EMI)	Distance from a source Carrying:	
	< 2 kVA	2 – 5 kVA
Unshielded power lines, electrical equipment near open/non-metal pathways.	12.7 cm 5 in.	30.5 cm 12 in.
Unshielded power lines, electrical equipment near grounded metal pathways.	6.4 cm 2.5 in.	15.2 cm. 6 in.
Power lines enclosed in grounded conduit.	5.0 cm 2.0 in.	7.6 cm. 3 in.
Transformers and electric motors.	1.02 m 40 in.	
Fluorescent lights.	30.5 cm 12 in.	

.7 When terminating cables, the length of cable twist (twist/cm) shall be identical to that of the remainder of the cable. This twist shall be maintained up to 10 mm from the termination point of the cable at the patch panel and the receptacle.

.8 UTP Cable Terminations

.1 Terminate UTP cables at the work area outlet with an RJ 45 female connector.

.2 The cable colour code/jack pin assignments shall match (TIA jack-pin pair assignment) T568A.

.3 Terminate data cables directly to RJ-45 patch panels on equipment racks at the communications closet end and, connected to data hubs via patch chords.

.4 Maximum untwisted length of conductors shall not exceed 12mm (0.5 inch).

.9 Identify each cable with a permanent indelible identification band which indicates the room and outlet number to which the cable is connected. Both ends of each cable must have identical identifier bands.

.10 Identify each communication outlet with a permanent indelible label using standard numbering scheme.

.11 Identify each patch panel position with the room and outlet number to which the cable is connected.

.12 Network outlets to comprise 8 position connectors as further specified as Belden IBDN, blue in color. Radio outlets to comprise 8 position connectors as further specified as red in color. Municipal outlets to comprise 8 position connectors as further specified as Black in color.

3.2 ACCEPTABLE TESTING AND CERTIFICATION

.1 Category 6A performance tests shall be in accordance with ANSI/TIA-568-B.2-10-2008 and must be performed with the wall plates in place.

.2 Augmented Category 6A system testing.

.1 For connecting hardware with modular interface components (i.e.

Plug and jack connectors) transmissions tests shall be performed with both components in a mated state on all 4 pairs, and shall meet the following performance criteria

PSANEXT	70 dB @ 100 MHz
Insertion Loss	0.2 dB @ 100 MHz 0.45 dB @ 100 MHz
Return loss	28 dB @ 100 MHz
TCL	34 dB @ 100 MHz
NEXT	54 dB @ 100 MHz 40 dB @ 500 MHz

.2 At a minimum, the balanced twisted-pair cabling system will exceed the key performance parameters for Augmented Category 6A found in ANSI/TIA-568-B.2-10-2008 – *Transmission Performance Specifications for 4-pair 100* Ω *Augmented Category 6 Cabling* over the specified frequency ranges by the values listed below.

Parameter	**Worst Case Margin (1 – 500 MHz)**	**Worst Case Margin (500 – 625 MHz)**
Insertion loss	3%	Beyond Standard (*)
Return loss	2.0 dB	Beyond Standard (*)
NEXT	2.5 dB	Beyond Standard (*)
PSNEXT	3.5 dB	1.5 dB(*)
PSANEXT	2.0 dB	2.0 dB(*)
PSACRF	10.0 dB	8.0 dB(*)
PSAACRF	Beyond Standard	Beyond Standard (*)

Note: The **Margin** is the additional headroom (in dB or %) compared to the minimum specified value for Category 6A at each frequency point over the specified frequency range. The **Worst Case Margin** is determined at the frequency where the measured data point is closest to the limit line. The Category 6A limit line equations are used to determine the **Worst Case Margin** over the frequency range from 500 MHz to 625 MHz.

NEXT = Near-end crosstalk

PSACRF = Power-sum attenuation-to-crosstalk ratio far-end

PSAACRF = Power-sum alien attenuation-to-crosstalk ratio far-end

PSANEXT = Power-sum alien near-end crosstalk

PSNEXT = Power-sum near-end crosstalk

NOTE: The values listed above are characterized as "Margin" or "Guaranteed Headroom" beyond the performance specified in standards, and serve as additional assurance of the cabling system's performance after installation and over its operational lifespan.

(*) Value proposed or statement represent guaranteed margin against ANSI/TIA-568-B.2-10-2008 – *Transmission Performance Specifications for 4-pair 100 Ω Augmented Category 6 Cabling* extrapolated to 625MHz.

.3 Certification

.1 Certify that all cabling and hardware meets the performance criteria in this specification and is free from any optical, electrical or mechanical defects as a result of the installation and termination practices for a period of twenty-five (25) years from the time of acceptance by the Owner.

.2 Provide two (2) copies of all installation documentation and reports. The minimum documentation set shall include:

.1 As-built drawings in paper format, fully documenting the cabling infrastructure. Copies of the approved drawings in AutoCAD "DWG" format shall be provided by the Owner to form a basis for as-built drawings.

.2 Records of all test procedures and test results in a report format and detailed test results including graphical data in an electronic format.

.4 Upon completion of the Work, the Engineer shall carry out an onsite final inspection.

As a minimum, the following points will be examined:

.1 Is the design documentation complete? Are all cables properly labelled, from end-to-end?

.2 Have all terminated cables been properly tested in accordance with the specifications for the specific category as well as tested for opens, shorts, polarity reversals, transposition and presence of AC and /or DC voltage?

.3 Is the cable type suitable for its pathway? Are the cables bundled in parallel?

.4 Have the pathways manufacturer's guidelines been followed? Are all cable penetrations installed properly and fire stopped according to code?

.5 Have the Contractors avoided excessive cable bending?

.6 Have potential EMI and RFI sources been considered?

.7 Are conduit cable fills correct?

.8 Are hanging supports within 1.5 meters (5 feet)?

.9 Does hanging cable exhibit some sag?

.10 Are telecommunications closet terminations compatible with applications equipment?

.11 Have patch panel instructions been followed?

.1 Jacket removal point.

.2 Termination positions.
.3 All pair terminations tight with minimal pair distortions.
.4 Twists maintained up to Index Strip.

.12 Have modular panel instructions been followed?
.1 Cable dressing first.
.2 Jackets remain up to the Connecting Block.
.3 All pair terminations tight and undistorted.
.4 Twists maintained up to the Connecting Block.

.13 Are the correct outlet connectors used?

.14 Is the jacket maintained right up to the jack?

.15 Are all pairs tightly twisted and straight across in the Panel?

.16 Are identification markings uniform, permanent and readable?

END OF SECTION

Part 1 General

1.1 CONTRACTOR QUALIFICATIONS

.1 The entire Access Control system shall be supplied and installed by a **Certified DSX Vendor & Integrator**. Awarded electrical contractor shall coordinate with all required electrical work with this Certified DSX Vendor & Integrator and general contractor.

1.2 REFERENCES

.1 Abbreviations:

.1 Electronic Access Control (EAC): control of people through entrances and exits of controlled area. Security utilizing hardware systems and specialized procedures to control and monitor movements within a controlled area.

.2 DRS:. Door Release System.

.3 PIN: Personal Identification Number.

.2 Reference Standards:

.1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 Underwriters' Laboratories (UL)

.1 UL 294-2009, Access Control System Units.

.2 UL 827-2008, Central-Station Alarm Services.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for access controls and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit:

.1 Functional description of equipment.

.2 Technical data for all devices.

.3 Device location plans and cable lists.

.4 Devices mounting location detail drawings.

.5 Typical devices connection detail drawings.

.2 Shop Drawings:

.1 Submit drawings stamped and signed by manufacturer and contractors.

.2 Shop drawings to indicate project layout, including details.

.1 Shop drawings to indicate, mounting heights and locations, wiring diagrams.

.2 Submit zone layout drawing indicating number and location of zones and areas covered.

.3 Submit wiring diagrams.

.4 Submit complete equipment list.

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.1 Submit ULC/UL Product Safety Certificates.

.2 Submit verification Certificate that service company is ULC/UL List alarm service company.

.3 Submit verification Certificate that monitoring facility is ULC/UL "Listed central station".

.4 Submit verification Certificate that security access system is "Certified alarm system".

.4 Test and Evaluation Reports:

.1 Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.5 Manufacturer's Instructions: submit manufacturer's installation instructions.

.6 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: submit operation and maintenance data for access controls and equipment for incorporation into manual.

.1 Include:

.1 System configuration and equipment physical layout.

.2 Functional description of equipment.

.3 Instructions of operation of equipment.

.4 Illustrations and diagrams to supplement procedures.

.5 Operation instructions provided by manufacturer.

.6 Cleaning instructions.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect communications equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging materials.

1.6 WARRANTY

.1 Project Warranty: refer to CCDC 14 for project warranty provisions.

.2 Manufacturer's Warranty: submit, for University of Calgary Security Department and Consultant's acceptance, manufacturer's standard warranty document executed by authorized company official.

Part 2 Products

2.1 MATERIALS

.1 Design Criteria:

.1 Whether under power or not, no device shall prevent egress through a door located in the exiting path from a room or building.

.2 Each building shall have a minimum of one exterior door fitted with a mechanical key override that allows access to the building, regardless of the state of the electronic access system. This door must allow direct access to the Master Panel of the building.

.3 All equipment is to be installed in IT Room that is easily accessible and at an acceptable working height without the use of ladders and/or sitting on the floor. Adequate space must be allowed for the installation and maintenance of this equipment, when locating equipment careful consideration should also be made for future additions to system.

.4 All equipment, panels and devices shall be protected by an Uninterrupted Power Supply (UPS). Battery backup on the power supply unit is not to be used. This does not apply to hardware that is to release on power failure eg. Electromagnetic locks and delayed egress devices. The suggested model is a CyberPower CP1000AVRLCD 1000VA UPS. It is the responsibility of the installer to ensure that UPS units are not overloaded.

.5 All UPS’s are to be mounted beside the equipment either on a shelf or inside another cabinet and this cabinet to be strong enough to support the weight of the UPS. This cabinet is to have adequate ventilation.

.6 All panels shall be connected to emergency generator power (where an emergency generator exists and where there is available capacity on the generator to power the Access Control system).

.7 All new installations are to use DSX labelled cabinets and equipment only model 1042 controllers are to be used as the standard.

.8 There is to be no equipment mounted on the doors of the DSX and or Siemens cabinets due to the weight of the equipment and potential for the wiring to be damaged when opening and closing the cabinets. The doors are to have a separate ground attached to the main cabinet to maintain continuity of the grounding system.

.9 All cabinets are to have tamper switches installed and operational. Tamper switches must be connected to the first device on each panel and connected to

input 5. Panel tampers can be connected in "series "when additional cabinets are located beside each other.

.10 All cabinets are to be hinged from the right or left side of cabinets. Hinging upward or downward will not be acceptable.

.11 As part of the commissioning process cabinets to be labeled and notification signage to be applied to all cabinets indicating that they are to notify Department Security prior to entering and after exiting the cabinets.

.12 All cabinets used are to be key lockable. Any cabinet used mounting DSX equipment not manufactured by DSX to be of keyed alike to key LL802 only, this is to include all power supply cabinets. DSX cabinets to all be keyed alike to the N277 key.

.13 All DSX doors shall be equipped with a pre-alarm function that sounds a local alarm within 2 minutes of a forced and/or propped door condition. Within a further 1.5 minutes following the local alarm, the DSX system must activate an alarm in the Campus Security Dispatch Centre.

.14 A commissioning form is to be filled out upon completion of a new DSX install, this needs to be submitted to both Security and to Facilities Lockshop. When work is completed on a new install a final site meeting/inspection with a member of the Facilities Lockshop will occur as a part of the commissioning process.

.15 All as built drawings are to be complete showing location and room number of all master and sub master panels and all peripheral equipment and to be sent to records management department, and a second copy to the facility.

.16 All DSX access control doors shall be clearly labeled using a "P-Touch" labeling system. Labels shall be 18mm high X the length required to fit the door designation. All text shall be minimum 6mm high. The label shall clearly indicate the door designation using white text on dark colored doors and black text on light colored doors. Labels shall be positioned 25mm down from the top and 200mm in from the leading edge of the door leaf. All labels shall be placed on the locked side of the door. Door designations shall be determined by Security Department.

.17 Door naming conventions shall be as per the following format:

- .1 Building name (3 letters or less)
- .2 Floor number (4 characters or less – BASE for basement, MAIN for main floor, 1st, 2nd, etc.)
- .3 Exterior or interior door (1 character)
- .4 For interior doors, room or hallway identification (4 characters or less) – For exterior doors a direction (i.e. NE, SW)
- .5 Door Name (i.e. A,B,C,D) – doors are "named" left to right from A – Z on a bank or group of doors surrounding the same area.

NOTE: Doors are named by the area they are leading into.

.18 All doors must be clearly identified on the controller panel itself with a "P-Touch" label on the controller.

.19 All wiring shall be concealed in EMT, cable tray or inside doorframes and walls.

.20 All wiring shall be of continuous length (no splices) and shall be of gauge and construction as per DSX installation instructions.

.21 All terminations of wires at the device ends shall be completed with solder and heat shrink or Compression connectors.

.22 All cable terminations located at the panel end shall be as follows:

.1 Devices requiring external power shall be connected to the terminal block.

.2 Devices with direct signal (no power requirement – i.e. door position switches) shall be wired direct to panel.

.23 All Cabling shall have a service loop incorporated in the cable run located inside the panel.

.24 As per DSX software requirements standard terminations on controller are;

Input 7 – Door Position Switch

Input 8 – Request to Exit Detector (With Piezo Alarm)

Output 1 – Door Lock

.25 Cables shall be terminated as follows:

.1 An input device that is connected to the panel and does not require additional power may be connected to the panel without terminal strips. There must be a minimum of 1m slack cable at the panel end of the run. Devices that fall under this category include Door Position Switches and Card Readers.

.2 Any cable that is interrupted by a control relay, fire alarm relay, input signal and aux. power on the same cable or, multiple devices that are powered by the same power supply, must be terminated on terminal strips then jumpered to the various panel locations. Devices that fall under this category include Latch retraction or Exit delay devices, Magnetic Locks, Electric Strikes, Exit Detectors, Blue Lights (panic buttons) and Door Hold Opens.

.26 New DSX installations as per design standards are not to use Electromagnetic Locks of any kind without written permission from Facilities Lockshop. Refer to FMD design standards on locks and locking hardware for electrical locking hardware standards.

.27 HID ProxPro / ProxPro II are the standard readers used. Upon consultation with FMD Lockshop other readers may be substituted if required due to mounting restrictions.

.28 Only Kantech T-REX model request to exit device are to be used, unless it is determined via consultation with Department representative and consultant a substitute product is required.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for access control system installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Department representative and Consultant.

.2 Inform Department representative and Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Department representative and Consultant.

3.2 INSTALLATION: SECURITY ACCESS

.1 Install security access systems and components in accordance with CAN/ULC-S302, CAN/ULC-S310, UL 681, UL 1641.

.2 Install components in accordance with manufacturer's written installation instructions to locations, heights and surfaces shown on reviewed shop drawings.

.3 Install components secure to walls, ceilings or other substrates.

.4 Install required boxes in inconspicuous accessible locations.

.5 Conceal conduit and wiring.

3.3 SITE TEST AND INSPECTION

.1 Perform verification inspections and test in presence of Department representative.

.1 Provide all necessary tools, ladders and equipment.

.2 Ensure appropriate subcontractors, and manufacturer's representatives and security specialists are present for verification.

.2 Pretesting procedure:

.1 Verify (utilizing an approved spectrum analyzer and test equipment) that system is fully operational and meets all system performance requirements of this specification.

.2 Measure and record, control (and/or voice) carrier levels of every system channel at each of following points in the system:

.1 Door located actuating devices.

.2 Door control panel functions.

.3 Electronic supervisory control units inputs and outputs.

.4 Distribution system input and output.

.5 Telephone system interface input and output.

.3 Submit to Department representative and Consultant 2 copies of recorded system pretest measurements, along with pretest certification.

.3 Performance testing:

.1 Test procedure: perform test on a "go-no-go" basis.

.1 Make only operator adjustments required to show proof of performance.

.2 Test to demonstrate and verify that installed system complies with installation and technical requirements of this specification under operating conditions.

.3 Test results to be evaluated by Department representative and Consultant as either acceptable or unacceptable using following procedures.

.2 Documentation review:

.1 This review will determine if information provided is sufficient to meet requirements of this specification.

.2 Provide for review all System manuals, as installed drawings, pretest forms, equipment cabinet pictorials, antenna pictorial, antenna mount pictorial, video and audio equipment details.

.3 Mechanical inspection:

.1 Department representative and Consultant and Contractor to tour areas to insure that Systems and Subsystems are installed in place for proof of performance testing.

.2 Take system inventory at this time. Verify following items before beginning proof of performance tests:

.1 Electrical power circuits designated for system equipment are properly labeled, wired, phased, protected and grounded.

.2 Conductor ends are protected by heat shrink wrap; audio spade lugs, barrier strips and punch blocks are used.

.3 Dust, debris, solder splatter, etc. are cleaned and removed from site.

.4 Equipment is properly labelled.

.5 Equipment identified in system's equipment lists are in-place and properly installed.

.6 Each lightning and System ground method are installed in accordance with manufacturer's instructions and this specification.

.4 Subsystem functional test:

.1 Conduct operational testing after review of documentation and mechanical inspection completed. Proceed as follows.

.1 Perform operational test of each Subsystem to verify that all equipment is properly connected, interfaced and is functionally operational to meet requirements of this specification.

.2 Control units:

.1 Take S/N readings from control unit's input and output in manual (and/or automatic) mode. Check output of DC/Data converter for S/N. Evaluate entire signal quality at baseband connector output of control unit and remote equipment.

.3 Audio:

.1 Take S/N readings from transmitter input and receiver output with equipment placed in manual gain mode. Check output of the audio converter, modulator or demodulator for S/N. Evaluate entire audio signal at baseband connector input and output of control unit.

.4 Distribution (or interface) system:

.1 Check each door utilizing a volt/ohm (or signal level) meter to confirm each function and to insure that system meets all performance requirements.

.2 Test each interconnection point (i.e.: door unit, junction box "cross connection", control unit, etc.) to ensure compliance with this specification.

.5 Total system test:

.1 Proceed with testing when system and subsystems are functionally tested and accepted. Total system tests to verify that requirements have been met for DC (and/or audio), sub carrier, and control signals in accordance with this specification.

.6 Safety:

.1 Demonstrate with documentation that access control system meets safety requirements specified in UL 294.

.5 Visual verification: objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:

.1 Sturdiness of equipment fastening.

.2 Non-existence of installation related damages.

.3 Compliance of device locations with reviewed shop drawings.

.4 Compatibility of equipment installation with physical environment.

.5 Inclusion of all accessories.

.6 Device and cabling identification.

.7 Application and location of ULC approval decals.

.6 Technical verification: purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:

.1 Validate sensitivity of readers and applicability and application of cards.

.2 Connecting joints and equipment fastening.

.3 Compliance with manufacturer's specification, product literature and installation instructions.

.7 Operational verification: purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:

.1 Operation of each device individually and within its environment.

.2 Operation of each device in relation with programmable schedule and or/specific functions.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer Services:

.1 Manufacturer of products, supplied under this Section, to review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.

.2 Manufacturer's Field Services:

.1 Obtain written reports from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product.

.2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Ensure manufacturer's representative is present before and during critical periods of installation & testing.

.4 Schedule site visits to review Work at stages listed:

.1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.

.2 During progress of Work at 50% and 80% complete.

.3 Upon completion of Work, after cleaning is carried out.

3.5 CLEANING

.1 Progress Cleaning: leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by access controls and equipment installation.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for access control systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:

.1 Submit drawings stamped and signed by manufacturer and contractors.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect communications equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging materials.

1.3 DESCRIPTION

.1 Access Control System will be centralized monitored by Department security, through Cat6A connections.

Part 2 Execution

2.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for access control system installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Department representative and Consultant.

.2 Inform Department representative and Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Department representative Security and Consultant.

2.2 INSTALLATION

.1 Install security monitoring system equipment as required, in accordance with Department Security and manufacturer's instructions.

2.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

2.4 CLEANING

.1 Progress Cleaning: leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

2.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by access control system installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 Canadian Electrical Code 2015.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for security door supervision systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:

.1 Submit drawings stamped and signed by manufacturer and contractors.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect communications equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging.

Part 2 Products

2.1 DESCRIPTION

.1 System to consist of alarm control panel, door position switches located at door to be supervised.

2.2 CONTROL PANEL

.1 Control panel: DSX control panel surface mounted with modular design. "Power on" light, "reset" key switch, "acknowledge button", common "trouble light, buzzer and silencing switch". Separate alarm lamp, trouble lamp and deactivating key switch for each zone and necessary modules, and relays as required for operation as indicated. Power supply from 120 V ac emergency power circuit with UPS supply to operate complete system. Standby power of UPS sized to provide supervisory and trouble signal

current for 4 hours. Capable of differentiating between open line condition and alarm. Panel to display "trouble" conditions when fault occurs in wiring.

2.3 MAGNETIC DOOR SWITCHES

.1 Door switches: suitable for surface and flush mounting on door as indicated.

2.4 TERMINAL CABINETS AND BLOCKS

.1 Terminal cabinets: Type T. In accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

2.5 END-OF-LINE RESISTORS

.1 Mount end-of-line resistors to control supervisory current in each circuit, in control panel.

2.6 LOCAL ALARM

.1 Buzzer for local alarm at each door location and mount in single gang box as indicated.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for security door system installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Department representative and Consultant.

.2 Inform U of C Campus Security and Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Department representative and Consultant.

3.2 INSTALLATION

.1 Install complete door supervision system as indicated and in accordance with manufacturer's instructions.

3.3 SEQUENCES OF OPERATION

.1 System operation: when supervised door is opened, zone indicating lamp flashes and operates audible alarm at control panel. When "acknowledge" button is operated, audible signal is silenced and flashing light changes to steady glow.

.2 System restored to normal when door is closed and "reset" key switch on control panel operated.

.3 Buzzer located at each door to give pulsating signal when door opened. Upon acknowledgment from control panel signal to change to continuous note. Buzzer at door location to be silenced only after door reclosed and "reset" key switch operated. Closing of door alone not to affect signal once it has started to sound.

.4 When deactivating switch is operated, supervised door on that zone opened without causing alarm. Zone trouble lamp illuminated when zone is deactivated but audible trouble signal not to sound.

.5 Fault in wiring of one zone to cause audible signal to sound even if zone in deactivated position.

3.4 SITE TESTS

.1 Perform tests in accordance with Canadian Electrical Code.

.2 Test system components in presence of Department representative and Consultant to ensure correct operation of system. On completion of tests, submit to Department representative and Consultant commissioning forms and certificate listing components tested.

3.5 CLEANING

.1 Progress Cleaning: leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by security door system installation.

END OF SECTION

Part 1 General

1.1 SCOPE OF SERVICES

.1 Electrical contractor is to supply and install a complete Panic Alarm system including front end equipment, system components, conduits, wiring, required hardware and software.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Contractor is to provide:

- .1 Product Data.
- .2 Shop Drawings completion.
- .3 Test and Evaluation Reports.
- .4 Manufacturer's Instructions: submit manufacturer's installation instructions.
- .5 Manufacturer's Field Reports.

1.3 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Contractor is to submit maintenance data for incorporation into Operating and Maintenance manual.

- .1 Include:
  - .1 System configuration and equipment physical layout.
  - .2 Functional description of equipment.
  - .3 Instructions of operation of equipment.
  - .4 Illustrations and diagrams to supplement procedures.
  - .5 Operation instructions provided by manufacturer.
  - .6 Cleaning instructions.

Part 2 Products

2.1 GENERAL

.1 Panic alarms shall be activated by a hardwired panic button(s).

.2 Panic buttons to be strategically located, suitably sized and identified/clearly labeled for “security emergency”.

.3 All panic buttons shall be clearly identified by a label (Brother P2000 or equivalent).

2.2 LOCAL RESPONSE SYSTEM (NOT MONITORED)

.1 The panic alarm system shall be a separate, standalone system and will not be monitored.

.2 Local panic systems will not be integrated into the main intrusion alarm panel.

.3 When the panic alarm push button is pressed, a flashing light and chime (or other unique audible signal) shall sound in designated areas shown on drawings.

.4 Multiple panic alarm locations are provided with the standalone panel shall be installed in Room 140.

.5 Each standalone panic alarm panel will be controlled by an LED keypad that will clearly identify the location of each panic button.

.6 Standard of Acceptance:

Multi-zone non-monitored panel: DSC 1832 or 4020

Panic button: Potter HUB-M (non-latching), HUB-DL-L (Latching LED), GE Sentrol 3045 (non-latching LED)

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for video surveillance installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative, Owner and Consultant.

.2 Inform Departmental Representative, Owner and Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative, Owner and Consultant.

3.2 INSTALLATION

.1 Install a complete Panic Alarm system in accordance with drawings, specifications and manufacturer’s instructions.

.2 Install components secure, properly aligned and in locations coordinated with The Client.

.3 Install required boxes in inconspicuous accessible locations.

.4 Conceal conduit and wiring.

3.3 FIELD QUALITY CONTROL

.1 Schedule site visits to review Work at stages listed:

.1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.

.2 Twice during progress of Work at 60% and 85% complete.

.3 Upon completion of Work, after cleaning is carried out.

3.4 ADJUSTING

.1 Adjust all components for correct function.

3.5 CLEANING

.1 Progress Cleaning: leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 – General Requirements.

.1 Clean camera housing, system components and lens, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by Panic Alarm rough-in installation.

END OF SECTION

Part 1 General

1.1 Related Work:

.1 General Requirements: Section 26 05 00

.2 Conduits: Section 26 05 34

.3 Wiring: Section 26 05 21

1.2 References:

.1 Alberta Building Code, 2014

.2 Alberta Fire Code, 2014

.3 NFPA 72, National Fire Alarm Code.

.4 NFPA 13, Installation of Sprinkler Systems.

.5 CAN/ULC Standards.

.6 CSA C22.1-15, Canadian Electrical Code, Part I.

.7 Local Jurisdictional Adopted Codes and Standards.

1.3 Description of System:

.1 Provide complete, electrically supervised, single-stage, addressable fire alarm system.

.2 System includes:

.1 Fire Alarm Control Panel, to carry out fire alarm and protection functions including; receiving alarm signals, initiating general single stage alarm, supervising system continuously, actuating zone annunciators, initiating supervisory and trouble signals and activating relays, as per the sequence of operation.

.2 Trouble signal devices.

.3 Power supply facilities (including all required cabling, conduit, and circuit breakers).

.4 Manual alarm stations.

.5 Automatic alarm initiating devices.

.6 Audible signal devices.

.7 Isolation devices.

.8 Visual alarm signal devices.

.9 Ancillary devices.

.10 Remote annunciator (as required)

.11 Battery backup.

.12 Booster Circuit Panel (as required)

1.4 Acceptable Manufacturers:

.1 Manufacturers: The equipment and services described in this specification are those supplied and supported by Simplex or Chubb Edwards, and represent the base bid for the equipment.

1.5 Shop Drawings:

.1 Submit shop drawings for final approval within three weeks of award of the project.

.1 Manufacturer's Submittals to include, but not limited to:

.1 Manufacturer's product data sheets for all components, modules and peripherals.

.2 If data sheets show more than one product, the proposed product shall be clearly indicated by arrows or other suitable means.

.3 Battery calculations listing amperage draw for standby and alarm conditions and supplied batteries amp/hour rating. For design criteria, de-rate Manufacturers listed battery capacity by 15%.

.2 Electrical Submittals to include but not limited to:

.1 Circuit loading calculations. (The contractor will be responsible for coordinating with the manufacturer to ensure that all power limited circuits do not exceed their power limitations).

.3 Ensure shop drawings adequately cover all requirements above, prior to submittal to the consultant as one package.

.4 Additional costs incurred to the owner, for subsequent review(s) of shop drawings due to failure to comply with the requirements will be deducted from the Contract amount. Based upon consultant's standard rates.

1.6 Operation and Maintenance Data:

.1 Provide two hard copy sets and one electronic file on either a CD or flash drive of Fire Alarm System operation and maintenance data for incorporation into the Operation and Maintenance manual.

.2 Include operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance, including the following:

.1 Index (Contractor).

.2 Numbered sections (Contractor).

.3 Work site as-built plans that show conduit runs including direction of the wiring provided to the consultant (Contractor).

.4 AutoCAD As-Built Drawings that show conduit runs including direction of the wiring (Consultant).

.5 Approved Shop drawings with technical data - illustrated parts lists with parts catalogue numbers (Contractor).

.6 Verification Inspection certificate signed and stamped by the Engineer-of-Record.

.7 Copies of Change Notices (Contractor).

.8 Copies of Proposed Notices of Change (Contractor).

.9 Site instructions (Contractor).

.10 Closed Permits (Contractor).

.11 Operation and Maintenance Manuals (Contractor).

.12 Fire Alarm manufacturer report(s) (Contractor).

.13 Device list if not included in the above (Contractor).

.14 Warranty certificate (from the VI date or Acceptance date, whichever is the later) (Contractor).

.15 List of contractors (Contractor and Sub-contractors).

.16 List of consultants (Consultant).

.17 Lien Search (Contractor).

.18 Copy of approved as-built drawings.

.19 Copy of all test reports (procedures and results).

.20 Training documents and list of personnel that attended the training orientation and information on maintenance, operation and servicing of all equipment supplied.

.21 A copy of the zone graphic approval drawing.

.22 A copy of the building and electrical permits.

.3 The manuals shall be assembled in a neat and orderly manner into fabric or durable plastic 3-ring binders, clearly identified as to the contents.

.4 All data must be in a neatly typed format and sectionalised.

1.7 Maintenance:

.1 Provide one year's free maintenance with one inspection by the manufacturer during the warranty period. Inspection tests to conform to CAN/ULC-S536 latest version. Submit inspection report to Owner and Consultant.

Part 2 Products

2.1 Materials:

.1 Equipment and devices: ULC listed and labelled and supplied by a single manufacturer.

.2 Power supply: to CAN/ULC-S524.

.3 Audible signal devices: to ULC-S525.

.4 Visual signal devices: to CAN/ULC-S526.

.5 Control unit: to CAN/ULC-S527.

.6 Manual stations: to CAN/ULC-S528.

.7 Thermal detectors: to CAN/ULC-S530.

.8 Smoke detectors: to CAN/ULC-S529.

2.2 System Operation:

.1 Single stage operation: Operation of any alarm initiating device to;

.1 Activate horns (temporal pattern) and strobes throughout the building.

.2 Transmit alarm signal to Department identified monitoring station.

.3 Cause zone of alarm device to be indicated on control panel and any associated remote annunciator(s).

.4 Cause air conditioning and ventilating fans to shut down from the associated duct smoke detector or to function so as to provide required control of smoke movement.

.5 Cause fire doors and smoke control doors if normally held open, to close automatically, unless indicated otherwise.

.2 When a trouble or supervisory signal is detected, the signal shall sound and the device and zone shall be indicated at the control panel and any associated remote annunciator(s). The general building alarm shall not be activated.

.3 Other auxiliary relays will activate as required (where applicable).

2.3 Control Panel:

.1 Single stage operation.

.2 Zoned with a minimum capacity to support all the devices shown on the drawings with the ability to add additional devices without the need to add additional hardware.

.3 New Enclosure: CSA Enclosure 1, complete with lockable concealed hinged door, full viewing window, flush lock and two keys.

.4 New Enclosure shall be surface mounted in the location indicated on the drawings.

.5 Supervised, modular design with plug-in modules:

.1 Fire Alarm Control Panel (FACP) with trouble and alarm indications for class “A” circuits.

.2 Spare zone annunciation: minimum two or 10% spare whichever is greater of existing for alarm and trouble indication.

.3 Space for future modules.

.4 Latching type supervisory inputs.

.5 Discrete indication for both off-normal and trouble.

.6 "Power on" LED (green) to monitor primary source of power to system.

.7 "Power trouble" indication (amber LED).

.8 "Ground trouble" indication (amber LED).

.9 "System trouble" indication(amber LED).

.10 “Alarm” indication (red LED)

.11 "System trouble" buzzer and silence switch c/w trouble re-sound feature.

.12 System reset switch.

.13 "LED test" switch.

.14 "Alarm silence" switch to silence signals manually. If new alarm occurs after signals have been silenced, signals to resound.

.15 "Signals silenced" indication.

.16 All visual indicators shall be high contrast LED type or an LCD text display to meet the CAN/ULC-S527-09.

.17 Detection devices shall be capable of being interchanged without any changes required to the wiring or control equipment.

.18 Master power supply panel to provide 24-VDC to system from 120-VAC, 60-Hz input.

.19 Remote Monitoring Transmitter Connections Terminal.

.20 Plug-in module for shunt type terminal box.

.21 Individual Bypass switch (es) c/w indicator for trouble at panel as follows:

.1 Horn/Strobe (NAC)
.2 Mini Horn (NAC)
.3 Fan shutdown (where applicable)
.4 Door Hold Open Release (where applicable)
.5 Magnetic Lock Release (where applicable)
.6 Clock System
.7 Elevator Recall (where applicable)

.22 Minimum eighty (80) character text display.

.23 Auxiliary relays: plug-in type, dust cover, supervised against unauthorized removal by common trouble circuit and c/w individual bypass switch.

.24 Contacts (remote): 2.0-amp, 120-VAC, for functions such as release of door holders or initiation of fan shut down.

.25 Contact terminal size: capable of accepting 22-AWG to 12-AWG wire.

2.4 Power Supply:

.1 120-VAC, 60-Hz input, 24-VDC output from rectifier to operate alarm and signal circuits.

.2 The Contractor is to provide all circuit breakers, conduit, cabling and terminations for the power of the new fire alarm system (and disconnection of power to the existing fire alarm system).

.3 Standby nickel cadmium battery unit with automatic battery charger to provide supervisory and trouble signal current for 24-hours, plus general alarm load for minimum of sixty (60) minutes. Unit is to be sized to carry the complete fire alarm system.

.4 Connection to the new fire alarm system shall be made in accordance with the 2015 Canadian Electrical Code, Rule 32-108. The Circuit breaker for the control unit and any associated power supplies such a NAC booster panels shall not be supplied from a panel board that supplies other circuits such as lighting circuits. Refer to the CEC handbook for further explanation. Confirm with electrical SCO prior to installation.

.5 The related breaker shall be coloured red, labeled as "fire alarm" and have a lock to prevent accidental shut-off.

.6 On the exterior of the breaker panel, control panel and remote power supply door, rivet a lamicoid label with the words "Fire Alarm System is connected to panel #X, circuit #XX", where "X" is the panel number and "XX" is the circuit number to which the fire alarm panel is connected. The label is to have white letters on a red background.

.7 Provide additional NAC booster panel power supplies as necessary, based upon circuit loading calculations.

2.5 Manual Stations:

.1 Manual stations: wall mounted semi-flush, single action with key-operated reset lock, break glass rod or visual activation indication type.

.2 Manual stations shall be of a type that does not have sharp edges or hard pointed corners.

.3 Manual station back boxes shall be colored red, and supplied by the fire alarm equipment manufacturer when surface mounted.

.4 Manual stations are to be supplied with addressable base modules. Such modules shall be integral to the station so that the installer does not have to connect the module first to the station and then to the initiating loop, leaving the module hanging loosely in the back box.

.5 In some high-risk locations, surface boxes are not acceptable. These devices shall be provided with a Plexiglas guard with rounded corners.

.6 Manual stations, shall be located on the latch side of the door within 1500-mm (where possible) immediately beside the door frame in such a way that the station faces down the corridor and is visible at a distance down the corridor. One exception to this rule is when a manual station is to be installed near a cross-corridor.

.7 Replace slot style screws which fasten the manual station assembly to the back box, with similar Robertson square head screws of the same thread size and length.

.10 Manual stations shall be located so that they can be easily seen when the door is open or closed. If in any doubt as to the correct location required, request clarification from the consultant.

.11 Manual pull stations requiring Allen keys or with tension spring retainers to access interior are NOT acceptable.

2.6 Automatic Alarm Initiating Devices (Heat Detectors and Smoke Detectors)

.1 Heat detectors shall be;

.1 Rate-of-rise of 8.3^{o}C (15^{o}F) per minute and 58^{o}C (136^{o}F) fixed temperature combination type: for most applications.

.2 Fixed temperature 58°C (136°F) type: for fan rooms, home economics rooms (if/where applicable – containing stoves and/or clothes irons in sewing areas or where sudden air temperature variations may occur).

.3 Fixed temperature 94°C (200°F) type: for boiler rooms or rooms containing cooking ranges or kilns.

.4 Detectors shall be addressable type, provided with a base suitable for installation of the chosen detector unit, including the following;

.1 Twist-lock Plug-in type with fixed base.

.2 Wire-in base assembly with integral red alarm LED and terminals for remote relay alarm LED.

.5 Where heat detectors are required in rooms that open to the exterior, (such as outside storage rooms) and are subject to inclement weather, use a fixed temperature conventional device and end of line, with an addressable monitoring module to be located in a heated location.

.6 Heat detectors shall be ULC approved for 15.24 m (50') spacing center to center.

.7 Spot type heat detectors shall not be installed directly above equipment that prevents easy access for maintenance. If in doubt as to whether the location is suitable, request clarification from the consultant.

.8 Provide trim skirt attachments to conceal base.

.2 Smoke Detectors;

.1 Addressable photoelectric type in all areas.

.2 Duct detectors shall also be addressable photoelectric type. The sampling tube shall be long enough to completely transverse the duct to provide a representative sample of the air passing through the duct.

.3 Ventilation systems shall not be shut down on general alarm by the fire alarm panel directly. Only the ventilation system in which the smoke is actually detected shall be shut down.

.4 Install a smoke detector in the supply air duct(s) of a multi-floor building where the air handling unit serves more than one floor or fire alarm zone.

.5 Where Duct smoke detectors are located above ceiling tiles or are located where the alarm indicator cannot be easily seen, provide and install a remote duct smoke indicator LED in a suitable location close to the ceiling where the LED can be observed from the floor level.

.6 Baffles shall be installed upon completion of verification of the duct detector (for those types of detectors that require a baffle in the detector unit).

.7 The Contractor shall pay all costs associated with obtaining the elevator contractor to provide shutdown of elevators for any work required in the shaft (including the installation of new detectors).

.8 Smoke detectors shall be ULC approved for 9.14 m (30') spacing center to center.

.9 Spot type smoke detectors shall not be installed directly above equipment that prevents easy access for maintenance. If in doubt as to whether the location is suitable, request clarification from the consultant.

.10 Provide trim skirt attachments to conceal base.

2.7 Audible/Visual Signal Devices (Horns/Strobes):

.1 Class A loop installation.

.2 Horn/Strobe shall be listed to UL 1971 and UL 464 and shall be approved for fire protective service. Horn/Strobe shall be wired as a primary signalling notification appliance and comply with the Americans with Disabilities Act requirements for visible signalling appliances, flashing at 1Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. The horn shall have two tone options, two audibility options and the option to switch between a Temporal Continuous pattern. Strobes shall be powered independently of the sounder with the removal of factory-installed jumper wires. The horn shall operate on a coded or non-coded power supply (the strobe must be powered continuously)

.3 Horn/strobe and strobe devices shall be wall or column mounted at a height between 2100mm-2300mm on center and not closer than 150mm from the ceiling.

.4 Strobe type: flashing white, 24-VDC.

.5 Strobes Candela (cd) outputs as per noted on the drawings.

.6 Designed for semi-flush mounting on walls as indicated.

.7 All visual strobes shall be synchronized.

.8 The maximum number of devices connected to a signal loop shall be based on the current rating of the signal card, de-rated to 80%, allowing a minimum spare capacity of 20% for future additions.

.9 All visual strobes mounted outside shall be of weatherproof type and suitable for the location. Outside visual strobes shall be set at 75cd.

.10 NAC (audible and visual) devices shall operate simultaneously, and when the signal silence button is activated shall also stop simultaneously.

2.8 Booster Signal Circuit Panel:

.1 Provide booster circuit panel to accommodate and maintain signal circuit voltage drop. Booster circuit panel as per manufacturer recommendation.

2.9 Tamper Isolation Sprinkler Switches:

.1 For fire protection system valves where a tamper switch is to be installed, supply and install the following, **coordinate with sprinkler contractor**:

- 'Potter' RBVS type tamper switch for Ball Valves;
- 'Potter' PCVS type tamper switch for Butterfly Valves, complete with appropriate butterfly valve kit, and Post Indicator Valves;
- 'Potter' OSYSU type tamper switch for Outside Screw & Yoke Valves;

- 'Potter' PTS-C plug type tamper switch for Non-Rising Stem Valves and where no other type of switch is available or practical.

.2 Unless otherwise noted, 'Potter' PTS-C cord and plug type switches, if used, shall connect to receptacle housings. The receptacle housing covers are to be equipped with a micro-switch or tamperproof screws.

.3 Tamper switches are to be connected to addressable modules with end of line devices installed in separate enclosures.

.4 Tamper switches are to initiate a latching supervisory signal when activated.

2.10 Water Flow Sprinkler Switches:

.1 Shall be Simplex 2097 series or similar, sized to fit pipe on designated sprinkler system and with a time delay adjustable up to 90-seconds. **Coordinate with sprinkler contractor.**

.2 Water flow switches are to initiate a general alarm on the fire alarm system when activated. Set the time delay at 30-seconds to avoid nuisance tripping.

.3 Water flow switches are to be connected to addressable modules and each flow switch zoned separately as required by the Code, with end of line devices installed in separate enclosures at 1800mm on center.

.4 All flow switches shall be replaced unless otherwise noted.

2.11 Addressable Input/Output Modules:

.1 Input modules shall be used to provide an address for devices that normally would not be supplied with this capability, including tamper switches and flow switches.

.2 Output modules shall be selected for the particular application which they are intended, such as disabling signaling circuits or for equipment control/switching. The contractor shall be responsible for confirming that the power ratings of the contacts are not exceeded.

.3 All modules shall be mounted in locations to minimize vandalism and immediately below standard height T-grid ceilings in close proximity to the controlled device.

.4 Modules shall be mounted in a separate device box and shall be equipped with a faceplate or cover. All addressable modules shall be identified using Brother PT-110 (or similar) identification on the faceplate.

2.12 Isolation Modules:

.1 Isolation modules shall be installed to provide separation between zones as indicated on the drawings or as per the Alberta Building Code Div B Article 3.2.4.8. The location of isolation modules will depend on the contractors suggested wiring route. A short circuit on the data communication link within a zone must not affect the operation of any of the other devices located within other fire zone boundaries. Utilize the CAN/ULC-S524-06 for further information as to where the isolation modules are required. If in any doubt as to where the isolation modules are required, request clarification from the consultant.

.2 Isolation modules shall be wired in the Class "A" system configuration.

.3 Isolation modules shall be identified and labelled with the zone numbers which wires are entering and exiting, using a Brother PT-110 (similar) label.

.4 Mount isolation modules in locations that will minimize vandalism and that are below the ceiling.

2.13 End-of-Line Devices:

.1 End-of-line devices sprinkler devices.

.2 Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing off normal condition at main control panel and remotely as indicated.

.3 End-of-Line devices shall be mounted in separate device boxes, and not within signal device boxes, at a height less than 1.8-metres above floor level. Install at 1.6-metres above fixed floor (to the top of the device box), unless otherwise instructed. This also applies to where there is only one device on the circuit.

.4 End-of-Line resistor boxes shall include the fire alarm system manufacturer's cover plates (with clearly indicated resistor symbol) and fire alarm system manufacturer's back boxes painted in red.

2.14 Protective Guards:

.1 Simplex-Grinnell

1. Guard Model 2098-9829C

NOTES:

1. When installing model 2098-9829C, rotate guard so that conduit port is blocked by the perforated tab on the mounting plate.

2. Guard model to be able to handle air velocities greater than 3 meters per minute as a condition of ULC approval.

3. All protective cages must be stamped with manufacturer and model number on the face plate of the protective cage.

.2 Or, Chubb Edwards

1. Guard Model 6255-004

NOTES:

1. When installing model 6255-004, rotate conduit entrance cover 90 degrees to ensure no opening exists when installed.

2. Guard model 6255-004 must be used in air velocities greater than 9 meters per minute as a condition of ULC approval.

3. All grilles must be stamped with manufacturer and model number on the faceplate of the grille.

.3 Or, Vipond

.1 Model KSFDF-002 compatible with Notifier detector FSL-85A

.2 Guard model GIA-2.

2.15 Automatic Shutdown of HVAC Systems:

.1 Where duct type smoke detectors are indicated on the drawings, they shall cause the related fan system (both supply and return fans) to shut down on smoke detection. The H.V.A.C. system involved shall be manually reset through the fire alarm panel for operation.

.2 The H.V.A.C. system shall automatically resume operation only when the fire alarm system is manually reset.

.3 Where code or the design requires the HVAC systems to be shut down on a fire condition, the electrical contractor shall be responsible for making the appropriate connections. Their wiring diagram must be reviewed and approved by the consultant before commencing any work. Electrical consultant must be copied on all correspondence.

.4 Install new duct smoke detector(s) in the supply air duct of air handling units (as indicated on the drawings) in accordance with CAN/ULC-S524-06 and manufacturers installation instructions. Confirm correct location with mechanical contractor on site prior to installation.

.9 The HVAC system shall shut down on general fire alarm.

2.16 Remote Monitoring Transmitter Connection:

.1 Connection shall be verified.

2.17 Device Labelling:

.1 All initiating devices shall be labelled with black letters on white background. Such labels shall be on the outside of the device, where the device is beyond the reach of students. Install labels inside manual stations.

.2 The identification shall be the programmed device number and zone to which it is connected.

.3 Brother P-Touch label system (or equivalent) is minimum standard.

.4 The fire alarm control panel and any remote power supplies must have Lamicoid identification labels.

2.18 Graphic Zone Schematic:

.1 The Contractor shall install the site zone graphic at a location specified by the consultant. It shall be protected by Plexiglas provided by the Contractor.

.2 As a minimum the graphic shall show the building name and address, a plan of the building showing architectural room numbers, north arrow, “you are here”, Zone schedule and Fire alarm system zones (including duct smoke detector and sprinkler flow switch locations) shall be color coded throughout the zone.

.3 The location of the fire alarm panel, fire extinguishers, hose cabinets, the main electrical and gas shutoff and any Siamese hose connections shall be shown on the graphic, where these are not already shown on the consultant’s drawings the contractor shall provide the information.

.4 The graphic is to be installed within three weeks of verification completion.

.5 The Contractor shall provide a temporary zone graphic whilst the new system is swapped over.

2.19 Ancillary Devices:

.1 Remote relay unit to include (but not limited to) to initiate: fan shutdown, gas solenoid shutdown, door release etc., as required.

3.1 Installation:

.1 Design and installation shall comply with CAN/ULC-S524.

.2 Any work or equipment that is necessary to meet manufacturer's specifications for the installation and operation of a code compliant fire alarm system shall be provided by the Contractor as if it were specified.

.3 All work shall be executed in a neat and professional manner by qualified tradespersons to the satisfaction of the consultant.

.4 Modify main control panel and batteries.

.5 Install manual alarm stations and connect to alarm circuit wiring.

.6 Install detectors and connect to alarm circuit wiring. Do not mount detectors within 1-m of air outlets. Maintain at least 600-mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts and provide air baffles as required. Measure the air velocity within the air duct and air pressure differentials between the duct smoke detector sample and exhaust tubes whilst the unit is running. Confirm they are within the manufacturers specified operating parameters for the duct smoke detector and then provide these readings to the consultant prior to wiring the duct smoke detector to the DCL.

.7 Connect alarm circuits to main control panel.

.8 Install remote annunciator panels and connect to annunciator circuit wiring.

.9 Reconnect all door releasing devices.

.10 Install remote relay units to control fan shut down.

.11 Install booster panels (as required) for horn/strobe circuits even not shown on the drawing.

.12 Sprinkler system: wire alarm and supervisory switches and connect to control panel.

3.2 Install Smoke Detector in Cell:

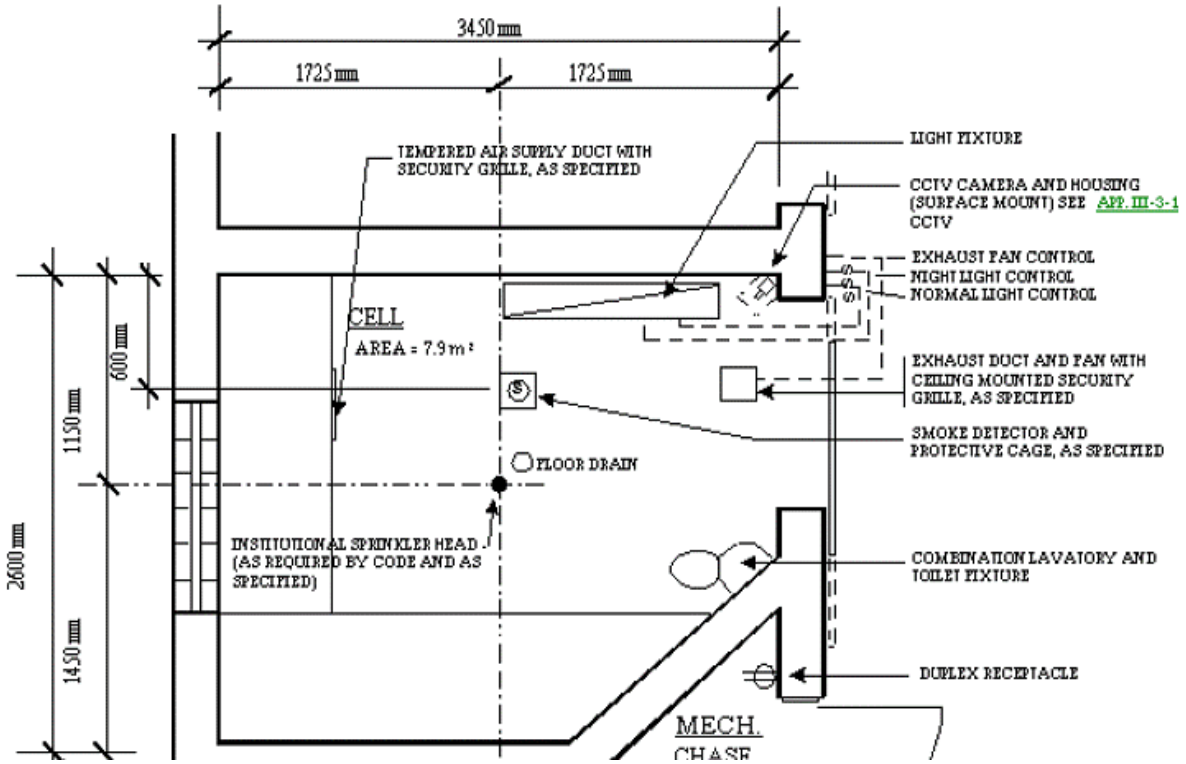
.1 At the location detailed on drawing "Cell Layout, Mechanical and Electrical" Section 1 or at a ceiling area which is less accessible to a detainee, install the following surface mounted equipment: one area-type smoke detector; protected by one RCMP-approved and ULC-listed protective cage.

NOTES:

1. During installation, use high yield grout material to fill any space between the back of the mounting plate and the ceiling surface.

2. ULC listing of protective cages is typically detector specific.

3. Surface conduit not approved.



3.3 Wiring:

.1 Use manufacturer approved fire alarm wiring.

3.4 Fire Alarm Schedules and Panel Display – Device Descriptors:

.1 The contractor shall be responsible for supplying to the design engineer the device schedules with a description for each device with an "ID Tag #" shown on the drawings for approval prior to any programming. The device descriptors shall be provided in an excel file format prior to any programming using the following column headings (the contractor may request an excel file template from the engineer):

.1 DCL Device Descriptions

Device ID TAG #	Device Description (as per 3.3.2 format)

.2

Device ID TAG #	Device Description (physical location)

.2 All DCL descriptors shall be programmed in the following format:

Zone Number – Floor level, Description of Area, Room Number

Example: Z01 - Main flr - Office - RM112

.3 The contractor shall use appropriate abbreviations for the descriptions of areas in the case of limited character display and/or where necessary. Below is a list of approved abbreviations:

AHU	AIR HANDLING UNIT
BOIL	BOILER
BOYS	BOYS WASHROOM
BSMT	BASEMENT
CLOS	CLOSET
CMPR	COMPRESSOR
CONF	CONFERENCE
CORR	CORRIDOR
CTR	CENTRE
DD	DUCT DETECTOR
E	EAST
ED	EDUCATION
ELEC	ELECTRICAL
ENTR	ENTRANCE
FAC	FACILITY
FLR	FLOOR
FS	FLOW SWITCH
GEN	GENERAL
GIRLS	GIRLS WASHROOM
LIB	LIBRARY
INT	INTERSECTION
MEZZ	MEZZANINE
MID	MIDDLE
N	NORTH
NE	NORTHEAST
NET	NETWORK (COMPUTER)
OFF	OFFICE
OP	OPERATOR
OPP	OPPOSITE
PHYS	PHYSICAL
MS	MANUAL STATION
MECH	MECHANICAL
REL	RELOACATABLE CLASSROOM
RM	ROOM
S	SOUTH
S/A	SUPPLY AIR
SD	SMOKE DETECTOR
SE	SOUTHEAST
SPR	SPRINKLER
STAF	STAFFROOM
STAIR	STAIRWELL
STNP	STANDPIPE
STOR	STORAGE

SW	SOUTHWEST
TS	TAMPER SWITCH
VEST	VESTIBULE
W	WEST
W/C	WASHROOM(WATER CLOSET)
WG	WING
WRKRM	WORKROOM

.4 Exact device addressing shall be at the discretion of the fire alarm supplier and based upon their programming requirements. However, must be approved by the Consultant and U of C project manager prior to the verification.

.5 All addressable devices shall be programmed with a unique text identifier.

.6 Any changes to the plans shall be indicated on the as-built drawings, including recording the physical address of the addressable device/module as programmed in the control unit.

3.5 Field Quality Control:

.1 Perform tests in accordance with CAN/ULC-S537-13.

.2 Fire alarm system:

.1 Test each device and alarm circuit to ensure each manual alarm station, heat detector, and smoke detector transmits an alarm to the fire alarm panel and actuates general alarm and ancillary devices.

.2 Test detectors using the *Testifire multi-stimulus detector tester,* or approved equal. For further details refer to www.testifire.com.

.3 Spray-can testers and hairdryers will not be accepted under any circumstances.

.4 Check annunciator panel to ensure zones are displayed correctly.

.5 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.

.6 Class “A” circuits:

.1 Test each conductor on all circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near midmost point of circuit.

.2 Reset control unit after each alarm function and correct imposed fault after completion of each test.

.3 Test each conductor on all circuits for capability of providing alarm signal during ground-fault condition imposed near midmost point of circuit.

.4 Reset control unit after each alarm function and correct imposed fault after completion of each test.

.7 As part of the field quality control test in accordance with the CAN/ULC-S537-13, the contractor shall coordinate the functional test of the Notification Appliance devices with HDL facility manager to be performed after hours. This test is to include measuring the sound levels of the speakers in accordance with the CAN/ULC-S537-13 using a calibrated dBA sound level meter, fire alarm

speakers' intelligibility shall be measured as well. Provide a record to the consultant of the areas tested with the measurements taken identifying both ambient and alarm sound level readings. Report any areas of concern in writing to the consultant and U of C project manager prior to scheduling the fire alarm verification to be witnessed by the consultant required by item 3.6.

3.6 Verification and Certification:

.1 The manufacturer shall make an inspection of the fire alarm equipment, including those components necessary to the direct operation of the system such as detectors and controls, whether or not manufactured by the manufacturer added under this contract. The inspector shall perform an examination of such equipment for the following:

.1 The type of equipment installed is that designated by the specification.

.2 The wiring connections to all equipment components have met ULC and CSA requirements.

.3 Equipment has been installed in accordance with the manufacturer's recommendations and that all signalling devices have been operated or tested to verify their operation.

.4 The supervisory wiring of equipment connected to a supervised circuit meets code requirements to the satisfaction of the inspection authority. Such wiring will be tested to show the circuit is operating correctly.

.5 To assist the contractor in preparing his bid, the manufacturer shall indicate the number of hours necessary to complete this inspection prior to closing of tenders, and the number of hours necessary to provide a training seminar on the system for the building owner.

.2 The complete verification procedure will be under the control and supervision of a Professional Engineer registered with APEGA and in accordance with the CAN/ULC-S537-13. The services of the contractor and representatives of the fire alarm manufacturer are required for the verification. **Allow for professional engineer's fire alarm verification fee in tender cost**. Engineer's fee will be **$3,850** for a single fire alarm verification. If the verification does not pass the first time or additional verifications are required the engineer will charge at the contractor's expense $190/hr for the length of the additional VI(s) plus travel time from Edmonton.

.3 The following is a rough breakdown of the responsibilities of each party participating in the verification. This list does not necessarily note all the required work. The contractor and fire alarm manufacturer shall provide equipment and manpower as necessary to complete the verification to the Consultant's requirements and approval.

.1 Contractor:

.1 The Contractor shall have minimum of one (1) electricians and one (1) fire alarm system technician available for the entire verification.

.2 Provide one pair of radios.

.3 Provide all hand tools and ladders (as required).

.4 Remove/reinstall devices.

.5 Activate alarms with the appropriate detector test equipment, as indicated above.

.6 In the event that the Contractor (or sub-contractor) is not sufficiently equipped, the Verification Inspection will be cancelled at the Contractor's expense.

.7 Activate trouble alarms.

.8 Correct deficiencies.

.9 Adjust fire alarm horn/strobe output setting where required.

.10 Any changes to the BMS/HVAC system must be tested and verified as operational prior to the actual Verification Inspection. The contractor shall include a schematic wiring diagram with the O&M manuals and inside the control box where the changes were made. The company will provide the date, contact name, and number on these documents.

.11 When the Verification Inspection is being completed there must be a supplementary record to confirm the proper operation of the HVAC system (hand, off, auto, BMS controls).

.12 Verification Inspection documents; as-built drawings, O&M manuals, close out letters, certificates, closed permits, etc. must be provided within **one month** of the Verification Inspection date.

.2 Manufacturer:

.1 Ensure correct operation of all alarms, signals, auxiliary functions, trouble indication.

.2 Record all data and issue report similar to that shown in the CAN/ULC-S537-13 Appendix C.

.3 Correct any deficiencies.

.4 Check, calibrate, adjust and confirm correct operation of control panels, annunciator.

.5 Generally assure that all aspects of system function properly.

.6 Provide all test equipment, including but not limited to; manometer, anemometer, dBA sound pressure level meter, speaker intelligibility meter, volt meter, clamp on dc ammeter and fire detector tester.

.7 Record the dBA readings throughout the facility new expansion areas during final verification.

.3 Witness Professional Engineer:

.1 Witness and supervise verification.

.2 Check and ensure that system is installed to all applicable codes and operates properly.

.3 Review test documentation, give to the owner and contractor for forwarding to the fire authorities (where requested).

.4 Issue signed and stamped verification certificate.

3.7 CLEANING AND ADJUSTING

.1 Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.

.2 Occupancy Adjustments: When requested, within 1 year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.8 TRAINING

.1 Provide the services of a factory authorized service representative to demonstrate the system, and train Owner's maintenance personnel as specified.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 21 00 – Allowances.

.2 Section 31 05 16 – Aggregate Materials.

.3 Section 31 11 23 – Aggregate Base Courses.

.4 Section 31 20 10 – Earthwork General Requirements.

.5 Section 31 23 10 – Site Excavation, Filling and Grading.

.6 Section 31 23 13 – Sitework Subgrade Preparation.

.7 Section 31 23 13-13 – Proof Rolling.

.8 Section 31 23 38 – Trench Excavation and Backfill.

.9 Section 32 05 23 – Sitework Cement and Concrete.

.10 Section 32 12 13 – Preparatory Coats.

.11 Section 32 12 16 – Asphalt Paving.

.12 Section 32 12 16-13 – Asphalt Paving Materials.

.13 Section 33 05 16-13 – Concrete for Utility Structures.

.14 Section 33 11 00 – Water Utility Distribution Piping.

.15 Section 33 31 00 – Sanitary and Storm Utility Piping.

1.2 REFERENCE DOCUMENTS

.1 Applicable test methods for earthwork testing specified in this Section:

.1 Particle Size Analysis of Fill Materials: Testing for conformance with specified gradation limits will utilize testing sieves complying with CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.2 Compaction Testing: to ASTM D698-91, Laboratory Compaction Characteristics Of Soil Using Standard Effort.

1.3 GEOTECHNICAL SITEWORK TESTING AGENCY SERVICES

.1 The Contractor will appoint and pay for services of a Geotechnical Engineer to perform quality control testing associated with the site grading, underground services and roadway construction.

.2 As required by the Contractor and upon the request of the Engineer, the Contractor shall coordinate the Geotechnical Engineer to provide detailed recommendations to site specific requirements, such as a proof roll, or for unforeseen conditions. All recommendations are to be provided to the Consultant of Record and reviewed for contract changes, prior to implementation.

.3 All geotechnical sitework testing listed in the Related Sections herein shall be paid for under the specified Cash Allowance.

.4 The Contractor shall provide all test results to the Engineer within 4 weeks after being conducted, or upon request. Under no conditions shall the Contractor expect acceptance of sitework without the necessary test results submitted and accepted by the Engineer.

.5 The cost of retests for concrete and asphalt testing, due to original test failures, shall be the responsibility of the Contractor.

.6 Cooperate with testing agency in site sampling for testing.

1.4 FILL MATERIAL TESTING

.1 Provide onsite, for testing purposes, 1 m3 of each type of imported fill material.

.2 Imported fill materials will be tested by the Geotechnical Engineer, before placement, for conformance with requirements and to confirm suitability for intended uses.

.3 Native excavated material to be used as fill material will, before placement, be inspected for compliance with requirements and tested to confirm suitability for intended uses.

1.5 COMPACTION TESTING

.1 Fills for embankments, berms and beneath landscaped areas shall be compacted to 95% of Standard Proctor Density (ASTM D698 Method A) within 2% of optimum moisture content.

.2 Where concrete or pavement structures are to be placed next upon completion of filling, fill shall be compacted to 98% of a Standard Proctor Density (ASTM D698 Method A) within 2% of optimum moisture content.

1.6 OTHER TESTING

.1 Testing associated with subgrade, aggregates, concrete, trench backfill, concrete thrust blocks, asphalt and other Sitework components shall be undertaken as described in the Related Sections which specify field quality control.

Part 2 Products

.1 NOT USED

Part 3 Execution

.2 NOT USED

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Designated classes, gradation and physical requirements of aggregate.

.2 Production and supply of aggregate and quality assurance.

1.2 QUALITY ASSURANCE

.1 The Geotechnical Engineer will conduct sieve analyses to ASTM C136 and other tests to ensure that aggregate being produced and supplied meets the requirements of Tables 2.1, 2.2 and 2.3. The contractor shall provide a daily estimate of production tonnage to the Geotechnical Engineer.

.2 A minimum of one sieve analysis per 500 tonnes of aggregate supplied to a jobsite is required. The aggregate may be sampled from a stockpile at the jobsite or at the gravel pit / crusher site.

.3 If the aggregate fails to meet the specified gradation, the contractor shall suspend gravel placement until proof of compliance with the specification is provided to the Geotechnical Engineer. Alternatively, the contractor may elect to remove the suspect gravel from the jobsite and provide aggregate from a different source.

1.3 STORAGE AND PROTECTION

.1 Place aggregate into stockpile in horizontal lifts of 750 mm maximum thickness. Avoid segregation of particle sizes. Do not dump aggregate over the edges or down the faces of the stockpile. On completion, peak the stockpile at a minimum 3% grade.

Part 2 Products

2.1 MATERIALS

.1 Aggregates shall conform to the requirements in Tables 2.1, 2.2 and 2.3.

.1 Table 2.1: Aggregate Gradation Specifications for Designations 1 – 3

Designation	**1**				**2**	**3**				
Class	**10**	**10**	**16.0**	**20.0**	**20**	**20**	**25**	**40**	**63**	**80**
Application	**10mm-HT**	**10mm-LT**	**SMA**	**20mm-B**	**Soil Cement**	**Granular Base**	**Granular Base**	**Granular Base**	**Granular Base**	**Granular Sub-Base**
80,000										100
63,000								100	100	
25,000				100			100	70-94	55-75	46-85
20,000			100	97-100	100	100	82-97	60-90	50-70	40-81
16,000			97-100	83-97		-	70-93	55-85	44-65	32-76
12,500	100	100	88-100	70-92	60-96	60-96	60-86	50-80	38-60	30-70
10,000	97-100	97-100	30-80	61-84	-	-	52-79	44-74	-	-
8,000	70-94	80-94	-	52-77	-	-	-	-	-	-
6,300	45-85	65-85	22-45	44-70	-	-	-	-	23-47	-
5,000	32-75	50-75	20-35	38-65	36-75	36-75	35-64	32-62	20-45	25-50
2,500	23-55	35-55	16-26	26-52	-	-	-	-	-	-
2,000	-	-	-	-	24-54	24-54	24-50	20-50	14-38	19-42
1,250	16-45	25-45	14-22	18-41	20-43	20-43	19-43	17-43	12-34	15-38
630	11-36	20-36	13-20	13-31	14-34	14-34	14-34	12-34	10-28	10-32
400	-	-	-	-	11-29	11-29	10-27	10-28	8-24	7-27
315	8-26	14-26	12-18	9-22	9-26	9-26	9-24	8-25	7-22	6-24
160	5-15	7-15	10-16	6-14	6-20	6-20	6-18	5-18	4-17	3-18
80	3-8	4-8	10-14	3-7	2-10	2-10	2-10	0-10	0-10	0-10

.2 Table 2.2: Aggregate Gradation Specifications for Designations 4 – 8

Designation	**4**		**5**		**6**		**7**		**8**
Class	**2.5**	**10**	**5**	**80**	**20**	**25**	**10**	**80**	**25**
Application	**Unit Pavers Joint Sand**	**Unit Pavers Bedding**	**Grout Sand**	**Culvert Bedding**	**Sub-Drain Rock**	**Sewer Rock**	**Sewer Backfill**	**Culvert Backfill**	**Radon Rock**
80,000				100				100	
25,000						100			100
20,000				85-100	100				85-100
14,000					90-100				50-90
10,000		100			45-75		100		25-60
5,000		75-95	100	70-90	0-15	10 max	70-100	30-60	0-10
2,500	100	35-70			0-5				0-5
1,250	85-100	20-50							
800				40-80					
630	50-90	10-40							
315	25-60	5-20	50-95						
160	12-30	2-8					5-20		
80	10-15	0-5	25 max	0-15		2 max	0-12	0-15	

.3 Table 2.3: Aggregate Properties

Designation	**1**		**2**	**3**			
Class	**10**	**20**	**20**	**20 & 25**	**40**	**63**	**80**
Application	**10mm-HT & LT**	**20mm-B**	**Soil Cement**	**Granular Base**	**Granular Base**	**Granular Base**	**Granular Sub-Base**
+5000 µm With ≥2 Fractured Faces (% Mass)	*	*	60 min	60 min	75 min	75 min	
Plasticity Index <400 µm	*	*	6 max	6 max	6 max	6 max	
Liquid Limit	*	*	25 max	25 max	25 max	25 max	
LA Abrasion Wear (% Mass)	*	*					
Soundness Loss (% Mass)	*	*					
Lightweight Pieces (% Mass)	*	*	2 max	2 max	2 max	2 max	2 max

* Note: See Section 32 12 16-13 Asphalt Paving Materials for requirements

2.2 EQUIPMENT

.1 Crushers: capable of producing aggregate as specified.

.2 Scale Tickets: Supply truckers with scale ticket forms approved by the local municipality.

.3 Metric Sieves: CAN/CGSB-8.2-M sieve sizes shall replace ASTM E11 sieves as follows:

CAN/CGSB-8.2-M Sieves (µM)	ASTM E11 Sieves (mm)
125 000	125.0
80 000	75.0
63 000	63.0
50 000	50.0
40 000	37.5
25 000	25.0
20 000	19.0
16 000	16.0
12 500	12.5
10 000	9.5
5 000	4.75
2 500	2.36
2 000	2.00
1 600	1.70
1 250	1.18
800	0.850
630	0.600
400	0.425
315	0.300
160	0.150
80	0.075
45	0.045

Part 3 Execution

3.1 EXAMINATION

.1 Crushed aggregate shall consist of sound, hard and durable particles of sand, gravel and rock, free of elongated particles, injurious amounts of flaky particles, soft shale, coal, ironstone, clay lumps and organic and other deleterious material.

3.2 PREPARATION

.1 Adjust and modify aggregate as required to meet gradation requirements by aggregate splitting, elimination of fines, or blending with sand.

END OF SECTION

Part 1 General

1.1 INTENT

.1 This Section specifies general requirements common to all earthwork. Read this Section in conjunction with related Sections which specify requirements for specific types of earthwork.

1.2 RELATED SECTIONS

.1 General Conditions of Contract – Changes in Sub-Surface Conditions.

.2 Division 02 – Subsurface Soils Information.

.3 Section 31 00 10 – Geotechnical Sitework Testing.

1.3 DEFINITIONS

.1 Earthwork: Earthwork means excavating of all types, backfilling, filling, compacting, grading and related work.

1.4 BASIS OF EXCAVATION

.1 For bidding purposes, assume that all excavation work will be "Earth Excavation".

.2 Rock encountered within areas requiring excavation and classified by Engineer as "Rock Excavation in Trenches or Pits" or "Rock Excavation in Open Excavations", will be considered a change in the Work and valued in accordance with the General Conditions of Contract.

.3 Classifications of excavation encountered which are contrary to the foregoing, and are classified as such by Engineer, will be considered a change in the Work and valued in accordance with the General Conditions of Contract.

1.5 UNAUTHORIZED EXCAVATION

.1 Unauthorized excavation shall be any excavation beyond elevations and dimensions indicated, without specific direction by Engineer.

.2 Fill unauthorized excavation to elevations and dimensions indicated.

.3 Unauthorized excavation and remedial work shall be at Contractor's expense.

1.6 EXCAVATION LEVELS

.1 For bidding purposes, assume that the excavation levels will be as indicated on the Drawings.

.2 Notify Engineer if unsuitable subgrade materials are encountered at the design subgrade elevations. Upon approval by the Engineer, carry excavation deeper and replace excavated material with suitable materials.

.3 Adjustments in levels, if approved by the Engineer, will be considered a change in the Work and will be valued in accordance with the General Conditions of Contract.

.4 Contractor is responsible to undertake an earthworks analysis as part of the tender process, using the Grading & Drainage Plan and the Geotechnical Report, to determine the extent of earthworks required on the site. The Contractor shall be responsible for the import of suitable fill materials and the disposal of excess materials off-site, where necessary.

Part 2 Products

2.1 FILL MATERIALS

.1 Imported fill materials will be tested by the Geotechnical Engineer, before placement, for conformance with requirements and to confirm suitability for intended uses.

Part 3 Execution

3.1 PREPARATION

.1 Notify Engineer minimum 2 days prior to beginning excavating operations.

.2 Prior to commencing excavation:

.1 Contact all affected utility companies regarding exact location and current status of all utilities, voltage of underground and overhead power lines and pressure of natural gas lines.

.1 Notify Engineer if any utility lines have been omitted from or incorrectly indicated on Drawings.

.2 Identify known underground utilities. Stake and flag locations. Identify and flag surface and aerial utilities.

.3 Removal and/or relocation of existing utility lines will be coordinated with the Engineer, affected utility company, Contractor and Client to minimize disruption to the construction schedule.

.3 Hydrovac and/or hand excavate building connections, service connections, utilities at sufficient intervals to confirm horizontal and vertical alignment of existing utilities within the proposed work area.

.4 Maintain and protect existing above and below grade utilities which pass through work area. Protect active utility lines exposed by excavation, from damage.

.5 Where existing pipes, ducts or other underground services intersect a trench, support trench in a manner approved by Utility.

.6 Where existing overhead line poles are adjacent to excavations, temporarily support poles in a manner approved by Utility.

3.2 SHORING AND BRACING

.1 If required to provide safe working conditions and to prevent cave-ins and loose soil from falling into excavations, protect excavations by shoring, bracing, sheet piling, underpinning, or other suitable methods.

.2 Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases or cuts.

3.3 DEWATERING

.1 Maintain excavations free of water. Provide pumps, piping, temporary drains, trenches, sumps, and related equipment to remove water.

.2 Do not use sanitary sewers or private property for discharge of water.

.3 The Contractor is responsible for all dewatering costs and should reference the Geotechnical Report for further details on existing groundwater conditions.

3.4 EXCAVATING

.1 Verify topsoil and unsuitable materials have been removed to the satisfaction of the Geotechnical Engineer prior to beginning of excavation, embankment/engineered fill and subgrade preparation. Dispose any remaining topsoil and unsuitable materials off-site.

.2 Do not excavate under wet conditions or when such conditions are anticipated.

.3 When excavating is necessary through roots of plant materials, which are to remain, follow procedures approved by the Landscape Architect or local municipality.

3.5 MATERIAL STORAGE

.1 Native excavated material, other than topsoil, acceptable and required for use as fill material under this Contract: Stockpile on site until required.

.2 Stockpile locations shall be subject to Engineer and Client's approval.

3.6 DISPOSAL OF EXCESS AND WASTE MATERIAL

.1 Native excavated material, other than topsoil, acceptable but in excess of that required for use as fill material under this Contract: Remove from site.

.2 Unacceptable excavated topsoil, unacceptable native excavated material, waste material, trash and debris: Remove from site and ensure proper disposal.

.3 Contractor shall be responsible for all permits and fees associated with all disposal required by this section.

3.7 BACKFILLING

.1 Ensure areas to be backfilled are free of debris, snow, ice, water and that surfaces are not frozen. Do not backfill over porous, wet, or spongy subgrade surfaces.

3.8 COMPACTION

.1 Compact fill materials using only mechanical methods. Do not use hydraulic methods.

.2 Do not perform compaction using vehicles and other equipment not designed for compacting.

.3 Maintain optimum moisture content of materials being compacted, as required to attain specified compaction density.

END OF SECTION

Part 1 General

1.1 INTENT

.1 This section describes the minimum requirements for the supply and installation of a radon mitigation rough-in system.

.2 If, after the building is completed and occupied, long term radon testing results indicate the rough-in system needs to be activated, the installed components provide radon gas extraction points from within the building. Follow Health Canada guidelines for long term radon testing. The Building Owner would then need to mechanically vent the radon to the outside, so that radon levels are controlled within the building.

1.2 REFERENCES STANDARDS

.1 Alberta Building Code 2014.

.2 EPA/625/R-92/016 - 1994 Radon Prevention in the Design and Construction of Schools and Other Large Buildings.

.3 ASTM applicable standards.

.4 Health Canada – Guide for Radon Measurements in Public Buildings – 2016.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meeting:

.1 Contractor to arrange for a site meeting with the Consultant to review existing conditions and all requirements related to materials, material handling and storage, installation, scheduling, testing, and quality assurance and control, to confirm compliance with manufacturer and installation requirements.

.2 Submittals:

.1 Submit component product information related to the system design drawings and specifications. This includes the geotextile fabric, gas permeable venting layer, membrane barrier system, suction pit and pipe, collection/extension/riser piping, and sealing methods for the slab perimeters and penetrations.

.2 Provide final as-built drawings that indicate the final locations of the collection/ extension/riser pipes and the suction pits and cages.

.3 Quality Control:

.1 Component installation for the radon mitigation rough-in system is to be done by competent and skilled workers having a minimum of two (2) years experience installing vapour barriers, sealants and waterproofing membranes.

1.4 DELIVERY, HANDLING AND STORAGE

.1 Ensure all products delivered to the site meet manufacturer’s quality requirements. Remove and do not use any defective products. Store and handle materials as per manufacturer’s requirements, recommendations and safety data sheets. Protect materials from construction and weather related damage using appropriate coverings and adequate ventilation.

1.5 ENVIRONMENTAL / SITE CONDITIONS

.1 All products and materials are to be stored at temperatures and environmental conditions that conform to manufacturer guidelines.

.2 Perform installation work only when the weather conditions are within installation guidelines established by manufacturer.

.3 Do not proceed with membrane barrier system installation until the substrate preparation and condition is reviewed by the Consultant.

.4 Do not proceed with the concrete slab pour until the membrane barrier system preparation and condition is reviewed by the Consultant.

1.6 WARRANTY

.1 Provide a two (2) year warranty against slab perimeter and penetration sealing defects and/or deficiencies, and confirm that the materials meet performance specifications and installation requirements.

.2 Review all manufacturer's requirements for warranty period before the commencement of work. Ensure that all materials and installations are in conformance with manufacturer and warranty requirements, system design, and requirements of this specification.

1.7 PERFORMANCE REQUIREMENTS

.1 Installation of the geotextile fabric, gas permeable layer, suction pits, collection pipes, membrane barrier system, and sealing methods for the slab perimeters and penetrations for the building concrete in contact with the soil, is to comply with manufacturers requirements, system design, and the requirements of this specification.

.2 All system components are to be chemically compatible with the soil environment (ASTM E154-88).

.3 The radon rock (gas permeable venting layer) is to be a minimum 150 mm layer of clean, coarse, aggregate meeting Section 31 05 16 Aggregate Materials, Designation 8.

.4 The radon membrane barrier system (also the vapour barrier) is to be a minimum, 15 mil polyolefin based resin sheet membrane, meeting the requirements of ASTM E 1745-11.

.5 Radon membrane barrier system is to be overlapped and sealed at all perimeters and floor slab penetrations to provide a continuous seal of the building area in contact with the soil, as per manufacturer requirements, and the requirements of this specification.

.6 Install and seal floor drains, suction pits and collection pipes with polyurethane elastomeric joint compound.

Part 2 Products

2.1 MANUFACTURER

.1 No specific product manufacturers for the radon mitigation rough-in system are identified. All products shall conform to the applicable ASTM standards and the EPA/625/R-92/016 - 1994 technical design document, and as indicated in the design drawings and specifications. Materials and components included for use are to be reviewed by the Consultant.

2.2 GEOTEXTILE FABRIC

.1 The geotextile fabric is to be installed on the subsoil below the radon rock gas permeable venting layer. The geotextile fabric protects the gas venting layer from being contaminated with fines from the subsoil. Other geotextile fabric layers can be proposed.

.2 The geotextile fabric is to have the following physical characteristics:
- .1 Non-woven fiber construction with an apparent opening size of 0.15mm.
- .2 Unit weight of 340g/m^2 (ASTM D5261)
- .3 Grab tensile strength of 1100 N (ASTM D4632).
- .4 Elongation of from 45 to 105% (ASTM D4632).
- .5 Trapezoid tear resistance of 450N (ASTM D4533).
- .6 Puncture resistance of 700N (ASTM D4833).
- .7 Mullen Burst of 3600Pa (ASTM D3786).

2.3 GAS PERMEABLE VENTING LAYER

.1 The gas permeable venting layer (radon rock) is to be a minimum 150 mm layer of clean, coarse, aggregate meeting Section 31 05 16 Aggregate Materials, Designation 8.

2.4 MEMBRANE BARRIER SYSTEM

.1 The radon membrane barrier system (also the vapour barrier) is to be a minimum, 15 mil polyolefin based resin sheet membrane, meeting the requirements of ASTM E 1745-11.

.2 All membrane seams are to be prepared, overlapped and sealed as per the manufacturer's recommendations.

.3 Supply and install Blueskin WP 200, or an accepted substitution as a transition between the radon membrane and upturn onto grade beams, foundation walls, footings or any item that penetrates the finished floor slab, mechanically fasten on 300mm centers. Joints are to be designed to accommodate anticipated movement.

.4 Gas tight seals are to be provided around the surfaces of all vertical penetrations. Such surfaces are to be prepared as per manufacturer's requirements to facilitate membrane adherence. Use Blueskin WP 200, sealants and construction tape as required to provide a continuous seal between radon membrane and any pipe, conduit or other item that penetrates the floor slab.

2.5 SUCTION PIT

.1 The suction pits and pipes are to be as shown on drawings.

.2 Ensure that a vertical collection riser pipe extends a minimum 300 mm above the finished floor slab before a piping connection.

2.6 COLLECTION, EXTENSION AND RISER PIPES

.1 The collection, extension and riser pipe locations are to be as shown on 4 System Details.

.2 The collection, extension and riser pipes are to consist of non-perforated smooth walled 150mm diameter rigid pipe of XFR, or High Density PE construction, with joints fully sealed.

.3 A vertical riser pipe is to be installed at each suction pit location and extend from the suction pit to a minimum of 600mm above the finished roof membrane.

Part 3 Execution

3.1 INSTALLATION

.1 Contractor to review footing, wall and grade beam building construction drawings, and review radon mitigation rough – in system design drawings and specifications to ensure proper understanding before installation.

.2 All installation work is to be reviewed by the Consultant.

.3 Each individual sub-slab area isolated by building footings, foundation walls or grade beams is to be connected to an installed radon roughed-in mitigation system. The system design may use collection piping to draw radon gas from multiple sub-slab areas to a single suction pit, to minimize the number of suction pits.

.4 Prepare sub-grade surface prior to installation of the geotextile fabric, suction pits, and collection, extension and riser piping, as per the elevations specified in the building construction drawings and specifications.

.5 Place geotextile fabric layer over the entire sub-grade surface, with sufficient overlaps as per the manufacturer's requirements.

.6 Construct and install the suction pits in locations as shown on drawings.

.7 Install collection/extension/riser pipes in sub-grade beams between gridlines 4 to 9 and B to G. Exterior grade beams are not required to have pipes. Refer to Detail Section F22 on Drawing S6.5.

.8 All pipe joints are to be solvent welded and fully inserted into coupling or fitting to ensure joint integrity as per manufacturer's instructions.

.9 The gas permeable venting layer (radon rock) is to be a minimum 150 mm layer of clean, coarse, aggregate meeting Section 31 05 16 Aggregate Materials, Designation 8.

.10 The gas permeable venting layer (radon rock) is to be constructed by placing, grading and compacting it over the entire sub-grade surface, and geotextile layer. Ensure the suction pit remains clear of the gas permeable venting layer (radon rock).

.11 At completion of the substrate, component and gas permeable venting layer, the Contractor is to contact the Consultant to review the installation of this portion of the system.

.12 After review of the substrate, component and gas permeable venting layer installation, the membrane barrier system construction can commence.

.13 Membrane barrier system is to be placed over the gas permeable venting layer (radon rock). All membrane overlaps and sealing is to be done as per the manufacturer's requirements and specifications.

.14 Membrane barrier system installation is to be performed by trained qualified installers using manufacturer's recommended techniques and equipment.

.15 Membrane barrier system is to be a minimum, 15 mil polyolefin based resin sheet membrane, meeting the requirements of ASTM E 1745-11.

.16 Membrane barrier system is to be installed and sealed around all vertical penetrations with sufficient overlap and using Blueskin, sealant and construction tape or chemical welded seams as per manufacturer's requirements and specifications.

.17 At completion of the membrane barrier system, Contractor is to contact the Consultant to review the membrane barrier system.

.18 After review of the radon mitigation rough – in system installation, the floor slab construction can commence.

.19 Care must be taken not to puncture the membrane during floor slab construction. To limit membrane puncture during floor slab construction, items such as rebar chair supports designed with a wide base (instead of legs) are recommended to better spread the rebar load.

.20 Once concrete floor slab has cured sufficiently to allow work to proceed on it, clean joint surfaces in accordance with manufacturer's instructions and seal all finished floor slab perimeter cold joints and any other floor slab penetration junctions between dissimilar materials using high quality sealants suitable for use on each subject material surface. Test sealant to confirm adhesion with all surfaces prior to use.

.21 The above slab exposed joints in the riser pipes must be 100% solvent welded to provide a complete seal.

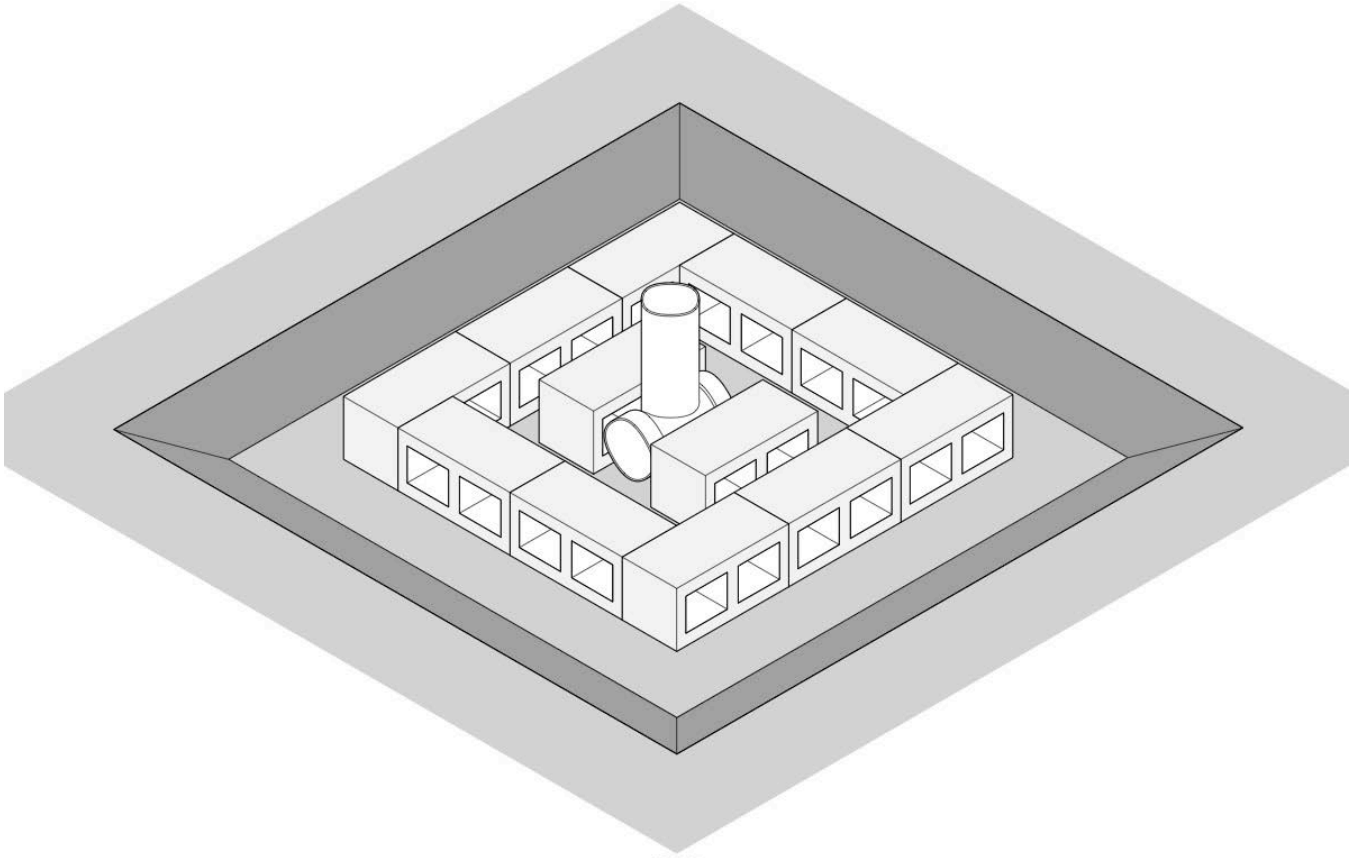
.22 The above slab exposed riser pipe to be labeled to identify as part of the "Radon Mitigation Rough-in System".

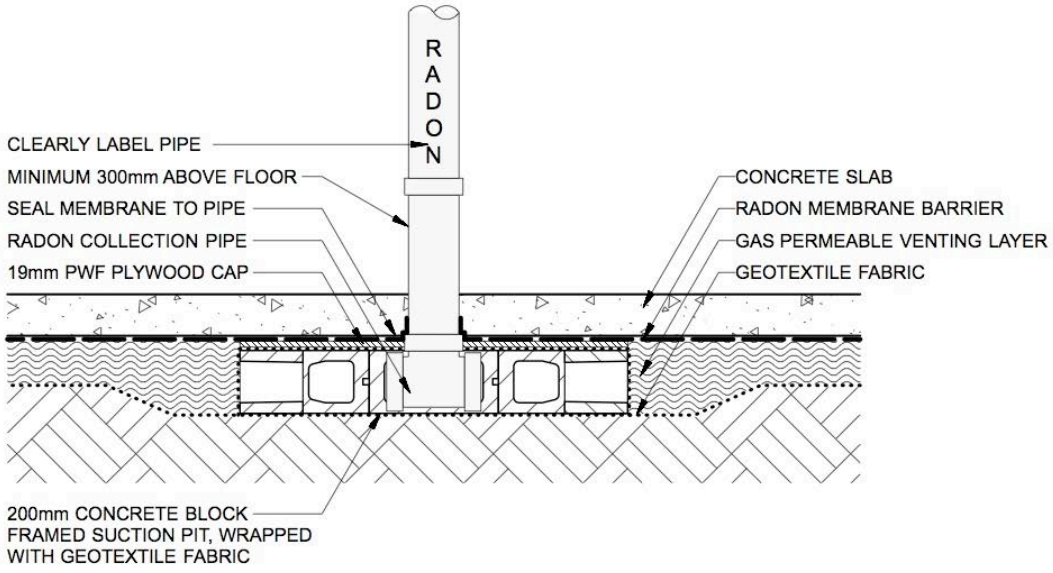
.23 At completion of the slab perimeter and penetration sealing and capping and labeling of the exposed riser pipes, Contractor is to contact the Consultant for a final review of the installation.

.24 When final review of the installation of the slab perimeter and penetration sealing and labeling of the exposed riser pipes has been completed by the Consultant, the passive radon mitigation rough-in system is considered complete.

.25 Deficiencies in the radon mitigation rough – in system are to be corrected in accordance with this specification and as per instructions from the Consultant.

3.2 System Detail





END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 00 10 – Geotechnical Sitework Testing.

.2 Section 31 20 10 – Earthwork General Requirements.

.3 Section 31 23 13 – Sitework Subgrade Preparation.

1.2 SECTION INCLUDES

.1 Excavation of soil for construction of roadway and associated structures.

.2 Construction of fill.

.3 Disposal of surplus and unsuitable materials.

1.3 DEFINITIONS

.1 Common Excavation: includes topsoil, clay, silt, sand, gravel and peat within a jobsite.

.2 Borrow Excavation: includes select topsoil, clay, sand and gravel from off the jobsite for use as fill within a jobsite.

.3 Garbage Excavation: includes household, commercial and industrial refuse or any other deleterious material.

.4 Fill: any earth structure built up by successive lifts of a specified material compacted to specified densities.

.5 Berm: a type of fill for a specific purpose, such as for noise attenuation or landscaping, as indicated on the drawings.

1.4 AS-BUILT DRAWINGS

.1 Provide as-built drawings on completion of contract. Contractor to supply as-built grading plan prepared by a surveyor in ACAD and pdf format that captures the as-built, geodetic elevation of all design elevations shown on the Grading & Drainage Plan.

Part 2 Products

2.1 MATERIALS

.1 Suitable Materials: The Geotechnical Engineer will determine the suitability of excavated materials for use in embankments, subgrade, backfill, berms and any other purpose.

.2 Salvageable Materials: When directed by the Geotechnical Engineer, reserve and stockpile at designated locations topsoil, sand, gravel, surplus fill and other materials deemed salvageable by the Geotechnical Engineer.

.3 Unsuitable Materials: Remove and dispose off-site of peat, roots, stumps, topsoil, frozen soil, garbage and any other material deemed unsuitable by the Geotechnical Engineer.

2.2 EQUIPMENT

.1 Only vehicles licensed for highway use shall be used for hauling on developed roadways.

.2 Off-highway earthmoving equipment shall not travel along or across developed roadways, unless authorized in writing by the local municipality before work starts.

.3 Equipment shall be adequately muffled to conform to local noise abatement bylaws.

Part 3 Execution

3.1 EXCAVATION

.1 Excavate to designated cross-sections. Complete initial excavation and exercise caution to preserve bank stability where necessary. Stage excavation to allow related work. The Engineer will provide an electronic base plan for use during the grading operation.

.2 Use of Excavated Soil: Use Geotechnical Engineer-approved excavated soil to construct embankments, subgrade, berms, boulevard fill, trench backfill and for other purposes as directed.

.3 Borrow Excavation: The Contractor is responsible to determine whether there is sufficient on-site suitable material for jobsite use. If not, the Contractor is responsible for costs associated with acquisition of additional suitable material from a borrow site. Excavate, load, haul, place and compact, as required.

.4 Undercut: When excavation exposes unsuitable materials below the subgrade elevation and the Geotechnical Engineer directs removal, excavate such materials using transition slopes no steeper than 10%. Make the bottom of the cut level, with no loose material.

.5 Over-Excavation: Where over-excavation occurs, restore grades by backfilling, compacting and re-grading as directed by the Geotechnical Engineer. If over-excavation is the result of the Contractor's error, no claim shall be made for the excess excavation and grade restoration.

.6 Excess Topsoil and Suitable Fill Soils: The Contractor shall dispose of all excess soils off-site at the Contractor’s cost and at a location to be chosen by the Contractor.

3.2 FILL

.1 Preparation: Where necessary, clear and grub the base of fill, remove topsoil, other unsuitable materials and granular base and scarify the base to ensure bond with fill material.

.2 Soil Moisture Alteration: The required compaction can best be achieved if the soil is dried or moistened to within ±2% of optimum moisture content. The Contractor is responsible to condition the soils, as necessary, to achieve the required compaction.

.3 Fill Placement and Compaction: Place and spread fill material in successive horizontal lifts, each lift not exceeding 150 mm thickness when compacted. Compact each lift to the required density using suitable equipment.

.4 Berm: Unless indicated otherwise on drawings or directed by the Geotechnical Engineer, build up the berm by spreading layers of approved material not more than 300 mm thick. Grade each layer using at least three passes of the spreading equipment.

3.3 SIDE SLOPES

.1 Trim slopes of cuts, fills and berms from top to bottom. Leave the base of the slope neatly trimmed by removing lumps or loose material, or by blending loose material into the base. Finish slopes true to designated alignment, grade and shape.

3.4 FIELD QUALITY CONTROL

.1 Grade Tolerances: Check graded surfaces to ensure they meet a grade tolerance of ±25 mm maximum variation from designated grade elevations and that crossfall and bottoms of ditches are graded to create positive flow:

.1 When tolerance is exceeded: Trim high areas to within tolerance and scarify low areas, backfill with approved material, compact to required density and regrade to within tolerance.

.2 Density Requirements:

.1 Maximum density: as used in this section, is the dry unit mass of sample at optimum moisture content as determined in the laboratory according to ASTM D698 Method A.

.2 The required densities for fill are:

.1 Fills for embankments, berms and beneath landscaped areas shall be compacted to 95% of Standard Proctor Density (ASTM D698 Method A) within 2% of optimum moisture content.

.2 Where concrete slabs or pavement structures are to be placed next upon completion of filling, fill shall be compacted to 98% of a Standard Proctor Density (ASTM D698 Method A) within 2% of optimum moisture content.

.3 Testing Frequency: The quality assurance laboratory will take a minimum of one field density test for each 2 000 m2 of compacted lift, or approved alternate frequency, according to ASTM D1556, ASTM D2167, or ASTM D2922 for comparison with a maximum density determined according to ASTM D698 Method A.

.4 Noncompliance: If a density test result is less than the required density, that test result is to be recorded as "failed" and a retest shall be performed on the area represented by the failed test. If the retest is less than the required density, the area shall be reworked to the full depth of the lift, the soil moisture altered as necessary and re-compacted to the required density.

.5 If the lift is covered before the Geotechnical Engineer has accepted the test results then the Contractor assumes the risk of uncovering and reworking the compacted lift.

3.5 PROTECTION

.1 Drainage: If the work area floods, drain immediately by natural flow or by pumping into catch basins, manholes or ditches. The Contractor is responsible to maintain positive drainage and mitigate rutting caused by construction equipment at all times during construction to prevent damage to the subgrade materials due excessive moisture.

.2 Protect subgrade materials and finished grades from damage. The Contractor is responsible to repair and retest damaged areas, as required by the Geotechnical Engineer.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 23 10 – Site Excavation, Filling and Grading.

.2 Section 31 23 13-13 – Proof Rolling.

1.2 SECTION INCLUDES

.1 Working and compacting sitework subgrade soil.

1.3 DEFINITION

.1 Prepared subgrade: soil immediately below a pavement structure or slab, compacted to a depth of 150 mm, or as specified on the Drawings, and to extend horizontally to 300mm past the back of curb or edge of asphalt.

1.4 QUALITY ASSURANCE

.1 Maximum Density: the dry unit mass of a soil sample at optimum moisture content as determined in the laboratory according to ASTM D698 Method A.

.2 Required Density: a minimum of 100.0% of the maximum density for each 150 mm lift of subgrade under pavement structures, concrete curb, concrete gutter, commercial and alley crossings and asphalt walks/bikeways and a minimum of 97.0% of the maximum density for each 150 mm lift of subgrade under concrete walks, curb ramps, slabs, private crossings and walk made of concrete pavers, brick pavers, or granular materials.

.3 Testing Frequency: the quality assurance laboratory will take a minimum of one field density test for each 1 000 m2 of compacted subgrade lift according to ASTM D1556, ASTM D2167, or ASTM D2922 for comparison with a maximum density determined according to ASTM D698 Method A or as directed by the Engineer.

.4 Proof Rolling: a proof roll of the finished subgrade will be required to confirm adequate bearing capacity of the subgrade soils. The proof roll shall be supervised by the Engineer, and must be performed in accordance with the Geotechnical Engineer's recommendations

Part 2 Products

2.1 MATERIALS

.1 Use only compacted clay subgrade soil with no deleterious material approved by the Engineer.

2.2 EQUIPMENT

.1 Equipment: various pieces of equipment designed for and capable of disking, scarifying, spreading, spraying water, compacting and trimming soil to specified depth.

Part 3 Execution

3.1 EXCAVATION

.1 Loosen soil to required depth. Work soil with cultivating and mixing equipment until soil is pulverized into pieces no larger than 25 mm maximum dimension, exclusive of stones.

.2 The required compaction can generally best be achieved if the soil is dried or moistened to within ±2% of the optimum moisture content before compacting.

.3 Undertake soil stabilization to Section 32 11 33 – Cement-Treated Base Courses, as required in the Drawings.

.4 If the Engineer and Geotechnical Engineer determine that the specified soil stabilization is insufficient following the proof roll, they may order additional soil stabilization to Section 32 11 33 – Cement-Treated Base Courses. Spread soil in lifts not exceeding 150 mm when compacted. Compact each lift to the required density in 1.4.2.

.5 Leave the surface of the compacted subgrade slightly higher than required elevation; then trim to design crown and grade. Leave finished surface even and free of depressions, humps and loose material.

3.2 FIELD QUALITY CONTROL

.1 Check finished surface of subgrade to ensure it meets the following tolerances:

.1 Grade: 6 mm maximum variation above designated elevation. 25 mm maximum variation below designated elevation.

.2 When Tolerance Exceeded

.1 Trim high spots and refinish surface to within tolerance.

.2 Add approved material to low areas, scarify and blend to full subgrade depth, recompact to required density and refinish surface at the contractor's expense. Alternatively, fill low areas with extra thickness of subsequent granular sub-base or base course at the contractor's expense.

.3 If a density test result is less than the required density, that test result is discarded and a retest shall be performed on the area represented by the failed test. If the retest is less than the required density, the area shall be reworked to the full depth of the lift, the soil moisture altered as necessary and recompacted to the required density.

.4 The Contractor shall assume the risk of uncovering and reworking the subgrade if it is covered before the Engineer has accepted test results thereof.

3.3 PROTECTION OF FINISHED WORK

.1 Do not permit vehicular traffic over the prepared subgrade.

.2 If folding of the subgrade occurs, drain immediately by natural flow or by pumping to catch basins, manholes, or ditches. This shall be done at the expense of the Contractor.

.3 Maintain protection of prepared subgrade until subsequent granular sub-base or base course is placed. Repair and retest as required by the Engineer if damaged.

.4 Install wick drain and connect to catchbasins, as per Drawings and manufacturer's specifications.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 00 10 – Geotechnical Sitework Testing.

.2 Section 31 23 10 – Site Excavation, Filling and Grading.

.3 Section 31 23 13 – Sitework Subgrade Preparation.

.4 Section 32 11 33 – Cement-Treated Base Courses.

.5 Section 32 11 23 – Aggregate Base Courses.

1.2 SECTION INCLUDES

.1 Verifying the stability and uniformity of the subgrade and aggregate base course compaction. This procedure shall be performed in the presence of the Engineer, or its designate, and the Geotechnical Engineer. Actual requirements for representation on the project site for the proof rolling operation will be site dependent.

1.3 EXECUTION

.1 Equipment

.1 The vehicle used to perform the Proof rolling shall conform to the following**:**

.1 Tandem axle, dual wheel dump truck, fully loaded water truck or grader.

.2 Tire pressure shall be no less than 90 percent of the manufacturer's recommended maximum inflation.

.3 The minimum gross weight of the loaded vehicle shall be 24,800 kg.

1.4 PROCEDURE

.1 The proof rolling vehicle shall be operated at a rate not to exceed 3.0 to 6.0 km/hr. or a comfortable walking pace. Adjust the speed to allow the Inspector/Engineer to measure any deflections and/or areas of rutting.

.2 Operate the proof roll in a pattern so that all areas are loaded with at least one pass of the proof rolling vehicle**.**

.3 After proof rolling, check the subgrade or granular base course for conformance to the plans, and correct all surface irregularities. Re-shape the subgrade or granular base course to specified tolerances.

1.5 EVALUATION

.1 There shall not be any discernable rutting during the proof roll. Visible rutting of less than 100 mm, shall be considered a failure and will require the subgrade or granular base course to be reworked and compacted.

.2 There shall not be any discernable deflection (pumping) during the proof roll. Visible deflections of less than 100 mm, shall be considered a failure, and will require the subgrade or granular base course be reworked and compacted.

.3 Rutting and/or deflections in excess of 100 mm must be reviewed by a Geotechnical Engineer, who is to provide recommendations as to how to meet density and performance requirements.

.4 When remedial work is performed under Item 1.5.3, a final proof roll must be performed upon completion of the work. If remedial work is performed as directed under 1.5.1 or 1.5.2, a second proof roll may be required at the discretion of the Engineer, or its designate.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 00 10 – Geotechnical Sitework Testing

.2 Section 31 05 16 – Aggregate Materials.

.3 Section 31 23 10 – Site Excavation, Filling and Grading.

.4 Section 33 31 00 – Sanitary and Storm Utility Piping.

.5 Section 33 05 13 – Manholes and Structures.

1.2 SECTION INCLUDES

.1 Excavating and backfilling trenches and cuts for sewer and watermains, manholes, valve chambers, catch basins, area drains, subdrains, culverts and other underground utilities and structures.

1.3 REGULATORY REQUIREMENTS

.1 The following legislation and related regulations shall be observed at all times:

.1 Alberta Occupational Health and Safety Act

.2 Local municipality bylaws

.3 Explosives Act Canada

1.4 QUALITY ASSURANCE

.1 Testing Standards: The quality assurance laboratory will take density and other tests on compacted soil to the following standards as directed by the Geotechnical Engineer: ASTM D698 Method A., ASTM D1556, ASTM D2167, ASTM D2922 and ASTM D3017.

Part 2 Products

2.1 MATERIALS

.1 Native Fill Material: Material excavated from trench or from grading and approved by the Geotechnical Engineer.

.2 Section 31 23 10 – Site Excavation, Filling and Grading: Fill material shall be free of stones larger than 200 mm, organic matter and other deleterious material.

.3 Imported Fill Material: Geotechnical Engineer approved material from off-site to supplement or replace insufficient or unacceptable material on-site. Fill material shall be free of stones larger than 50 mm, organic matter and other deleterious material.

.4 Granular Fill: to Section 31 05 16 - Aggregate Materials as specified.

.5 Pipe Bedding Material: Consult individual pipe installation sections for material specifications.

Part 3 Execution

3.1 TRENCHING

.1 Trench Excavation:

.1 Excavate trench to indicated alignment and to width and depth required to achieve indicated elevations and to accommodate required bedding. Hand trim bottom of trench where required.

.2 The Engineer or the utility Client may require that a professional engineer design the method of support to existing or proposed utilities within the trench limits. Submit any required design drawings for the Engineer's or utility Client's review before beginning trench excavation.

.3 The Engineer may limit the amount of trench to be opened or left open at any one time.

.4 Stockpile excavated material or imported fill at a safe distance from edge of trench.

.5 Dispose of surplus or otherwise non-useable excavated material offsite or as directed by the Engineer.

.2 Trench Dimensions:

.1 The depth of trench shall be as shown on the drawings.

.2 Cut back the walls of trench in strict compliance with the Occupational Health and Safety Regulations.

.3 For a vertical cut trench with sheeting, the width of trench shall be:

.1 At the pipe springline: a minimum width equal to the outside diameter of pipe plus 450 mm and a maximum width equal to the outside diameter of pipe plus 600 mm.

.2 At ground level: a maximum width of outside diameter of pipe plus 600 mm.

.4 Do not over-excavate beyond the specified limits. If the trench must be excavated deeper or wider than specified, obtain approval from the Engineer. No additional payment for over-excavation will be made unless authorized by the Engineer.

.3 Trench Shoring:

.1 Where the sides of the trench or excavation need to be sheathed, shored or braced to protect life, property, the work, structures adjacent to the work or for maintaining trench widths, the Contractor shall supply and place all material required at no additional cost. Strictly follow Occupational Health and Safety regulations or a professional geotechnical engineer's recommendations.

.2 If required, the Contractor shall engage the services of a qualified professional engineer (the design engineer) who is registered in Alberta to design and regularly inspect cofferdams, shoring, bracing and underpinning required for the work.

.3 Design and supporting data are to bear the stamp and signature of the design engineer. They shall be submitted to the Engineer at least two weeks prior to start of work. Reports of the design engineer’s inspections shall be displayed in the engineer’s site office.

.4 The design engineer responsible for the design of the temporary structures shall submit to the local municipality proof of insurance coverage for professional liability, except where the engineer is an employee of the Contractor, in which case the Contractor shall submit proof that the work by the design engineer is included in the Contractor’s insurance coverage.

.5 Construct temporary works to depths, heights and locations as required to prevent failure.

.6 During backfill operations:

.7 Unless otherwise indicated or directed by the Engineer, remove sheeting and shoring from the excavations. Do not remove bracing until backfilling has reached the level of

such bracing. Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500 mm above the toe of sheeting.

.8 When sheeting is required to remain in place, cut off tops at elevations indicated or as directed by the Engineer.

.9 Upon completion of the substructure construction, remove shoring and bracing and remove excess materials from site.

.10 Obtain any required permits from the authority having jurisdiction for the diversion of watercourses.

.11 Protect excavations and adjacent properties against cave-ins, shear failure, slides, undermining, erosion and settlement. Erect shoring, cribbing, bracing, sheet piling or planking as necessary to provide such protection. Place such work so as not to interfere with operations and independent of any footing.

.12 The contractor shall assume full responsibility for any failure, collapse or movement of shoring or bracing method, collapse of earth banks, trenches, manholes or other excavations.

.4 Trenching in Poor Ground:

.1 If the bottom of the trench is in soil which, in an undisturbed state, has adequate bearing capacity, but becomes "quick" due to soil water pressure or becomes unstable due to the construction activity in the trench, the contractor shall over-excavate to a depth specified by the Engineer, place geotextile fabric and cover with foundation granular material, all as specified by the Engineer.

.2 If the bottom of the trench is in peat or other unsuitable foundation material, apply one of the following corrective measures as appropriate:

.1 Over-excavate to suitable material and backfill with compacted gravel or washed rock to the underside of bedding if the amount of over-excavation is less than 0.5 m.

.2 Backfill with fillcrete if the amount of over-excavation is 0.5 m to 1.0 m.

.3 Do not over-excavate, but provide structural support for the pipe as specified by the engineer, if the depth to suitable foundation soil from the bottom of the pipe bedding is greater than 1.0 m.

3.2 EXCAVATION FOR UNDERGROUND STRUCTURES

.1 Excavations for structures shall conform to the Occupational Health and Safety Act.

.2 Do not over-excavate beyond the specified limits. If the excavation is larger in length or width than specified, advise the Engineer and obtain instructions.

.3 Advise the Engineer If the excavation is deeper than the specified limits. Fill the over-excavation with 30 MPa (28-day strength) concrete or proceed as directed by the Engineer.

.4 If, at the specified depth, unsuitable foundation material is encountered, advise the Engineer and obtain instructions. Over-excavation and replacement with competent backfill or a structural foundation may be required.

.5 Minimize disturbance of the native soil at foundation level. Do not use heavy equipment at the bottom of the excavation. If necessary, provide pads for the equipment. If soil that has adequate strength in an undisturbed condition is disturbed, advise the Engineer and obtain instructions.

.6 Where, at the specified depth, the soil has adequate bearing capacity in an undisturbed state, but becomes unstable due to ground water pressure, advise the Engineer. Over-excavate, place a

geotextile fabric, fill to the specified depth with competent backfill material and compact, as instructed by the Engineer.

.7 Haul all unsuitable or surplus excavated material to an approved site for disposal.

3.3 DEWATERING

.1 Keep the excavation free of water.

.2 Protect open excavations against flooding and damage due to surface runoff.

.3 Do not allow ground water to drain into water pipes.

.4 Water from the excavation shall be disposed of in accordance with the General Requirements or in a manner approved by the Engineer. Do not pump muddy water into local sewers. Obtain written approval for disposal of clean water into local sewers.

.5 Dispose of water in a manner not detrimental to public and/or private property or any portion of the work completed or under construction.

3.4 BEDDING

.1 Place and compact pipe bedding for sewers in accordance with the individual pipe installation sections.

3.5 BACKFILLING AND COMPACTION

.1 Backfill the trench with approved fill material from the top of bedding to the designated subgrade elevation or existing ground level, whichever is lower.

.2 Place backfill in uniform horizontal lifts and compact each lift according to trench and backfill types in 3.6 below.

.3 Remove any free water from a lift before placing the next lift of backfill.

.4 Backfilling Alternatives: The Engineer may consider alternative proposals from the Geotechnical Engineer to use special materials or methods that will achieve long term stability of trench backfill. Use only alternatives accepted by the Engineer.

.5 Backfilling in Cold Weather:

.1 The reference for shutdown temperatures shall be the temperature reported by Environment Canada.

.2 Do not start daily excavation, backfilling or compaction for open cut trenches under pavement when the average air temperature is expected to be -10°C or lower or when the minimum air temperature is expected to be -20°C or lower.

.3 For open cut trenches the shutdown temperature is -15°C. If an approved trench covering system is used the shutdown temperature is -25°C.

.4 Frozen ground shall be thawed by an approved ground burning method before commencing excavation. Remove all frozen materials from the trench including snow and ice.

.5 Do not backfill with frozen soil or with material containing ice, snow, straw, organic or other deleterious material.

.6 Limit the length of open trench ahead of the backfilled portion to 10 m.

3.6 TRENCH AND BACKFILL TYPES

.1 Backfill with native or imported fill material over bedding up to the designated subgrade or existing ground elevation, whichever is lower, in lifts not exceeding 200 mm when compacted.

3.7 DENSITY REQUIREMENTS

.1 Reference Density:

.1 Standard Proctor: the maximum dry density obtained from a plot of the dry densities of multiple specimens at various moisture contents, moulded and compacted in the laboratory according to ASTM D698 Method A.

.2 Required Compaction:

.1 Compact sand bedding to 95% Standard Proctor Density.
Compact each lift to 98% Standard Proctor Density.

.3 Testing Frequency:

.1 Sand bedding: A minimum of 1 density test per 100m of trench length.

.2 Trench greater than 15 m in length: A minimum of 2 density tests per 600 mm of trench depth per 100 m of trench length. The tests shall be representative of the entire length, width and depth of trench backfill, including areas around catchbasins, manholes, valves and service connections. The Engineer or a qualified geotechnical representative, may require additional testing as deemed necessary.

.3 Trench 15 m or less in length: A minimum of 3 density tests evenly spaced through the depth and length of the trench or as directed by the Engineer.

.4 Non-compliance: If a density test result is less than the required density, that test result is discarded and a retest shall be performed on the area represented by the failed test. If the retest is less than the required density, the area shall be reworked to the full depth of the lift, the soil moisture altered as necessary and recompacted to the required density.

3.8 RESTORATION AND CLEANUP

.1 Restore or replace all pavement structures, sidewalk and curb and gutter damaged or removed during trenching and backfilling, unless directed otherwise by the Engineer.

.2 Restore or replace in an approved manner all fences, poles, shrubs, grass and other structures damaged or removed during trenching and backfilling, unless directed otherwise by the Engineer.

.3 Remove and dispose of all debris, surplus fill and unused material excavated from the trench.

.4 Leave work site clean and as nearly as possible in original condition.

END OF SECTION

Part 1 General

1.1 GENERAL INSTRUCTIONS

.1 Read and conform to Division 1 requirements and documents referred to therein.

1.2 SUMMARY

.1 Section included: Provide general requirements including but not limited to the following:

- .1 Implement ESC measures shown on Project drawings and described in these Specifications.
- .2 Install ESC Products in accordance with manufacturer's instructions and prescribed installation procedures in referenced document: Washington State Department of Ecology's Stormwater Management Manual for Western Washington, Volume II, Construction Stormwater Pollution Prevention (2005 edition).
- .3 Inspect ESC measures on a weekly basis and following significant storm events. If deficiencies are found, make repairs within 24 hours of detection.
- .4 Maintain an ESC inspection photograph log to document observations, deficiencies, and corrective actions.

1.3 REFERENCES

.1 Abbreviations and Acronyms:

- .1 ESC: Erosion and Sedimentation Controls
- .2 BMP's: Best Management Practices

.2 Reference Standards

- .1 Washington State Department of Ecology's Stormwater Management Manual for Wester Washington, Volume II, Construction Stormwater Pollution Prevention (2005 edition).

1.4 OBJECTIVES

.1 Prevent loss of soil from construction site resulting from storm water runoff, wind erosion and construction activities.

.2 Prevent sedimentation of storm sewers and receiving waters.

.3 Prevent air pollution caused by dust and particulate matter.

1.5 SUBMITTALS

.1 Submit Erosion and Sedimentation Control Implementation Plan, specific to the project site. The erosion and sedimentation control plan must describe how the project team will do the following:

- .1 Preserve vegetation and mark clearing limits.
- .2 Establish and delineate construction access
- .3 Control flow rates.
- .4 Install sediment controls.
- .5 Stabilize soils.
- .6 Protect slopes.
- .7 Protect drain inlets.

.8 Stabilize channels and outlets.

.9 Control pollutants.

.10 Control dewatering

.11 Maintain the BMP's

.12 Manage the erosion and sedimentation control plan.

.2 Submit ESC inspection reports (or similar document) of inspections to the consultant monthly. Inspection reports shall include:

.1 Sample Dates

.2 Inspection Frequency

.3 Descriptions of any corrective action

.3 Submit digital photographs of implemented ESC measures (and any corrective actions) to the consultant monthly. Photos shall include date / time stamp.

PART 2 Products – not used

PART 3 Execution

3.1 INSTALLATION

.1 Installed measures shall be as per the approved Erosion and Sedimentation Control Implementation Plan submittal. At a minimum measures shall include (edit to require the contractor prepare an ESC plan).

.1 Stabilize Construction Entrance: Before construction begins construct a Stabilized Construction Entrance at every point where traffic leaves site and enters onto a public road and / or any unpaved entrance / exit location where there is a risk of transporting mud or sediment onto paved roads.

.2 Material Stockpiling: Apply temporary seeding, tarps, compaction, or surface roughening to stabilize stockpiled materials that will not be used within 2 days.

.3 Dust Control: Apply, spray-on adhesives, calcium chloride, sprinkling, stone, or barriers on open dry areas of soil as required to minimize dust.

.4 Silt Fence: Construct posts with a filter fabric media to remove sediment from storm water volumes flowing through fence.

3.2 INSPECTIONS AND MAINTENANCE

.1 Inspection procedures specified below shall be followed in conjunction with details, Drawings, and manufacturer requirements.

.2 Inspect ESC control measures at least once each week (unless otherwise noted) and following any significant storm event (13 mm (1/2") of precipitation or greater). Complete an inspection report (or similar document) and take photographs during these inspections and at fixed waypoints (as directed by the consultant) in order to document compliance.

.3 Maintain ESC control measures in good working order; correct any deficiencies noted in installed control measures immediately and document corrective actions in inspection reports. Ensure photographs are taken pre and post remediation to document corrections made to deficiencies.

.4 Review ESC control measures with the consultant during each site visit.

.5 Stabilized Construction Entrance: Apply additional gravel as required, remove sediments and other materials from areas to minimize clogging. Keep adjacent public roadway(s) free of sediment.

.6 Silt Fence: Inspect silt fence for depth of sediment, tears and loose fabric. Remove built-up sediment from silt fence when it has reached 1/3 height of fence. Repair fence to its original installation condition.

.7 Inlet Protection: Inspect to ensure measures are in original installed condition. Ensure measures are effectively trapping sediment. Remove accumulated sediment and debris when it reaches 1/2 design depth of trap. Repair protection measures as required.

3.3 REMOVAL OF PROTECTION MEASURES

.1 Do not remove ESC measures and ensure they are fully inspected and maintained until final landscaping is complete.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This specification is for the supply, delivery, and installation of heavy rock riprap. This work shall include all necessary trimming, excavation, and fill required to satisfactorily place the rock riprap, such as:

.1 Excavation, trimming and shaping headslope.

.2 Excavation at headslope toe, and for rock apron.

.3 Excavation for rock in stream bank transition zone.

.4 Supply and placing of geotextile filter fabric.

.5 Supply and placing of gravel or granular bedding material.

.6 Backfill over rock in stream bank transition zone to restore lines of natural bank.

1.2 STORAGE AND PROTECTION

.1 Place riprap into stockpile in horizontal lifts of 750 mm maximum thickness. Avoid segregation of particle sizes. Do not dump riprap over the edges or down the faces of the stockpile. On completion, peak the stockpile at a minimum 3% grade.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Riprap shall conform to the requirements in the table below:

CLASS					
		1M	**1**	**2**	**3**
Nominal Mass (kg) **Nominal Diameter (mm)**		**7** **175**	**40** **300**	**200** **500**	**700** **800**
None greater than:	kg or mm	40 300	130 450	700 800	1800 1100
20% to 50%	kg or mm	10 200	70 350	300 600	1100 900
50% to 80%	kg or mm	7 175	40 300	200 500	700 800
100% greater than:	kg or mm	3 125	10 200	40 300	200 500

.1 Percentages quoted are by mass.

.2 Sizes quoted are equivalent spherical diameters, and are for guidance only.

.2 Rip Rap shall meet the following minimum requirements for specific gravity, absorption and durability:

Method of test	**Requirements**
California Department of Transportation Method of Test for Specific Gravity	Minimum Specific Gravity = 2.60
Absorption of Coarse Aggregate (California Test 206)	Maximum Absorption = 2.0 percent
California Department of Transportation	Minimum Durability Index = 52
Method of Test for Durability Index	Durability Index may be less than 52 if DAR* > 23 (California Test 229)

* Durability Absorption Ratio (DAR) = Durability Index / (Absorption % + 1%)

.3 Non-woven geotextile filter fabric shall meet the specifications and physical properties as listed in the table below.

Non-Woven Geotextile Filter Fabric		
Specifications and Physical Properties		
	Class 1M, 1 and 2	Class 3
Grab Strength	650 N	875 N
Elongation (Failure)	50%	50%
Puncture Strength	275N	550 N
Burst Strength	2.1 MPa	2.7 MPa
Trapezoidal Tear	250 N	350 N
Minimum Fabric Lap to be 300 mm		

Part 3 EXECUTION

3.1 EXAMINATION

.1 The rock supplied shall be hard, durable and angular in shape, resistant to weathering and water action, free from overburden, spoil, shale or shale seams and organic material, and shall meet the gradation requirements for the class specified. In general, no sandstone will be permitted for all classes, however if the proposed material meets or exceeds the minimum requirements, consideration may be given to accepting the material. For these occurrences, further testing shall be done to ensure acceptability. This would include testing of the material in accordance with CSA A23.2-15A “Petrographic Examination of Aggregates”. The minimum dimension of any single rock shall be not less than one third of its maximum dimension. The minimum acceptable unit weight of the rock is 2.5 t/m3.

.2 The Contractor shall provide the Consultant with evidence of the acceptability of the riprap material. Reliable performance records of proposed material, other than fieldstone, will be considered evidence of acceptability. Fieldstone shall be considered to have a reliable performance record, and will be accepted if it meets the gradation requirements.

.3 Sampling and testing are required for Class 2 and Class 3 rock riprap for which no performance records are available. Sampling and testing are not required for Class 1 rock riprap and field stone. Tests are based on the Durability Index and Durability Absorption Ratio as developed by the State of California, Department of Transportation. The Contractor shall submit samples of the proposed material to an independent certified testing laboratory of his choice and provide written reports of the test results to the Consultant. The reports shall be stamped by a Professional Engineer. The Contractor shall be responsible for all associated costs for rock riprap sample testing including, but not limited to, transporting samples to an independent certified testing laboratory, testing, disposing of samples after testing, and providing written reports to the Consultant.

.4 A representative sample of 70 kg minimum is required for each type and source of rock to be tested, and shall contain a number of pieces ranging up to 25 kg mass.

.5 The acceptance of rock samples from a particular source or quarry site shall not necessarily be construed as constituting acceptance of all material from that location.

.6 Control of gradation will be by visual inspection. The Contractor shall provide a sample of rock, of the minimum sample size specified below. The sample shall be proven to acceptably conform to the required gradation by direct weighing of all the individual pieces with suitable scales; the mass of each piece in the sample shall be painted on the piece. The sample, located as required by the Consultant at the construction site and at the source or quarry site, may be incorporated in the finished riprap when they are no longer required for reference purposes. The sample shall be used for frequent reference in judging the gradation of the riprap being loaded at the source and placed at the site.

.7 The minimum sample size in area shall be as follows:

Class	**Minimum Sample Size**
1M	1 m x 1 m
1	2 m x 2 m
2	3 m x 3 m
3	4 m x 4 m

.8 If, during the delivery of the material to the site, a particular load is found to be made up of pieces predominantly one size, or to be lacking in pieces of one size, it shall be dumped in a suitable location outside the area to be protected. Additional material as required to make up the deficient sizes shall be added to this load such that the combination can then be placed to ensure uniformity.

3.2 GEOTEXTILE

.1 Where geotextile filter fabric is specified, the slope shall be graded to provide a smooth, uniform surface. All stumps, large rock, brush or other debris that could damage the fabric shall be removed. All holes and depressions shall be filled so that the fabric does not bridge them. Loose or unstable soils shall be replaced.

.2 The fabric shall be laid parallel to the slope direction. It shall be placed in a loose fashion, however folds And wrinkles shall be avoided. Adjacent strips of fabric shall be overlapped a minimum of 300 mm, except where placed underwater, the minimum lap width shall be 1 m. Overlaps shall be pinned using 6 mm diameter steel pins fitted with washers and spaced at 1 m intervals along the overlaps.

.3 The top edge of the filter fabric shall be anchored by digging a 300 mm deep trench, inserting the top edge of the fabric and backfilling with compacted soil.

.4 Care shall be taken to prevent puncturing or tearing the geotextile. Any damage shall be repaired by use of patches that extend at least 1 m beyond the perimeter of the tear or puncture.

.5 The fabric shall be covered by rock riprap within sufficient time so that ultraviolet damage does not occur; in no case shall this time exceed 7 days for ultraviolet material and 14 days for ultraviolet protected and low ultraviolet susceptible polymer geotextiles.

3.3 RIPRAP

.1 Riprap placement shall commence at the base of the blanket area and proceed up the slope. The height of drop of riprap shall be limited to 1.0 m or less, and the riprap shall not be allowed to roll down the slope. Heavy equipment will not be permitted to operate directly on the geotextile.

.2 The rock shall be handled, dumped or placed into position to conform to the specified gradation and to the cross section shown on the drawings. The finished surface shall be reasonably uniform, free from bumps or depressions, and with no excessively large cavities below or individual stones projecting above the general surface.

END OF SECTION

1. GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 – Cast-In-Place Concrete

.2 The Contract Documents apply to and govern the Work of this section.

1.2 REFERENCES

.1 ASTM A252-98 (2007) - Welded and Seamless Steel Pipe Piles.

.2 ASTM C94/C94M-09 - Ready-Mixed Concrete.

.3 ASTM D1143/D1143M-07e1 - Test Methods for Deep Foundations Under Static Axial Compressive Load.

.4 CAN/CSA A3000-08 - Cementitious Materials Compendium.

.5 CAN/CSA A23.1-04/A23.2-04 - Concrete Materials and Methods of Concrete Construction / Methods of Test for Concrete.

.6 CSA A283-06 - Qualification Code for Concrete Testing Laboratories.

.7 CSA G30.18-92 (R2007) - Billet-Steel Bars for Concrete Reinforcement.

.8 Workers' Compensation Board.

1.3 SUBMITTALS

.1 Provide the following:.

.2 Shop Drawings:

.1 Submit a minimum of 10 working days in advance of start of pile operations on site.

.2 Review of Shop Drawings is intended as an assistance to the Contractor and does not relieve him of his responsibility for the accuracy and completeness of his work.

.3 Drawings shall include the following information:

.1 Pile layout.

.2 Size of shaft and bell.

.3 Type of pile.

.4 Grade and details of reinforcing steel.

.5 Type of cement and concrete strength.

.6 Elevation of pile bases.

.7 Elevation of top of pile caps.

.3 Unit Rates:

.1 Provide a separate price for casing of all piles for full length.

.2 Provide unit rate price for casing of all different pile diameters.

1.4 QUALITY ASSURANCE

.1 Install pilings under direct supervision of Geotechnical Engineer retained and paid by the Contractor. Contractor to coordinate all inspections with the geotechnical engineer.

.2 Extend pile reinforcement for full length of pile.

.3 Casting: In accordance with Workers' Compensation Board Regulations Quality Assurance article in Section 03 30 00 - Cast-In-Place Concrete will apply to piles.

2. PRODUCTS

.1 Not used.

3. EXECUTION

3.1 INSTALLATION

.1 Perform concrete work in accordance with requirements of CSA A23.1, unless indicated otherwise herein.

3.2 FIELD QUALITY CONTROL

.1 Placement and coordination of reinforcing steel and concrete to be by a full-time qualified superintendent representing the Contractor, and required to be in attendance during all phases of the Work.

.2 Testing of concrete will be carried out by an independent testing firm certified in accordance with CSA A283 retained and paid by the Contractor.

.3 Full-time pile inspection of shaft and bases will be carried out by a Geotechnical Engineer retained and paid by the General Contractor.

.4 Notify Engineer seven (7) working days in advance of starting work on site.

.5 Concrete Testing:

.1 Test concrete in accordance with CSA A23.2.

.2 Provide free access to all portions of work and co-operate with appointed firm.

.3 Conform in all respects to the requirements noted in Section 03 30 00 of this specification.

.6 Inspection:

.1 Installation of piles to be under the supervision of the Geotechnical Engineers.

.2 Provide access for inspection to all places where work is being done.

.3 Submit copies of all inspection reports. Report shall be signed and sealed by a Professional Engineer registered in the Province of Alberta.

.4 Contractor to Pay for all costs for re-inspection as a result of defective workmanship.

.5 Contractor to Pay for all costs of repairs to correct defective work.

3.3 FIELD RECORDS/DRAWINGS

.1 Maintain accurate records of all piles installed. Records are to include the following:

.1 Locations of the piles.

.2 Sequence of placing.

.3 Final base and head elevations.

.4 Drilled shaft diameters.

.5 Date and time of placing concrete.

.6 Inspector's name and condition of base material.

.2 Submit three (3) copies of all field records and drawings to the Engineer.

3.4 SOILS REPORT

.1 Refer to Soils Report, which is associated with this specification.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 32 10 00 – Sitework Concrete Forms and Accessories.

.2 Section 32 20 00 – Sitework Reinforcing Steel.

.3 Section 33 05 16.13 – Concrete for Utility Structures

1.2 SECTION INCLUDES

.1 This section applies only to sitework concrete, including curbs and gutters, sidewalks, curb ramps, driveways and patios, but excludes external structural stoops and structural slabs.

.2 Production of Portland cement concrete.

.3 Requirements for concrete mix design, quality control, quality assurance and placement.

1.3 QUALITY ASSURANCE

.1 Approval of a mix design, or inspection and testing by the Engineer shall not relieve the Contractor of responsibility for the quality of concrete used in the Work.

.2 The Geotechnical Engineer will perform concrete quality assurance sampling and testing for slump, air content, air voids and compressive strength.

.3 Quality assurance testing shall be performed by a technician certified by CSA or ACI.

.4 Slump Tests:

.1 Methods: to CAN/CSA-A23.2-1C and CAN/CSA-A23.2-5C.

.2 Test Frequency: Slump tests will be taken between the 10% and 90% points of discharge of a concrete load with every strength test and as required by the Engineer.

.5 Air Content Tests:

.1 Methods: to CAN/CSA-A23.2-1C and CAN/CSA-A23.2-4C or CANCSA-A23.2-6C.

.2 Test Frequency: Air content tests will be taken between the 10% and 90% points of discharge of a concrete load with every strength test and as required by the Engineer.

.6 Air-Void Examination:

.1 Method: to ASTM C457, modified point-count traverse method at 100X magnification.

.2 Sample: a 100 mm diameter core drilled from hardened concrete.

.3 Cross-Section Preparation: The top of the core shall be ground to 2 mm ±0.5 mm below and parallel to the finished concrete surface to produce a surface suitable for microscopic examination.

.4 Maximum Allowable Spacing Factor: If the spacing factor obtained by a full traverse of the cross-section of the single core is greater than 0.23 mm, the concrete represented by the core shall be removed and replaced.

.7 Strength Tests:

.1 Methods: Compressive strength test specimens shall be cast and cured in accordance with CAN/CSA A23.2-3C. Initial curing Temperatures must be reported. Test specimens cast from concrete mixes with slump levels equal to or less than 40mm shall be consolidated by rodding. The testing agency shall ensure complete densification of the test cylinders

and will confirm that corresponding unit weights are characteristic of the mix design unit weights. Test cylinders exhibiting a lack of consolidation will be weighed and the unit weight and accompanying remarks recorded on the concrete test report. Compressive strength determination shall be in accordance with CAN/CSA A23.2-9C.

.2 Test Frequency: Standard tests for strength will be conducted at a frequency of not less than one strength test for each 60m3 of concrete or fraction thereof, for each class of concrete produced in any one day.

.3 Definition of a Strength Test: to CAN/CSA A23.1 clauses 4.4.6.4.1 and 4.4.6.4.2.

.4 For standard strength tests, either 150mm x 300mm cylinders or 125mm x 250mm cylinders may be used.

.5 Required Strength: The result of each compressive strength test shall equal or exceed the specified minimum compressive strength.

Part 2 Products

2.1 MATERIALS

.1 Portland Cement**:** to CAN/CSA-A3000, A3001-03 of the following types.

.1 Type GU – General use hydraulic cement

.2 Type HE - High early-strength hydraulic cement

.3 Type HS – High sulphate-resistant hydraulic cement

.2 Aggregate: to clause 4.2.3, CAN/CSA-A23.1, testing shall include but not be limited to: unconfined Freeze-thaw in course aggregate, MgSO4 soundness loss, petrographic examination, alkali-aggregate reactivity, and ironstone content, and as supplemented below:

.1 Petrographic Analysis: To be performed by a qualified laboratory to CAN/CSA-A23.2-15A.

.2 Ironstone Content: To be performed by an approved facility to the Method for Ironstone Content Determination in Fine and Coarse Concrete Aggregates. Do not use aggregate until the corresponding results have been reviewed by the Engineer. Ironstone content in coarse aggregate shall not exceed 1.0% by mass of the total coarse sample (retained on the 5 mm sieve and larger), and in fine aggregate shall not exceed 1.5% by mass of the total dry, unwashed fine aggregate sample (passing the 5 mm sieve to that retained on the 2.5 mm sieve). Any concrete supplied with aggregate exceeding the specified ironstone content will be rejected, and shall be removed by the Contractor as directed by the Engineer.

.3 Water: to clause 4.2.2, CAN/CSA-A23.1, clear, free from injurious amounts of oil, acid, alkali, organic matter, sediment, or other substance harmful to the mixing and curing of concrete.

.4 Air-Entraining Admixture: to ASTM C260.

.5 Chemical Admixtures: to ASTM C494, including water-reducing agents, retarders and accelerators. Chemical admixtures shall not be used unless permitted in writing by the Engineer.

.6 Fly Ash: to CAN/CSA-A3000, A3001-03 pozzolan type F or Cl. For Class A,B, and C concrete no replacement of the specified minimum cement content with fly ash from the commencement of the construction season to May 15 and after September 30 unless permitted by the Engineer.

.7

.8 Sulfate Resistant Concrete: Concrete using Type HS (High sulfate-resistant hydraulic cement) cement shall not be placed after September 30, for Class A, B, and C concrete.

.9 Curing compound: to ASTM C309, type 2, class B, white pigmented, resin based, liquid membrane-forming compound.

.10 Preformed Joint Filler: to ASTM D1751.

.11 Joint Sealant: to ASTM D1190, Sika 2c or approved equivalent.

.12 Forms: To Section 03 10 00 Concrete Forms and Accessories.

.13 Reinforcement: To Section 03 21 00 Reinforcing Steel.

2.2 MIX DESIGN

.1 Mix design criteria for each class of concrete:

.1 Spring and Fall Mixes

Class	Minimum 28 Day Compressive Strength (MPa)	Slump (mm)	Entrained Air Limits (% by volume)	Maximum Aggregate Size (mm)	Maximum Water to Cementing Materials Ratio (by mass)	Minimum Portland Cement Content (kg/m3)	Cement Type
A	30	60 ± 20	5.0 - 8.0	20	0.45	335	GU*
B	30	60 ± 20	5.0 - 8.0	20	0.45	335	GU*
C	30	60 ± 20	> 5.0	20	0.45	335	GU*
D	30	100 ± 30	5.0 - 8.0	20	0.45	335	HS*
E	30	80 ± 20	5.0 - 8.0	20	0.45	300	HS*

.2 Summer Mixes

Class	Minimum 28 Day Compressive Strength (MPa)	Slump (mm)	Entrained Air Limits (% by volume)	Maximum Aggregate Size (mm)	Maximum Water to Cementing Materials Ratio (by mass)	Minimum Portland Cement Content (kg/m3)	Cement Type
A	30	60 ± 20	5.0 - 8.0	20	0.45	302	GU*
B	30	60 ± 20	5.0 - 8.0	20	0.45	302	GU*
C	30	60 ± 20	> 5.0	20	0.45	302	GU*
D	30	80 ± 20	5.0 - 8.0	20	0.45	335	HS*
E	30	80 ± 20	5.0 - 8.0	20	0.45	300	HS*

* Note: GUb and HSb cements can be used only upon approval of the Engineer

.3 Class C concrete: shall attain the minimum compressive strength corresponding to the percentage of entrained air in the plastic concrete as follows.

Air Content (%)	Minimum 28 Day Compressive Strength (MPa)
5.0 to 5.9	32.0
6.0 to 8.0	44 - (2 * Air Content)
greater than 8.0	28.0

.4 High Early Strength Concrete: For special situations or conditions the Engineer may require that the specified 28 day compressive strength be met in 7 days.

.5 If any class of concrete is to be placed by pumping, the specified slump and air content shall be met at the point of pump discharge. Samples for testing will be obtained at the point of pump discharge.

.6 For class C extruded parapet retaining walls and New Jersey Barriers the mix shall contain 0.6kg of synthetic micro fibres or approved equivalent per m3 of concrete.

.7 For class E concrete the following mix conditions shall apply: A minimum ratio of supplementary cementitious materials to total mass of cementitious materials of 0.15, and A minimum sand content of 45% by total weight of aggregate.

.2 Application of concrete classes:

.1 Class A: One course exposed pavements, commercial and residential alley crossings.

.2 Class B: Unexposed pavement base.

.3 Class C: All exposed road associated works including curb and gutter, sidewalks, walkways, crossings, swales, medians, New Jersey barriers and parapet walls.

.4 Class D: Structural pile foundations.

.5 Class E: Exposed retaining walls.

.3 Seasonal concrete mix requirements:

.1 Spring Mixes

.1 From the commencement of the construction season to May 15, or as directed by the Engineer: no replacement of the minimum cement content with fly ash (Clause 2.1.6) is permitted.

.2 Summer Mixes

.1 From May 16 to September 30: no more than 10% of the specified minimum cement content may be replaced with fly ash.

.3 Fall Mixes

.1 From October 1 to October 15: no replacement of the minimum cement content with fly ash is permitted (clause 2.1.4) and type HS cement may not be used (clause 2.1.5).

.4 Cold Weather Mixes

.1 From October 16 to the end of the construction season, or as defined by the Engineer: meet the requirements for cold weather concrete in clause 2.2.4.

.4 Cold weather concrete: All classes of concrete placed after October 15 shall attain a minimum compressive strength of 27.0 MPa in 7 days and shall be provided with cold-weather protection to clause 7.4.2.5.3, CAN/CSA A23.1. High early strength concrete (as defined in clause 2.2.1.2) shall attain a minimum compressive strength of 32.0 MPa in 7 days and shall be provided with

cold weather protection to clause 7.4.2.5.3, CAN/CSA A23.1 (type 2 curing). This cold weather protection must be adequate to maintain concrete surface temperatures at a minimum of 10º C for a period of 7 days following placement.

.5 For slipformed (machine placed) concrete, limit slump as follows:

.1 20 ± 10 mm for curb, curb and gutter and New Jersey barrier, and 30 ± 10 mm for walk, monolithic walk and pavement.

.6 Type HE or Type HS cement may be substituted for Type GU cement, except as limited in clause 2.1.5.

.7 Class A, C and E concrete may be subjected to air-void examination.

.8 Concrete mix designs shall be prepared by a CSA approved laboratory, or by a concrete supplier with the capability and a facility approved by the Engineer.

.9 If requested, the supplier shall provide evidence that proportions in the mix design will produce concrete of the quality specified. Include strength tests on trial mixes made under plant conditions.

.10 Concrete production may not proceed until the Engineer has approved the applicable mix design.

Part 3 Execution

3.1 INSPECTION OF FORMWORK AND REINFORCEMENT

.1 Carefully inspect the installed work of all other trades prior to all of the Work of this section, and verify that all such work is complete to the point where this Work may properly commence.

.2 Provide 48 hours notice and obtain the Engineer's approval before placing concrete.

.3 Ensure that reinforcement, formwork, inserts or accessories are securely fastened and will not be disturbed during concrete placement.

.4 Verify that all items to be embedded in concrete are in place.

.5 Verify that concrete may be placed to the lines and elevations indicated on the Drawings with all required clearance for reinforcement. In the event of any discrepancy, immediately notify the Engineer. Do not proceed with installation until all such discrepancies have been fully resolved.

3.2 DELIVERY OF CONCRETE

.1 Deliver concrete to the job site to clause 5.2.4, CAN/CSA-A23.1, as supplemented or modified below.

.2 Rotating Drum Trucks: Transport concrete using only equipment with mixing or agitating capability.

.3 Rotate the drum on the job site at mixing speed for 3 minutes immediately before discharge.

.4 The minimum load size to be delivered to site is 3 cubic meters.

.5 Retempering with Water: Do not add water after the initial introduction of mixing water at the plant except as follows:

.1 When the slump at the point of initial discharge is less than specified

.2 Introduce additional water into the drum mixer in an amount not exceeding 12 litres/m^3, to bring the slump to within specified limits.

.3 Rotate the drum a minimum of 30 revolutions at mixing speed until the required uniformity of concrete is attained.

.4 Do not subsequently add any further water to the load.

.5 If a load of concrete is retempered with water and the resulting slump exceeds the specified maximum slump, that load of concrete will be rejected.

.6 If the need for retempering with water becomes persistent or continuous, the Engineer or his representative may refuse to accept concrete loads that have been retempered with water.

.6 Slow rotation of the drum for extended periods of time for the purpose of slump reduction in loads of concrete delivered with a slump exceeding the specified maximum slump will only be permitted for concrete placed by extrusion.

.7 Retempering with Air-Entraining Admixtures is only permitted under the following conditions

.1 Retempering on site with an approved air-entraining admixture shall only be performed by a quality control technician working for the concrete supplier or the Contractor. Dry, powdered, bagged or premeasured liquid air-entraining admixtures may be added by the concrete truck operator under the direction of the supplier's quality control technician. For retempering purposes the concrete supplier shall use a comparable air-entraining admixture to what was originally approved for use in the mix design. Rotate the drum for 3 to 5 minutes or until the mix is uniform, after the addition of the air entraining admixture.

.2 The Geotechnical Engineer technician shall perform an air content test on each load of concrete retempered with air-entraining admixtures and shall immediately provide the test results to the Engineer.

.3 Guidelines for retempering with air-entraining admixtures

Measured Air Content (%)	Action
4.0 – 4.9	Air-entraining admixtures or air-entraining admixtures and water must be added as deemed necessary by the supplier to meet specifications
< 3.9	No re-tempering with air-entraining admixtures or water is permitted; load will be rejected

.4 When retempering with air-entraining admixtures, the supplier will be given one opportunity to meet the specified air content.

.5 If the need for retempering with air-entraining admixtures becomes persistent or continuous, the Engineer or his representative may refuse to accept concrete loads that have been retempered with air-entraining admixtures.

.6 The use of de-airentraining admixtures is not permitted.

.7 A load of concrete will be rejected if it is retempered with air-entraining admixtures and the resulting air content exceeds the specified maximum air content.

.8 A load of concrete that is rejected at the jobsite may not be retempered at the concrete plant with cement, aggregate, sand or admixtures and subsequently returned to the jobsite.

.9 On site mix adjustments with cementitious materials, sand aggregate or any chemical admixtures other than air-entraining admixtures and superplasticizers will not be permitted.

.8 When the ambient air temperature in the shade is 23º C or higher, concrete at time of placement shall not have a temperature exceeding 30º C.

.9 When the ambient air temperature is lower than 5º C, the concrete delivered to the site shall have a temperature between 15º C and 30º C.

.10 Discharge Time: Complete the discharge of concrete within 90 minutes of the initial introduction of mixing water to the cement and aggregate at the plant. The discharge time may be extended to 120 minutes by incorporating hydration control admixtures. The supplier must submit mix designs for approval and provide evidence that the plastic concrete properties (slump, air content and temperature) can be maintained through the extended discharge time period.

.11 Delivery Record: Provide the Engineer with a delivery ticket showing the batch plant location, the supplier's name, ticket and truck numbers, mechanically punched date and time of initial plant mixing, class and mix design designation, cement type and aggregate sizes, type and amount of admixtures, water added, volume of concrete, site arrival time, start and end of discharge time and other information requested by the Engineer.

3.3 PLACING CONCRETE

.1 Handle, deposit and consolidate fresh concrete to CAN/CSA-A23.1 and as supplemented below.

.2 Moisten the surface of the subgrade or subbase before placing concrete to minimize absorption of water from the deposited concrete. Do not create mud, nor let water pond.

.3 Ensure that reinforcement and formwork are thoroughly clean and wetted before placing concrete.

.4 Do not place concrete during rain or when there is imminent danger of rain or if the weather, in the opinion of the Engineer, is not suitable**.**

.5 Place hot and cold weather concrete to CAN/CSA-A23.1. Ensure that the procedures used are approved by the Engineer.

.6 Pour concrete continuously and as rapidly as possible between predetermined construction joints to the approval of the Engineer.

.7 Locate construction joints to Section 03 10 00 – Sitework Concrete Forms and Accessories.

.8 Consolidate concrete in accordance with CAN/CSA-A23.1.

.9 Concrete cover over reinforcing steel shall be to CAN/CSA-A23.1.

3.4 FINISHING

.1 Perform the initial and final finishing of the plastic concrete surfaces to CAN/CSA-A23.1, as described on the Engineering and Landscape drawings and as supplemented below.

.2 Do not apply water to the concrete surface to facilitate finishing under any circumstances. To retain surface moisture and facilitate concrete finishing, the contractor may elect to fog the surface with Master Builders Confilm or an approved equivalent.

.3 Protect the Work from rain to avoid excessive moisture on the unfinished surface and to prevent pitting to the finished surface if still plastic.

.4 Concrete finishing shall be performed by or under the direction of certified Journeyman concrete finishers.

.5 Brush or Broom Finish: Use a brush or a broom with nylon bristles that can form surface grooves no deeper than 3 mm. Remove excess water from the bristles before brushing. Brush in the designated direction.

.6 Burlap Finish: Drag multiple ply burlap equal in length to the width of the slab and having at least a 1 m strip in contact with the plastic concrete surface. Drag carefully in the direction of concrete placement to produce a finished surface simulating a sandy texture with no disfiguring marks.

3.5 JOINTS

.1 Construct joints as required in each type of construction to the following standards as applicable. The Architectural, Civil and Landscape drawings shall be referenced for the type, size and frequency of joints.

.2 Crack-Control Joints: intended to control the location of shrinkage cracks in hardening concrete. Construct joints to the indicated dimensions, spacing, and pattern by any of the following methods:

.1 Formed Joint: Form the groove by inserting a metal or fibre strip, or polyethylene film into the plastic concrete. Finish the edges to a 6 mm radius. Remove the insert immediately after the initial set of the concrete. Seal the joint with a specified sealant.

.2 Tooled Joint: Hand form the groove using a jointing tool with a thin metal blade to impress a plane of weakness into the plastic concrete. Finish the edges to a 6 mm radius. Seal the joint with a specified sealant.

.3 Sawed Joint: Cut the groove with a concrete saw as soon as the concrete surface has hardened sufficiently to resist raveling as the cut is made, but before shrinkage cracks form in the concrete. The Contractor is responsible for the proper timing of the saw cut. Immediately flush the saw cut clean with water. Once the joint surfaces are dry, seal the joint with a specified sealant.

.3 Isolation Joint: required where concrete is placed adjacent to an immovable structure or where indicated on the Drawings. Construct the joint by sawing or forming to create a clean break through the full cross-section of the concrete member. Make the joint wide enough to permit a snug fit for the pre-formed joint filler. Alternatively, place the pre-formed joint filler against the structure and pour the concrete against the pre-formed joint filler.

.4 Construction Joint: required between concrete pours or for joining new concrete to existing work. Construct the joint with a keyway, dowels or tie bars as detailed on the drawings or as directed by the Engineer. Finish edges to a 6 mm radius. Vertically trim the existing concrete by sawing at least 50 mm deep and breaking. Leave the joint form in place until the concrete has set, then remove the joint form without damaging the concrete.

3.6 PROTECTION AND CURING

.1 Protect freshly placed concrete from freezing, premature drying, temperature extremes, adverse weather conditions, and physical disturbance to clause 7.4, CAN/CSA-A23.1, and as supplemented below.

.2 Cold Weather Protection: Concrete shall be protected from freezing for a minimum of 4 days after placement or for the time necessary to achieve 75% of the specified 28-day compressive strength.

.3 Membrane Curing: Cure exposed concrete surfaces using a specified curing compound applied with a pressurized spray nozzle. Curing compound shall be applied immediately after final finishing and cover the entire exposed surface with an unbroken and uniform film at a rate depending on surface roughness but not less than 1 litre per 4 m2 of surface. Membrane curing will not be required when the maximum daily air temperature for the 72 hours following placement of the concrete is not expected to be greater than 5º C.

.4 Moist Curing: Use where specified or directed by the Engineer. After the concrete has set, maintain exposed surfaces continuously moist using wet burlap or polyethylene film in contact with the concrete for a minimum of 7 consecutive days after placement when Type GU or Type HS cement is used, or a minimum of 3 consecutive days when Type HE cement is used.

3.7 FIELD QUALITY ASSURANCE

.1 The contractor and the concrete supplier shall assist the field technician in obtaining samples for quality assurance testing**.**

.2 The contractor shall suspend pouring operations after sampling until the results of the field quality tests are known.

.3 Inadequate Protection and Curing:

.1 For concrete where the surface temperature is measured to be below 0º C the concrete may be accepted subject to inspection by the Engineer.

.4 Deficient Slump:

.1 For any load of concrete, if the measured slump is outside the specified limits, a check test is taken on another portion of the load, or a retest is done if retempering with water is permitted by the Engineer. If the second test fails, the Engineer may reject that load of concrete including removal of the portion already poured.

.5 Deficient Air Content:

.1 For any load of concrete, if the tested air content is outside the specified limits, the Engineer will require one of the following:

.2 Air content below 5.0%: Concrete poured from the load shall be removed and the rest of the load shall be discarded.

.3 Air content above 8.0%: Except for class C concrete, concrete poured from the load shall be removed and the rest of the load discarded. For class C concrete where high early strength is not specified, the concrete will be accepted if the specified 28 day strength is met.

.4 If the measured air content is below the specified minimum air content, then the contractor may elect to retemper with air entraining admixtures to Clause 3.2.6.

.5 When Air Void Examination Is Required The quality assurance laboratory will drill cores from the hardened concrete for air void examination to Clause 1.3.6, at a frequency of at least one core for each 2 000 m of local and collector sidewalk, curb and gutter or monolithic walk, curb and gutter, or as requested by the Engineer.

.6 Where concrete has been rejected and is to be removed for not meeting the spacing factor requirement in Clause 1.3.6, the Contractor at the Contractor’s expense shall prove that the concrete left in place at both ends of the removal meets the specified spacing factor by air void examination to be performed by a qualified laboratory. The test results shall be submitted to the Engineer.

.6 Deficient Strength:

.1 Concrete work for roadways represented by a strength test result which is less than specified may be accepted subject to approval of the Engineer. If the strength is unacceptable, the Engineer may reject the concrete and require removal and replacement or direct the Contractor to undertake additional coring as outlined below.

.2 Optional core strength test:

.3 The Contractor, at their expense, may be required to provide evidence of strength by coring and testing to CAN/CSA-A23.2-14C moisture conditioned, by a qualified laboratory within 7 days of a failed 28-day cylinder test or within 3 days of a failed 7-day cylinder test. Three cores shall be drilled from the hardened concrete represented by the failed cylinder strength tests at locations approved by the Engineer.

.4 Test results shall be submitted to the Engineer.

.5 The average strength of the 3 cores shall equal 100% of the specified cylinder strength; otherwise, the concrete will be rejected and removal and replacement will be required.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Supply of all labour, materials and equipment to complete the concrete formwork, including slipforming required for Sitework Concrete external to the building, excluding structural stoops and aprons, as indicated on the drawings or specified herein.

1.2 RELATED SECTIONS

.1 Section 32 16 13 – Concrete Curb, Gutters and Walks.

.2 Section 32 20 00 – Sitework Concrete Reinforcing Steel.

.3 Section 33 05 16-13 – Concrete for Water and Drainage Structures.

1.3 QUALITY ASSURANCE

.1 At least one person thoroughly familiar with the type of material being installed, the referenced standards and the requirements of this section shall direct this portion of the Work.

.2 Supply, erect and dismantle concrete formwork in accordance with CSA-A23.1-04 except where specified elsewhere.

.3 The design of all formwork shall be the responsibility of the Contractor.

Part 2 Products

2.1 MATERIALS

.1 Formwork Materials: comply with CAN/CSA-S269.3, plain reusable pre-coated plywood sheets or formed steel panels.

.2 Form Ties: use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in the concrete surface.

.3 Form Release Agent: chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps.

.4 Form Stripping Agent: colourless mineral oil, free of kerosene, with viscosity between 15 to 24 mm2/s at 40°C, flashpoint minimum 150°C, open cup.

.5 All other materials, not specifically described but required for proper completion of concrete formwork, shall be as selected by the Contractor, subject to the advance approval of the Engineer.

.6 Slipform Equipment: of a design suitable to the type of work being constructed, for use with vibrators, and capable of uniformly extruding, spreading, shaping, and consolidating fresh concrete to produce a dense homogeneous mass with surfaces requiring a minimum of hand finishing; self-

propelled and capable of automatically controlling alignment and grade from taut wires or string lines.

Part 3 Execution

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels and centres before proceeding with formwork, and ensure dimensions agree with drawings.

.2 Use of earth forms is prohibited.

.3 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1-04

.4 Align form joints and make watertight. Keep form joints to a minimum.

.5 Use 50 mm chamfer strips on external corners and 25 mm fillets at interior corners of concrete members, unless specified otherwise.

.6 Form chases, slots, openings, drips, recesses and expansion and control joints as indicated.

.7 Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

3.2 SLIPFORMING

.1 Set and maintain grade line by establishing taut string line or wire, based on survey control datum.

.2 Provide stable support for travelling slipform machine. Protect adjacent work and repair if damaged.

.3 Coordinate concrete delivery and placing to ensure uniform progress of slipform machine without stoppage. If machine is stopped for any cause, immediately stop vibrating and tamping elements.

.4 Maintain proper slump to ensure slipformed concrete does not sag.

.5 Slipformed surfaces shall be smooth, dense, and free of pockets and honeycomb. Apply a minimum of hand finishing to correct minor irregularities.

3.3 FORM REMOVAL

.1 Review the proper timing of form removal with the Engineer in all cases.

.2 Loosen all forms within the first 24 hours after placing, and strip forms within 48 hours to facilitate finishing.

3.4 CONSTRUCTION JOINTS

.1 Construct joints in accordance with the details shown on the Architectural, Civil and Landscape drawings and/or local municipal standards.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 05 16 – Aggregate Materials.

.2 Section 31 23 10 – Site Excavation, Filling and Grading.

.3 Section 31 23 13 – Sitework Subgrade Preparation.

.4 Section 31 23 13-13 – Proof Rolling.

1.2 SECTION INCLUDES

.1 Spreading and compacting imported aggregate into a base or sub-base.

.2 Scarifying, shaping and compacting existing granular base or sub-base.

.3 Windrowing existing gravel, preparing the subgrade and spreading and compacting granular base or sub-base.

1.3 DEFINITION

.1 Maximum Density: The dry unit mass of a sample at optimum moisture content as determined in the laboratory to ASTM D698 Method A.

1.4 QUALITY ASSURANCE

.1 Testing Frequency:

.1 The quality assurance laboratory will take a minimum of one field density test on a compacted granular lift for each 1 500 m^2 of road or parking and 500 m^2 of walk, monolithic walk, curb ramp, alley crossing, commercial crossing, private crossing, or median or island strip, according to ASTM D1556, ASTM D2167, or ASTM D2922 for comparison with a maximum density determined according to ASTM D698 Method A.

.2 Required Density:

.1 The compacted lift thickness of a granular course shall not exceed 150 mm, or as directed by the Engineer. The required density of granular base courses is shown in the following table.

Compacted Granular Base Course	Required Percentage of Maximum Density
under roads, curb and gutter	100%
under commercial or alley crossings	100%
under asphalt or concrete walk, transit pads	97%
under walk portion of monolithic walk	97%
under curb ramps	97%
under private crossings	97%
under median or island strips	97%
under granular walkways	95%

.3 Proof Rolling:

.1 A proof roll of the finished granular base course will be required to confirm adequate bearing capacity of the aggregate layer. The proof roll shall be supervised by the Engineer, and must be performed in accordance with the Geotechnical Engineer's recommendations.

Part 2 Products

2.1 MATERIALS

.1 Granular Materials: to Section 31 05 16 Aggregate Materials, Designation 3, classes as indicated on the Drawings.

2.2 EQUIPMENT

.1 Equipment: Graders, rollers and other equipment of adequate design and capacity to produce a granular base or subbase as specified.

Part 3 Execution

3.1 PREPARATION

.1 The prepared subgrade shall be inspected by the Engineer before placing the granular course.

3.2 NEW GRANULAR BASE OR SUBBASE COURSE

.1 Deposit aggregate and spread uniformly in lifts not exceeding 150 mm thickness when compacted.

.2 Segregation: If segregation occurs:

.1 In Class 20 aggregate: blade the lift and mix thoroughly before final spreading and shaping to crown and grade.

.2 In Class 63 or Class 80 aggregate: remove and replace the segregated material.

3.3 COMPACTION

.1 Bring the moisture content of the aggregate to near optimum.

.2 Non-compliance: If a density test result is less than the required density, that test result is discarded and a retest shall be performed on the area represented by the failed test. If the retest is less than the required density, the area shall be reworked to the full depth of the lift, the soil moisture altered as necessary and recompacted to the required density.

.3 The Contractor shall assume the risk of uncovering and reworking the granular base if it is covered before the Engineer has accepted test results thereof.

3.4 FIELD QUALITY CONTROL

.1 Check finished surface of granular base to ensure that it meets the following tolerances:

.1 Surface Tolerance: 15 mm maximum variation under 3 m straightedge.

.2 Grade Tolerance: 6 mm maximum variation above designated elevation and 15 mm maximum variation below designated elevation.

.2 When Tolerance Exceeded

.1 Trim high spots and refinish surface to within tolerance.

.2 Add approved aggregate to low areas, scarify, blend, re-spread and recompact to required density and refinish surface. Alternatively, compensate low areas with extra thickness of subsequent granular base course.

3.5 SUBSEQUENT PAVING COURSE

.1 Do not permit vehicular traffic on the compacted granular base before paving.

.2 If the granular base floods, drain immediately by natural flow or by pumping to catch basins, manholes, or ditches.

.3 Repair any damage, including freezing, to the granular base course and retest for density before paving.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Asphalt prime coat: the supply and application of liquid asphalt to seal the surface of granular base courses or soil cement and to provide a bond with subsequent paving courses.

.2 Asphalt tack coat: the supply and application of liquid asphalt to provide a bond between an existing asphalt or concrete surface and the overlying asphalt course.

.3 Specifications for liquid and emulsified asphalts.

1.2 SUBMITTALS

.1 Submit refinery data to the Engineer, if requested by the Engineer.

1.3 RELATED REQUIREMENTS

.1 The quality assurance laboratory may take and test samples of liquid asphalt used weekly from each source. Material not meeting specifications shall be replaced.

Part 2 Products

2.1 FILL MATERIALS

.1 Liquid or Emulsified Asphalt: types and grades as indicated below.

	Liquid Asphalt Type & Grade	Application Rate litres/m2	Concentration
Prime Coat	MC-30/70	1.5 ±0.5	100%
Tack Coat	SS-1 MC-30/70	0.5 ±0.2 0.3 ±0.1	50% 100%

.2 Dilute SS-1 emulsified asphalt with an equal amount of water.

2.2 EQUIPMENT

.1 Pressure Distributor: shall be self-powered, equipped with a tachometer, a pressure gauge, an adjustable length spray bar, a positive displacement asphalt pump with a separate power unit, heating coils and a burner for even heating of asphalt and a thermometer. The pressure distributor shall be capable of maintaining a uniform speed and provide uniform application of liquid asphalt at the designated rate to areas up to 4 m wide.

.2 Hand Spray Wand: shall have a nozzle connected by a hose to a pressure distributor and shall be capable of the uniform application of liquid asphalt.

Part 3 Execution

3.1 COMMON REQUIREMENTS

.1 Prepare surface to be coated to the applicable Section. Have the surface inspected by the Engineer before coating.

.2 Protect adjoining curb, gutter, walk, slabs, barrier, poles and other surfaces not intended for coating, from splattering or overspray. Remove any splattering stains.

.3 Do not apply liquid asphalt when the weather is foggy, rainy, windy, or when the air temperature is below 2°C, unless otherwise permitted by the Engineer.

.4 Spray liquid asphalt to a uniform coat. Do not spray excessively to create ponding. Hand spray areas missed by or inaccessible to the distributor.

3.2 PRIME COAT

.1 Apply prime coat while the soil cement surface is still moist.

.2 Do not allow traffic on prime coat within 6 hours of application or until the prime coat has cured.

3.3 TACK COAT

.1 Do not apply tack coat unless the surface is dry and free of dust and other material that could reduce the bond.

.2 Apply tack coat only to an area that can be paved in the next 24 hours.

.3 Minimize construction traffic on the cured tack coat. Reapply the tack coat if damaged by traffic.

Table 3.1 – Specifications for Medium Curing Asphalts

ASPHALT GRADE REQUIREMENTS	**ASTM TEST**	**MC-30 Min**	**Max**	**MC-70 Min**	**Max**
Flash Point, Open Tag, °C	D1310	38	-	-	-
Kinematic Viscosity at 60°C, mm2/s	D2170	30	60	70	140
Distillation Test:					
% by volume of total distillate to 360°C - 190°C	D402	-	-	10	-
- 225°C		-	25	50	-
- 260°C		40	70	70	-
- 315°C		75	93	85	-
Residue from distillation to 360°C					
Volume % by difference		50	-	55	-
Tests on Residue from Distillation:					
Penetration at 25°C, 100 g, 5 s, dmm Ductility at 25°C, cm Solubility in Trichloroethylene, % by mass	D5 D113 D2042	120 100 99.5	250 –	80 100 99.5	120 –
Water, % by mass or volume	D95	-	0.2	-	0.2
Delivery Temperature, °C		35	55	55	75

Note: If the ductility at 25°C is <100 cm, the material will be acceptable if the ductility at 15°C is >100 cm

General Requirements: The asphalt shall not foam when heated to the application temperature range. The asphalt shall be produced by the refining of petroleum and shall be uniform in character.

Table 3.2 – Specifications for Anionic Emulsified Asphalts

ASPHALT GRADE REQUIREMENTS	**ASTM TEST**	**SS-1**		**SSMin**	**-1H Max**
		Min	**Max**		
Viscosity at 25°C, SF s	D244	20	60	20	60
Residue by Distillation, % by mass	D244	55	-	55	-
Settlement in 5 days, % difference by mass	D244	-	5	-	5
Storage Stability Test, 24 hour, % by mass	D244	-	1	-	1
Retained on No. 1000 sieve, % by mass	D244	-	0.10	-	0.10
Cement Mixing Test, % by mass	D244	-	2.0	-	2.0
Tests on Residue from Distillation: Penetration at 25°C, 100 g, 5 s, dmm Ductility at 25°C and 5 cm/minute, cm Solubility in Trichloroethylene, % by mass	 D5 D113 D2042	 100 60 97.5	 200 - -	 40 60 97.5	 100 - -
Delivery Temperature, °C		40	70	40	70

Notes: The upper limit on % residue is governed by the consistency limits.
The test for settlement may be waived when the emulsified asphalt is used in less than 5 days time.
The 24 hour storage test may be used in place of the 5 day settlement test. However, in case of dispute the 5 day storage settlement test shall govern.
CAN/CGSB-8.2-M Sieves, woven wire, metric shall be used for the sieve test.

General Requirements: All tests shall be performed within 15 days of the date of delivery. The asphalt shall be uniform in character and shall have a refined petroleum base.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 32 12 13 – Preparatory Coats

.2 Section 32 12 16-13 – Asphalt Paving Materials

1.2 SECTION INCLUDES

.1 Supply and placement of hot-mix asphalt concrete for pavement base, surface, or overlay.

1.3 RELATED REQUIREMENTS

.1 Overlay: paving over an existing pavement for rehabilitation purposes and not as part of staged paving.

.2 Staged Paving: paving where a lift or lifts that form part of the total pavement structure are deferred to a future date.

1.4 QUALITY ASSURANCE

.1 Thickness Cores: The Geotechnical Engineer will take a minimum of one core per 1 000 m^2 of asphalt pavement and determine the thickness of the mat, for each stage of paving.

.1 A thickness deficiency at the completion of the first stage of paving may be accepted by the Engineer provided the deficiency is less than 12mm and the deficient thickness can be included in the subsequent stage of paving.

.2 If the initial core thickness is deficient at the completion of the final lift of paving, that initial thickness is discarded, and 3 new cores will be taken within 10 m of the original core location at a minimum spacing of 2.5 m between cores. The average thickness of the 3 new cores represents that area.

.2 Density Specimen Sampling and Testing: The Geotechnical Engineer will:

.1 Determine the density of laboratory compacted Marshall Specimens at a minimum frequency of one Marshall Density for every 1 000 tonnes of hot-mix, or a day's production, whichever is less.

.2 Drill cores from a compacted mat placed from the same load of hot-mix from which Marshall specimens were taken, or from suspect compacted mat, and test for density.

.3 Basis of Acceptance: Pavement compaction will be accepted on the basis of the ratio (in percent) of the core density to the density of Marshall Specimen. If cores were drilled from a mat where no Marshall specimen was taken, acceptance will be based on the ratio of core density to the average density of all Marshall Specimens to date.

.4 Representative Cores: A single core is initially taken representing the quantity of hot-mix in not more than 1 000 m2 of mat, with a minimum of one core taken from a day's production. If the initial core thickness or density is below specified, that initial density is discarded, and 3 new cores will be taken within 10 m of the original core location at a minimum spacing of 2.5 m between cores. The average density of the 3 new cores represents that area.

1.5 WARRANTY

.1 All asphalt paving constructed within the municipal rights-of-way (Airport Road and Waskway Drive) shall be subject to a two (2) year warranty from the date of Construction Completion approval from the Municipal District Number 17. A Final Acceptance inspection will be conducted with the Municipal District Number 17 to identify deficiencies at the end of the warranty period. The Contractor shall be responsible to undertake any identified repairs. The Consultant shall assign responsibility for payment of these repairs to the Contractor or the Owner.

Part 2 Products

2.1 MATERIALS

.1 Hot-Mix Asphalt Concrete: To Section 32 12 16-13 - Asphalt Paving Materials.

.2 Tack Coat: To Section 32 12 13 – Preparatory Coats.

2.2 EQUIPMENT

.1 Trucks for Transporting Mix: Compatible with size and capacity of paver; with clean, tight smooth-sided boxes equipped with waterproof tarpaulins of sufficient size to cover securely all material when boxes are fully loaded; side of box to have a 12 mm diameter hole 300 mm from bottom for checking mix temperature.

.2 Paver: Self-propelled; with automatic screed controls to maintain grade from a reference stringline and to control crossfall, smoothness and joint matching; with vibratory screed equipped with vibratory extensions and augers capable of uniformly spreading the mixture to specified widths and depths without segregation or tearing. Follow the manufacturer's recommended operating procedures.

.3 Rollers: Self-propelled, reversible; static steel-tired or pneumatic-tired rollers, or vibratory rollers; with wetting and scraping devices to prevent adhesion of mix to drums or tires (petroleum derivatives not permitted for cleaning); capable of attaining required density and smoothness; pneumatic-tired rollers to be equipped with wind skirts. Follow the manufacturer's recommended operating procedures.

.4 Hand Tools: Rakes, lutes, tampers, straightedge, level, and other hand tools as required to complete the work.

Part 3 Execution

3.1 GOOD PAVING PRACTICE

.1 Refer to the latest edition of the Construction of Hot Mix Asphalt Pavements, Asphalt Institute Manual Series No. 22 (MS-22), for guidance in good paving practice insofar as consistent with this Section.

.2 Provide an experienced foreman who shall be in full time attendance on the paving site to take charge of the entire paving operation from transporting of mix to final rolling.

3.2 PREPARATION

.1 The Engineer will inspect the base course before paving. The Contractor shall repair imperfections and clean the base. The surface shall be true to line and grade within tolerance, firm, dry and free of loose or deleterious material.

.2 Catch basins, manholes, water valves, and other fixtures shall be brought to proper grade before the final lift. Provide temporary protection where necessary until paving is complete.

.3 Apply tack coat to surfaces intended to contact hot-mix asphalt, including the sides of gutters, catch basins, manholes, and other concrete and metal fixtures. Before placing hot-mix, let the tack coat completely cure and have the tacked surfaces inspected by the Engineer.

.4 Multiple Lift Paving: Apply tack coat to previously placed asphalt before placing subsequent lifts, unless the prior lift was placed less than 24 hours before and has not been opened to traffic. Clean surfaces before tacking.

.5 Preparation for Overlay or for Succeeding Stage Paving:

.1 Sweeping and Cleaning: Sweep the existing pavement surface with an approved mechanical sweeper. Remove all residual debris and accumulations of deleterious material.

.2 Tack Coat: When the existing surface has passed inspection by the Engineer, apply tack coat to Section 32 12 13 – Preparatory Coats.

.3 Asphalt Levelling Course: The Engineer will designate those areas having 25 mm or more depressions for levelling course application. Spread the levelling course of hot-mix asphalt with a paver one lift at a time, not exceeding 75 mm compacted thickness, and compact the asphalt to the required density.

3.3 WEATHER LIMITATIONS

.1 No paving is permitted when rain or snow is imminent, or when the surface to be paved is wet, icy, snow covered or frozen at any point within 150 mm of the surface, unless waived by the Engineer.

.2 No paving is permitted when air temperature and wind speed conditions are below the applicable mat curve in Chart 3.1, unless waived by the Engineer.

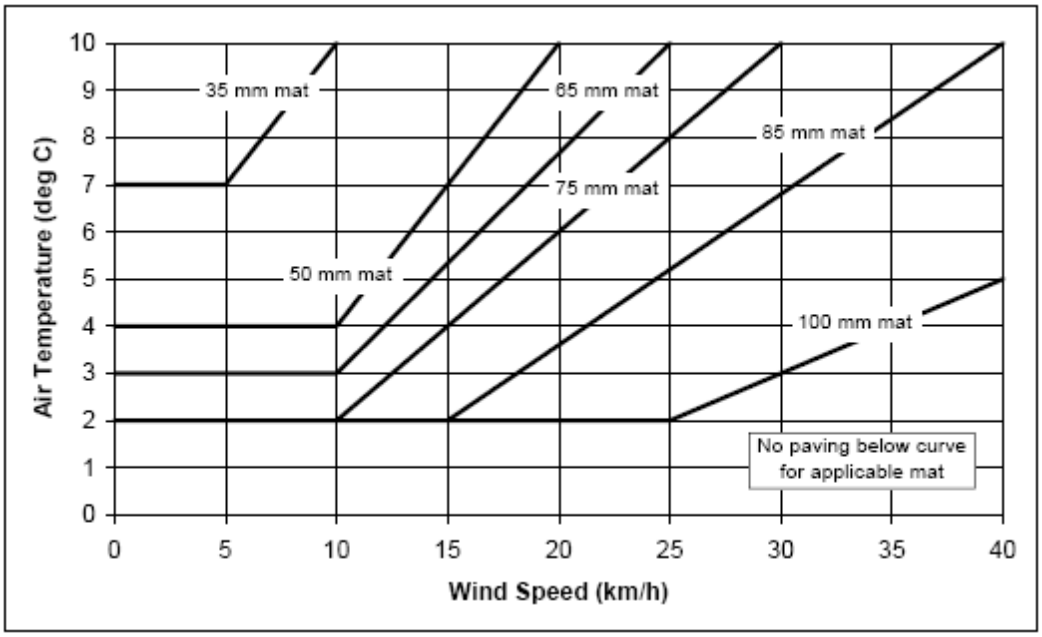


Chart 3.1: Air Temperature and Wind Limitations on Paving

3.4 TRANSPORTATION OF MIXTURE

.1 Transport the mixture in approved trucks with protective covers properly secured to the sides and back of the truck box so that no funneling air movement develops under the cover during hauling.

.2 Before loading with hot-mix, thoroughly clean the box of any accumulation of asphaltic material. Lubricate inside surfaces with a light coating of soap or detergent solution. Petroleum derivatives are not permitted.

.3 Maintain trucks clean of mud and other matter that could contaminate the paving area.

.4 Discharge hot-mix into the paver hopper without spilling and without the truck box bearing down on the hopper.

3.5 SPREADING

.1 Placing the mixture shall be a continuous operation with the paver moving at a uniform speed compatible with the rate of compaction rolling.

.2 Spreading Temperature of Mix: From 125°C to 150°C as measured in the mat immediately behind the paver.

.3 Spread hot-mix uniformly in one or more lifts, or as directed by the Engineer, to a minimum 35mm and maximum 75mm compacted thickness.

.4 Segregation: If segregation of the mix material occurs, the Engineer will immediately suspend spreading until the cause is determined and corrected.

.5 Prior to roller compaction, remove fat spots, sandy accumulations, high and low spots and other irregularities and repair with hot-mix. Scratch surface with rake tynes to ensure bonding of added mix. Do not broadcast loose material that has been raked off onto the mat.

3.6 HAND SPREADING

.1 Hand spread mix in small areas not accessible to the paver, and where permitted by the Engineer.

.2 Do not broadcast material. Hand place carefully to avoid segregation of coarse and fine aggregate. Use lutes and rakes to thoroughly loosen and uniformly distribute the mix. Remove lumps that do not break down readily.

.3 Heat hand tools to keep them free from sticking asphalt. Do not overheat and burn mix material.

.4 Before rolling, check the surface with a template or straightedge, and correct irregularities.

3.7 COMPACTION

.1 Compact the asphalt mat with rollers in good working order and operated by competent operators. Use the number, type and mass of rollers required to obtain the specified compaction within the available compaction time and compatible with the rate of hot-mix placement.

.2 Develop and follow the best pattern of rolling to obtain the most uniform compaction across the mat including joints and edges. Indicate the rolling pattern to the Engineer when requested.

.3 Perform compaction rolling with rollers following the paver as closely as possible, until required density is obtained. Perform finish rolling to eliminate equipment marks and to achieve a surface with a uniform tightly knit texture.

.4 Complete final rolling before the mat temperature reaches 80°C.

.5 For small areas inaccessible to rollers, use an approved vibratory plate compactor or hand tamper to thoroughly compact the mix. Minimal amounts of water may be sprayed on the asphalt surface to aid compaction with plate compactors or hand tampers.

.6 If mat is difficult to roll, redesign the mix and obtain Geotechnical Engineer's approval of a trial batch before resuming paving.

3.8 JOINTS

.1 Transverse Joint:

.1 Plan length of spread to provide for a minimum 1 m offsetting of transverse joints in successive lifts and adjacent mats.

.2 Transverse joints shall be straight, have a vertical face painted with tack coat before placement of the adjacent mat, be thoroughly compacted, and meet surface tolerances.

.2 Longitudinal Joint

.1 Location: Plan mats so that the surface longitudinal joint will be offset by not more than 150 mm from the centre of an indicated marking line between travel lanes. If permitted by the Engineer, the joint may be located at the centre of travel lane.

.2 Plan width of spread to provide for a minimum 150 mm offsetting (in a dovetail pattern) of longitudinal joints in successive lifts.

.3 Create a longitudinal joint while the edge temperature of the first of two adjacent mats is above 80°C. This may be accomplished by multiple pavers in staggered formation, or by limiting paver advance.

.4 Allow a 25 mm to 50 mm overlap between mats.

.5 Do not roll a 150 mm wide strip along the edge of first mat until the adjoining mat is placed. Roll the joined mat immediately to insure bonding while the joint temperature is above 80°C.

.6 A longitudinal joint shall be thoroughly compacted and shall meet surface tolerances.

3.9 FIELD QUALITY CONTROL

.1 Smoothness Tolerances

.1 Maximum variation under 3 m straightedge as follows:

.1 Longitudinal in direction of travel: 3 mm

.2 Transverse to direction of travel (straight crossfall): 6 mm

.2 Grade: ±6 mm maximum variation from designated grade elevations.

.3 Texture: The finished surface shall have a tightly knit texture free of visible signs of poor workmanship including, but not limited to:

.1 Segregation,

.2 Areas exhibiting excess or insufficient asphalt,

.3 Improper matching of longitudinal and transverse joints,

.4 Roller marks, cracking, or tearing.

.4 If surface and grade tolerances are exceeded, or if surface texture is not met, grind down and resurface defective areas as directed by the Engineer.

.2 Thickness Tolerance

.1 Deficient Thickness: If the average core thickness is deficient, after re-cores are taken, the following shall occur:

.1 If the thickness deficiency is less than 10.0% of the design thickness, the asphalt pavement shall be accepted.

.2 If the thickness deficiency is between 10.0% and 15.0% of the design thickness, the Contractor may be requested to remedy the thickness deficiency or be assigned a payment penalty, subject to agreement among the Client, Engineer and Contractor.

.3 If the thickness deficiency is greater than 15.0% of the design thickness, the Contractor shall grind and resurface the asphalt pavement in the area defined by the Engineer.

.2 Excess Thickness: Asphalt pavement with excess thickness may be accepted with no extra payment, if surface and grade tolerances and texture are met.

.3 Density Tolerance:

.1 Required Density: Each mat of hot-mix placed shall be compacted to 98% of Marshall Density.

.2 Deficient Density: If the average core thickness is deficient, after re-cores are taken, is below the specified density of 98% Marshall Density the following shall occur:

.1 If the average density is 97.5% or greater, the asphalt pavement shall be accepted.

.2 If the average density is between 95.0% and 97.4%, the Contractor may be requested to remedy the density deficiency or be assigned a payment penalty, subject to agreement among the Client, Engineer and Contractor.

.3 If the average density is less than 95.0%, the Contractor shall remove and resurface the asphalt pavement in the area defined by the Engineer.

3.10 CLEANUP

.1 Leave site clean and free of debris and surplus material.

.2 Opening to Traffic: Open new pavement to traffic when the surface has cooled to ambient temperature and when authorized by the Engineer. Remove barricades and signs no longer needed.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 – Aggregate Materials

1.2 SECTION INCLUDES

.1 Production of a hot mixture of asphalt binder and aggregate for paving.

.2 Requirements for mix design, quality control and quality assurance.

1.3 DEFINITIONS

.1 Mixes are designated according to use as follows:

.1 **Asphalt Concrete Pavement, ACP (Base Course):** base course for freeways, arterials, industrial/commercial roadways and collector roadways.

.2 **Asphalt Concrete Pavement, ACP (Type H2):** paving freeways, arterials, collector roadways, local residential roadways, alleys and commercial and industrial parking lots.

1.4 SUBMITTALS

.1 Asphalt Cement Data

.1 Submit refinery product data including temperature-viscosity curves for each source, together with the mix design and as requested by the Engineer.

.2 Mix Design

.1 Submit a mix design for each required asphalt concrete mix type to the Engineer at least 10 days before the start of production and for each subsequent change in supplier or source of materials. No hot-mix production can proceed until the applicable mix design and job-mix formula have been approved by the Engineer.

.2 A previously approved mix design of the required mix type may be accepted by the Engineer if the same materials for which the design was approved are used, provided the job-mix formula requirements are satisfied.

.3 Submit mill tests and gradation for mineral filler together with the mix design and as requested by the Engineer.

.3 Aggregate

.1 Submit abrasion, soundness and crushed face test results for each aggregate source at the time of stockpiling to the following frequencies:

.1 Abrasion and Soundness: one set of tests per aggregate source.

.2 Crushed Face: one test per 500 tonnes, or each day's production, whichever is less.

.2 Submit test results to the Engineering Services Section, Transportation Department, within 24 hours of testing. Do not use aggregate until the test results have been reviewed and accepted by the Engineer.

Part 2 Products

2.1 MATERIALS

.1 Asphalt Cement: premium grade 150-200 (A) or 80-100 (A), to Table 3.1.

.2 Aggregate: to Section 31 05 16 – Aggregate Materials, Designation 1 classes for the various mix types as follows:

	ACP (Base Course)	ACP (Type H2)
Designation 1 class:	25	12.5

.1 Coarse Aggregate: that fraction of the total aggregate retained on the 5 000 μm sieve.

.2 Fine Aggregate: that fraction of the total aggregate passing the 5 000 μm sieve.

Fine aggregate shall contain manufactured or crushed fines at a percentage by mass of fine.

	ACP (Base Course)	ACP (Type H2)
Minimum	75%	75%
Maximum	85%	85%

.3 Pit run material shall be pre-screened to remove natural sand and subsequently crushed and screened to obtain manufactured fines.

.4 Notify the Engineering Services Section at least 48 hours before production of manufactured fines to allow inspection the manufacturing process. Failure to properly notify the Engineering Services Section will preclude approval of the fines for use in asphalt concrete.

.3 Mineral Filler

.1 Portland cement, fly ash, or ground limestone may be used if necessary to meet grading specifications if permitted by the Engineer. Mineral filler shall have zero plasticity index and shall meet the following gradation:

Sieve Size (μm)	Minimum % Passing by Mass
400	100
160	90
80	70
45	62

2.2 EQUIPMENT

.1 Asphalt Plant

.1 Asphalt Mixing Plant: conforming to ASTM D995, capable of consistently producing a homogeneous mixture in which all aggregate particles are uniformly and thoroughly coated with asphalt and meeting the following supplementary requirements:

.2 Plant production shall not proceed unless all plant scales have been certified by Weights and Measures, Canada Consumer and Corporate Affairs prior to start of construction season and as often as deemed necessary by the Engineer to ensure their accuracy. Plant production shall not proceed until plant calibration and recalibration have been reviewed

by the Engineer on site. Notify the Engineer at least 24 hours before plant calibrations are made or altered.

.3 Provide free and safe access for the Engineer to verify proportions, settings, temperatures and to take samples of asphalt, aggregate and mixture.

.4 All asphalt paving plants are required to be operated in accordance with the Alberta Environmental Protection Code of Practice. All contractors operating asphalt plants shall provide proof of registration with Alberta Environmental Protection and agree that the asphalt plant shall be operated in accordance with the Code of Practice.

2.3 MIX DESIGN

.1 The mix design shall be performed by a qualified laboratory following the Marshall Method of Mix Design as set out in the latest edition of the Asphalt Institute Manual Series No. 2 (MS-2) to the following criteria:

Mix Type	ACP (Base Course)	ACP (Type H2)
Max size of aggregate, mm	25	12.5
Number of blows	75	75
Minimum stability, kN	6.7	6.7
Minimum retained stability1, %	75	75
Flow value, 0.254 mm unit	6 - 12	6 - 12
Air voids, % of total mix	4.0 ± 0.4	4.0 ± 0.4
Voids filled, %	67 - 78	68 - 80
Minimum film thickness2 , µm	6.0	7.0

Note 1: Minimum retained stability to be determined to Appendix A
Note 2: Minimum film thickness to be determined to Appendix B

.2 Job-Mix Formula

.1 Do not make changes to the approved job-mix formula without written approval from the Engineer. Display the currently approved job-mix formula in clear sight of plant operator. Failure to display the job-mix formula will result in a plant shutdown order by the Engineer.

2.4 SOURCE QUALITY CONTROL

.1 Aggregate Quality Control: Engage a qualified laboratory to conduct aggregate sampling, sieve analyses to ASTM C136, crushed face counts and abrasion and soundness tests.

.1 Tolerances in Extracted Aggregate from Approved Job-Mix Gradation:

Sieve Size	% Passing by Mass	
	Individual Sample	Average of Last 3 Samples
(µm)		
20000	±5.0	±3.0
12500	±5.0	±3.0
10000	±5.0	±3.0
5000	±5.0	±3.0
2500	±4.0	±2.5
1250	±4.0	±2.5
630	±3.0	±2.0
315	±3.0	±2.0
160	±2.0	±1.5
80	±1.5	±1.0

.2 Crushed-Face Count in Mix: For each mix type, the minimum percentage, by mass retained down to the 5 000 µm sieve, having at least 2 crushed faces shall be as follows, provided there is a minimum 50% crushed-face count in each individual sieve size greater than 5 000 µm.

Mix Type:	ACP (Base Course)		ACP (Type H2)	
Minimum 2 Crushed -Face	90%		90%	
Sieve Fraction (µm)	1 Face	2 Face	1 Face	2 Face
- 25 000 to + 20 000	90	80	-	-
- 20 000 to + 12 500	90	85	-	-
- 12 500 to + 10 000	95	90	95	90
- 10 000 to + 5 000	98	95	98	95

.3 Asphalt Content Tolerance: Allowable variation from approved design asphalt content shall be ±0.3% by mass of mix.

.4 Tolerance for Air Voids in Mix:

Mix Type:	ACP (Base Course)	ACP (Type H2)
Air Voids, %:	4.0 ±1.0	4.0 ±1.0

.5 Minimum Film Thickness in Mix:

Mix Type:	ACP (Base Course)	ACP (Type H2)
Min Film Thickness, µm:	6.0	7.0

.6 Voids Filled in Mix:

Mix Type:	**ACP (Base Course)**	**ACP (Type H2)**
Voids Filled, %:	67 - 78	68 - 80

.7 Mixing Temperature Tolerance: Allowable variation from design mixing temperature shall be ±9°C.

Part 3 Execution

3.1 PRODUCTION OF MIX

.1 Good Practice Guide: Refer to the latest edition of the Asphalt Institute Manual Series No. 22 (MS-22), Construction of Hot Mix Asphalt Pavements, for guidance in good practices of handling materials and hot-mix production insofar as consistent with this Section.

.2 Production Rate: Produce hot-mix at a rate compatible with the rate of placement and compaction on the job.

3.2 AGGREGATE IN STOCKPILE

.1 Stockpile aggregate in horizontal lifts. Stacking conveyors are not allowed for stockpiling. Draw aggregate from the stockpile in a manner that mixes the full depth of the stockpile face.

.2 Stockpile each source or size of aggregate individually when it is necessary to blend aggregates from one or more sources to produce the combined gradation. Do not blend aggregates in a stockpile; feed through separate bins to the cold elevator feeders.

.3 Nonconforming Mix Production: If one or more of the mix properties and tolerances are not met, the Engineer will order suspension of mix production until the Contractor has demonstrated to the Engineer's satisfaction that corrective measures have been taken to produce a mix that meets requirements. The Engineer will also require the Contractor to remove the nonconforming mix from the roadway at their cost.

Table 3.1: Specifications for Premium Grade Asphalt Cements

TEST CHARACTERISTICS	A.S.T.M. TEST METHOD	PREMIUM GRADES OF ASPHALT CEMENTS								
		80-100 (A)			150-200 (A)			200-300 (A)		
Absolute Viscosity, 60°C, Pa – s	D2171	The viscosity and penetration values must fall within the area bounded by A-B-C-D-A plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:			The viscosity and penetration values must fall within the area bounded by E-F-G-H-E plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:			The viscosity and penetration values must fall within the area bounded by G-H-J-K-G plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:		
Pentration, 25°C, 100g, 5s, dmm	D5	Pt.	Abs.V isc.	Pen.	Pt.	Abs.V isc.	Pen.	Pt.	Abs.V isc.	Pen.
		A	450	80	E	155	150	G	50	200
		B	208	80	F	70	150	H	92	200
		C	150	100	G	50	200	J	45	300
		D	300	100	H	92	200	K	26.5	300
Kinematic Viscosity, 135°C, sq. mm/s	D2170	The viscosity and penetration values must fall within the area bounded by A-B-C-D-A plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:			The viscosity and penetration values must fall within the area bounded by E-F-G-H-E plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:			The viscosity and penetration values must fall within the area bounded by G-H-J-K-G plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:		
Pentration, 25°C, 100g, 5s, dmm	D5	Pt.	Kin. Visc.	Pen.	Pt.	Kin. Visc.	Pen.	Pt.	Kin. Visc.	Pen.
		A	600	80	E	360	150	G	205	200
		B	417	80	F	225	150	H	285	200
		C	350	100	G	205	200	J	205	300
		D	500	100	H	285	200	K	150	300
Flash Point, Cleveland Open Cup, °C minimum	D92	235			205			175		
Solubility in Trichlorethelene, % minimum	D2042	99.5			99.5			99.5		
Tests on Residue from Thin Film Oven Test: Ratio of Absolute Viscosity of Residue from Thin-Film Oven Test to Original Absolute Viscosity, maximum:	D1754 D2171	4.0			4.0			4.0		
Ductility, 25°C, cm, maximum	D113	100			100			-		
Ductility, 15.6°C, cm, minimum		-			-			100		

General Requirement:

.1 The asphalt shall be prepared by the refining of petroleum. It shall be uniform in character and shall not foam when heated to 175°C.

.2 The temperature at delivery to the site shall be between 135°C and 175°C.

Table 02065.2: Specifications for Regular Grade Asphalt Cements

TEST CHARACTERISTICS	A.S.T.M. TEST METHOD	REGULAR GRADES OF ASPHALT CEMENTS					
		200-300 (B)			300 – 400 (B)		
Absolute Viscosity, 60°C, Pa - s	D2171	The viscosity and penetration values must fall within the area bounded by G-N-O-K-G plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:			The viscosity and penetration values must fall within the area bounded by K-O-P-L-K plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:		
Pentration, 25°C, 100g, 5s, dmm	D5	Pt.	Abs.Visc.	Pen.	Pt.	Abs.Visc.	Pen.
		G	50	200	K	26.5	300
		N	30	200	O	17.5	300
		O	17.5	300	P	12	400
		K	26.5	300	L	17	400
Kinematic Viscosity, 135°C, sq. mm/s	D2170	The viscosity and penetration values must fall within the area bounded by G-N-O-K-G plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:			The viscosity and penetration values must fall within the area bounded by K-O-P-L-K plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:		
Pentration, 25°C, 100g, 5s, dmm	D5	Pt.	Kin. Visc.	Pen.	Pt.	Kin. Visc.	Pen.
		G	205	200	K	150	300
		N	165	200	O	125	300
		O	125	300	P	102.5	400
		K	150	300	L	120	400
Flash Point, Cleveland Open Cup, °C minimum	D92	175			175		
Solubility in Trichlorethelene, % minimum	D2042	99.5			99.5		
Tests on Residue from Thin Film Oven Test: Ratio of Absolute Viscosity of Residue from Thin-Film Oven Test to Original Absolute Viscosity, maximum:	D1754 D2171	5.0			5.0		
Ductility, 25°C, cm, maximum	D113	-			-		
Ductility, 15.6°C, cm, minimum		100			100		

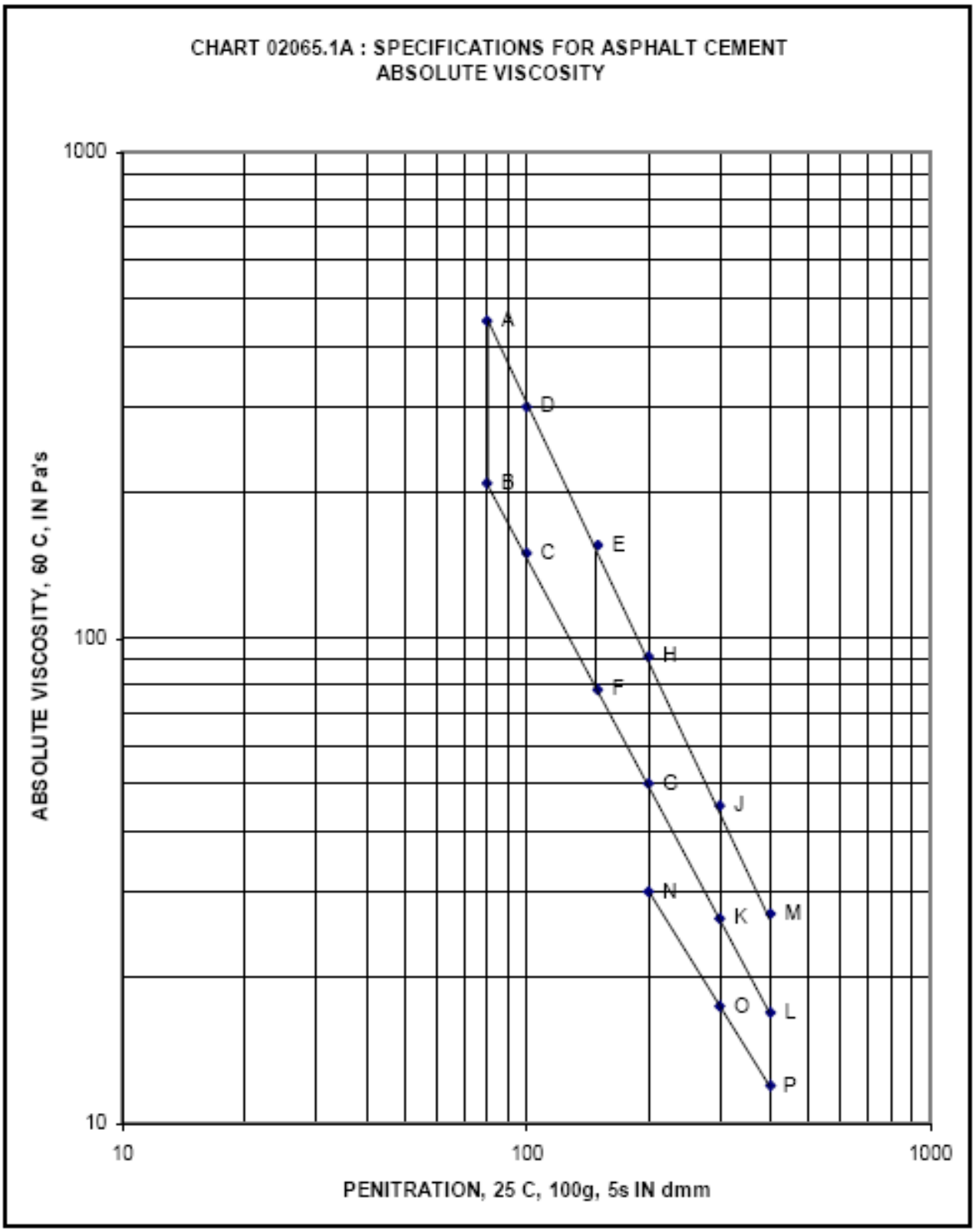
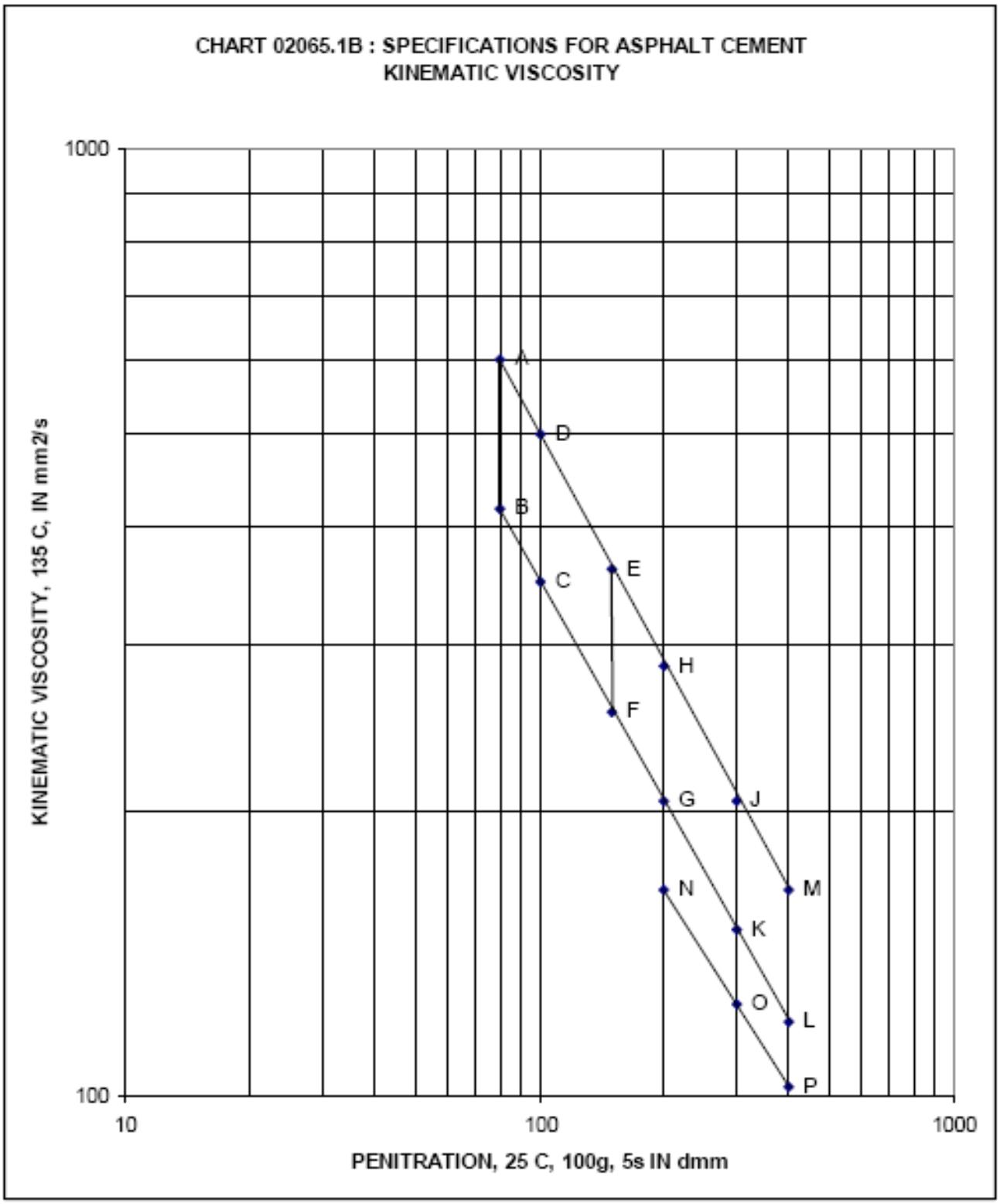


CHART 02065.1A : SPECIFICATIONS FOR ASPHALT CEMENT
ABSOLUTE VISCOSITY
ABSOLUTE VISCOSITY, 60 C, IN Pa's
1000
100
10
10
100
1000
PENITRATION, 25 C, 100g, 5s IN dmm
A
D
B
C
E
H
F
G
J
N
K
M
O
L
P

CHART 02065.1B : SPECIFICATIONS FOR ASPHALT CEMENT
KINEMATIC VISCOSITY



APPENDIX A
MARSHALL IMMERSION TEST

Part 4 General

4.1 GENERAL

.1 This is a test method involving the measurement of loss of Marshall Stability resulting from action of water on compacted asphalt paving mixtures containing penetration grade asphalt cement.

.2 Numerical index of reduced stability is obtained by comparing the stability of specimens determined by the usual Marshall procedure with the stability of specimens that have been immersed in water for a prescribed period.

4.2 REFERENCE

.1 Perform testing to ASTM D1559 as modified below.

.2 Determine Bulk Specific Gravity of test specimens to ASTM D2726-96.

Part 5 Products

5.1 MATERIALS

.1 Representative samples of each asphalt paving mixture.

5.2 APPARATUS

.1 One or more water baths with automatic controls for immersing specimens. Baths normally used for Marshall testing are suitable for this purpose.

.2 Scale and water bath with suitable accessory equipment for weighing test specimens in air and in water to determine their densities.

.3 Supply of flat transfer plates of glass or metal. One plate must be kept under each specimen during the immersion period and during subsequent handling, except when weighing and testing, to prevent breakage or distortion of the specimen.

.4 Apparatus required to conduct a Marshall test.

Part 6 Execution

6.1 PREPARATION OF TEST SPECIMENS

.1 Prepare at least 6 specimens for each test.

.2 Compact test specimens using the required number of blows on each face.

6.2 TEST PROCEDURE

.1 For each specimen, determine mass in air, mass in water and mass in saturated surface dry condition to ASTM D2726 (96) – 9.2.

.2 Calculate the specific gravity of each specimen as follows:

Specific Gravity = A / (B – C)

Where: A = mass of dry specimen in air

B = mass of saturated surface dry specimen in air

C = mass of specimen in water

.3 Sort each set of 6 specimens into 2 groups of 3, so that the average specific gravity of group 1 is essentially the same as that of group 2.

.4 Test group 1 specimens for Marshall stability.

.5 Immerse group 2 specimens in water at 60°C for 24 hours (±30 min), then test immediately for Marshall stability.

6.3 TEST REPORT

.1 Report the numerical index of resistance of asphalt paving mixture to detrimental effect of water, expressed as a ratio (in percent) of the stability retained after immersion to the original stability.

.2 Calculate the index as follows:

Index of Retained Stability = (S2 / S1) x 100

where S1 = average Marshall stability of group 1

where S2 = average Marshall stability of group 2.

APPENDIX B
METHOD FOR DETERMINING FILM THICKNESS

Part 7 Surface Area Factors (Sa):

Sieve Size (µm)	Surface Area Factor (m /kg)
5000	0.38
2500	0.78
1250	1.55
630	2.90
315	5.60
160	12.20
80	29.00

Determine total surface area as the sum of the surface areas for the seven specified sieve sizes according to the formula:

$$Sa = 0.38 + \frac{\Sigma\ (\%\ Passing \times Surface\ Area\ Factor)}{100}$$

Part 8 Corrected Sa (Sac):

Correct Sa for actual Aggregate Bulk Specific Gravity by the formula:

Sac = Sa x (2.650/Actual Bulk Specific Gravity)

Part 9 **Film Thickness (Ft) Calculation:**

Ft = 10 x (Pac - Pabs) / Sac x SGac in microns (mm)
Where: Pac = Percent Asphalt Cement Content by dry mass of Aggregate
Pabs = Percent of Absorbed Asphalt Cement by dry mass of Aggregate
Sac = Corrected Sa
SGac = Specific Gravity of Asphalt Cement

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 05 16 – Aggregate Materials.

.2 Section 31 23 13 – Sitework Subgrade Preparation.

.3 Section 32 05 23 – Sitework Cement and Concrete.

.4 Section 32 10 00 – Sitework Concrete Forms and Accessories.

.5 Section 32 20 00 – Sitework Concrete Reinforcing Steel.

.6 Section 32 11 23 – Aggregate Base Courses.

1.2 SECTION INCLUDES

.1 Construction of Portland cement sitework concrete, including curb, curb and gutter, gutter, walk, monolithic curb, gutter and walk, median or island slabs, curb ramp and crossings, excluding exterior structural stoops and slabs.

1.3 QUALITY ASSURANCE

.1 Slump, Air Content, Nuclear Density Tests, Air-Void Examination, Strength Tests and Acceptance Criteria to Section 32 05 23 – Sitework Cement and Concrete.

1.4 WARRANTY

.1 All concrete curbs, gutters, swales and walks constructed within the municipal rights-of-way (Airport Road and Waskway Drive) shall be subject to a two (2) year warranty from the date of Construction Completion approval from the Municipal District Number 17. A Final Acceptance inspection will be conducted with the Municipal District Number 17 to identify deficiencies at the end of the warranty period. The Contractor shall be responsible to undertake any identified repairs. The Consultant shall assign responsibility for payment of these repairs to the Contractor or the Owner.

Part 2 Products

2.1 MATERIALS

.1 Concrete:

.1 Class C, Type GU, or as specified in the Geotechnical Report. Refer to Section 32 05 23

.2 Reinforcement Bars, Tie Bars, Dowels, Welded Steel Wire Fabric:

.1 Refer to Section 03 21 00

Part 3 Execution

3.1 TYPES OF CONSTRUCTION

.1 The Contractor has the option of constructing the following types of work by hand forming or by slipforming methods, or by a combination of both. Construct as detailed on plans and drawings or as directed by the Engineer.

.2 Curb, Curb and Gutter & Barrier Curb:

.1 Construct curb, curb and gutter and gutter on prepared subgrade, cement stabilized subgrade, granular base course, soil cement, or asphalt concrete, as indicated on the drawings.

.3 Walk:

.1 Construct walk on a granular base course.

.4 Monolithic Walk Curb and Gutter:

.1 Construct the walk portion of monolithic walk, curb and gutter on a granular base course. If the walk portion is wider than 2 m, place longitudinal and transverse crack control joints at the proper spacing. Monolithic walk and curb (and gutter) shall be poured monolithically.

.5 Curb Ramps:

.1 Curb ramps are an incline built monolithically into curb cut and walk. Construct curb ramps on a granular base course.

3.2 PREPARATION

.1 Verify that the prepared subgrade or base is ready for concrete placement and repair any deterioration or damage.

.2 Cut behind Curb:

.1 Compact soil to Section 31 23 13 and trim to within 25 mm of the back of curb.

.3 Granular Base Course:

.1 The granular base course under concrete walk, curb ramps and the walk portion of monolithic walk, curb and gutter shall consist of 100 mm compacted thickness of Designation 3, Class 20 aggregate. Compaction and tolerance testing shall be to Section 32 11 23.

3.3 HAND FORMING

.1 Place forms to Section 03 10 00 and as supplemented below.

.2 Use flexible forms to construct curves of less than 40 m radius.

.3 Place a minimum 50 m of forms before a concrete pour to allow checking for true line and grade.

.4 The Engineer will not allow the use of forms that are out of shape, dented, rough, or otherwise unsuitable.

3.4 PLACING REINFORCEMENT

.1 Place reinforcement of the type, size and spacing as detailed on drawings or as required by Engineer, to Section 03 21 00.

3.5 PLACING CONCRETE

.1 Place concrete to Section 32 05 23 and as supplemented below.

.2 Use 50 mm pencil vibrators for curb and gutter and approved vibrating screeds for walk and slabs.

.3 Place concrete continuously until the scheduled pour is complete. Arrange the rate of concrete delivery to ensure that the discharge interval between successive loads does not exceed 30 minutes. If the discharge interval is greater than 30 minutes, place a construction joint.

.4 Where possible curbline walk, curb ramps and curb crossings shall be poured monolithically. Where it is possible to pour the curbline walk, curb ramps and curb crossings monolithically the use of dowels and joint sealant at the back of the curb is not permitted.

3.6 SLIP FORMING

.1 Slipform concrete to Section 03 10 00 and as supplemented below.

.2 Hand form and place concrete at corners, driveways and catch basins concurrent with the slipforming operation. Where concurrent work is not practical, complete this work within 7 days of the slipforming of adjacent work.

3.7 FINISHING

.1 Finish concrete to Section 32 05 23 and as supplemented below.

.2 Tool all edges and joints to a width of 50 mm and round edges to a 6 mm radius unless indicated otherwise.

.3 Apply a brush final finish longitudinally along curb and gutter and transversely on walk and slabs.

.4 Refer to finishing details as specified on the Civil and Landscape drawings.

Name Plate: Stamp the Contractor's name and year of construction in the plastic concrete on:

.1 The top of the curb in each block or at 200 m intervals, whichever is less and

.2 The walk at the end of each block on an extension of a property line.

3.8 CRACK-CONTROL JOINTS

.1 Joint Size:

.1 Refer to the Architectural, Civil and Landscape drawings for the location, size and spacing of joints.

.2 For general broom finish concrete, joints shall be 3 mm to 5 mm wide at the following depths:

.1 For curb and gutter and pin on curb: 50 mm minimum to a maximum of 25% of the gutter depth.

.2 For walk and slabs: 25 mm minimum to a maximum of 25% of the walk or slab thickness.

.3 Joint Spacing: 3 m maximum.

.4 Surface Dummy Joints: tooled 5 mm wide by 10 mm deep, centred between contraction joints across walk and slabs. In monolithic construction, place surface joints across the walk portion and contraction joints on the curb and gutter, both joints being on same line. Where required, place a longitudinal surface joint on walk and slabs continuing on through alley crossings and driveways.

3.9 TRANSVERSE CONSTRUCTION JOINTS

.1 Use 10M deformed tie bars at 300 mm spacing and extending 300 mm minimum into both sides of the joint.

.2 Vary joint spacing near the end of a concrete pour as follows:

.1 If a concrete pour ends within 300 mm of a required joint location, average the spacing of last two joints.

.2 If a concrete pour ends within 800 mm of a required joint location, average the spacing of last 3 joints.

3.10 LONGITUDINAL CONSTRUCTION JOINTS

.1 Use 10M deformed tie bars at 1 m spacing and extending 300 mm minimum into both sides of the joint.

3.11 JOINTS ABUTTING EXISTING CURB

.1 Form a 10 mm wide by 30 mm deep slot between the back of curb and the walk or slab.

.2 Fill the slot with a specified joint sealant.

3.12 BACKFILLING

.1 Backfill Material:

.1 If excavation is part of the work, use approved material from site excavation. If excavation is not part of the work, supply fill material approved by the Engineer.

.2 Behind Curb:

.1 Backfill with suitable clay within 7 days of concrete placement and before placing the initial paving course against the curb and gutter, a minimum of 300 mm width behind the curb in two 150 mm lifts. Tamp each lift with mechanical tampers to a minimum 95% of maximum density. Backfill to the top of curb elevation, unless topsoil placement or walk/slab construction immediately follows, in which case leave backfill low to accommodate subsequent work.

.3 Along Slab Edges:

.1 Backfill along the edge of the walk or slab as soon as practical after the removal of concrete forms, allowing for topsoil depth, unless otherwise directed by the Engineer. Tamp with mechanical tampers a minimum 300 mm width along the slab edge to a minimum 92% of maximum density.

.4 Maximum Density:

.1 As used in this Section, is the dry unit mass of sample at optimum moisture content as determined in the laboratory according to ASTM D698 Method A.

3.13 FIELD QUALITY CONTROL

.1 Walk or Slab Surface Tolerances:

.1 Maximum variation under a 3 m straightedge: 6 mm. Maximum variation from walk crossfall: ±1% provided the finished crossfall is not less than 1% nor more than 4%.

.2 Gutter Surface and Curb Top Tolerances:

.1 Maximum variation under a 3 m straightedge: 6 mm.

.3 Grade of Gutter Lip and Walk/Slab Tolerances:

.1 Maximum variation from designated elevation at any station as established from the survey stake: ±6 mm.

.2 Maximum variation from the difference in designated elevations between 2 consecutive stations as established from survey stakes, provided there is positive drainage in the designated direction: ±12 mm.

.4 Lip of Gutter Alignment Tolerances:

.1 Maximum deviation: ±12 mm in 30 m.

.5 **When Tolerances Exceeded:** If any of the tolerances in 3.13.1 to 3.13.4 are exceeded, remove or correct the concrete work in question as directed by the Engineer.

.6 Walk, Median Strip, Slab-on, Ramps or Crossing Thickness:

.1 At the Engineer's request, the Geotechnical Engineer will take one or more sets of cores from suspect concrete walk or crossing, each set comprising 3 cores whose average thickness represents not more than 500 m2 of concrete walk or crossing. If the average core thickness is deficient, that area shall be removed and replaced, at the discretion of the Engineer.

.2 Concrete walk or crossing with excess thickness may be accepted if surface and grade tolerances are met, but no claim for additional payment will be accepted.

3.14 REJECTED CONCRETE WORK

.1 Remove and replace rejected concrete work by full segments or slabs between crack control or construction joints.

3.15 PROTECTION OF FINISHED WORK

.1 Protect finished work from damage. Repair if damaged.

.2 Do not open walk or crossings to traffic until permitted by the Engineer. When opening to traffic, leave walk or crossings clean and free of debris and remove signs and barricades no longer needed.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 32 12 16 – Asphalt Paving.

1.2 SECTION INCLUDES

.1 Supply and placement of pavement markings on hot-mix asphalt concrete.

1.3 SUBMITTALS

.1 Submit product data for traffic marking paint, including MPI product number.

1.4 QUALITY ASSURANCE

.1 Materials and workmanship for new work shall meet or exceed requirements of the APS Manual.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials in sealed original labeled containers bearing manufacturer's name, type of material, brand name, colour designation.

Part 2 Products

2.1 MATERIALS

.1 Materials are specified by the designated MPI systems, with colours specified herein.

.2 Only products listed in the MPI “Approved Product List” are acceptable for use.

2.2 TRAFFIC MARKING PAINT SYSTEM

.1 Yellow Paint: Federal Standard 595, colour #33538; of CSGB colour #505-308.

Part 3 Execution

3.1 PROTECTION OF EXISTING WORK

.1 Protect structures, buildings, sidewalks, landscaping and other surface features against spillage and over-spray during painting operation.

3.2 PREPARATION OF SUBSTRATE

.1 Prepare new pavement in accordance with manufacturer’s instructions and in accordance with "Architectural Painting Specification Manual", Chapter 2, Section 3.

3.3 APPLICATION OF PAVEMENT LINE MARKINGS

.1 Clean pavement surface as recommended by paint manufacturer.

.2 Paint lines straight and in uniform width, at locations indicated on drawings.

.3 Apply paint using marking machine or line stencil, and as recommended by manufacturer, to minimum 0.18 mm dry film thickness.

.4 Line Width:

.1 Roadways and Parking Areas: 100 mm, except where otherwise indicated.

3.4 ADDITIONAL PAVEMENT MARKINGS

.1 Apply additional pavement markings as noted on the Architectural or Civil drawings, such as barrier free parking stall symbols and thermoplastic crosswalk markings.

3.5 CLEAN-UP

.1 Remove spillage and over-spray of paint from pavement, sidewalks, building and other site features. Use methods and materials without damaging and leaving visible residue on substrates.

3.6 PROTECTION OF COMPLETED WORK

.1 Keep traffic off pavement markings for a time as recommended by paint manufacturer.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Supply of all labour, materials and equipment to complete the reinforcing steel required for Sitework Concrete external to the building, excluding structural stoops and aprons, the work, as indicated on the drawings or specified herein.

1.2 SECTION INCLUDES

.1 Section 32 10 00 – Sitework Concrete Forms and Accessories.

.2 Section 32 16 13 – Concrete Curbs, Gutters and Walks.

.3 Section 33 05 16-13 – Concrete for Utility Structures.

1.3 QUALITY ASSURANCE

.1 At least one person thoroughly familiar with the type of material being installed, the referenced standards and the requirements of this section shall direct this portion of the Work.

.2 Install steel reinforcement in accordance with CSA-A23.1 and CSA-W186.

.3 Upon request, provide the Engineer with a certified copy of mill test report of the proposed reinforcing steel, showing physical and chemical analysis, a minimum of 2 weeks prior to ordering of reinforcing steel, or as necessary to facilitate a review.

.4 Upon request, inform the Engineer of proposed source of material to be supplied.

Part 2 Products

2.1 MATERIALS

.1 Reinforcing Steel: billet steel, Grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise. Weldable low alloy steel deformed bars to CAN/CSA-G30.18.

.2 Tie Bars: to CSA-G30.18 grade 300, billet-steel, deformed bars, uncoated; and also to ASTM D3963 for epoxy-coated.

.3 Steel Dowels: to CSA-G30.18, clean, straight, free from flattened or burred ends, uncoated and also to ASTM D3963 for epoxy-coated.

.4 Cold-Drawn Steel Wire: to CSA-G30.3M, uncoated; to ASTM D3963 for epoxy coated.

.5 Welded Steel Wire Fabric: to CSA-G30.5M, uncoated; to ASTM D3963 for epoxy coated.

.6 Chairs, bolsters, bar supports, spacers: adequate for strength and support of reinforcing and live loads during construction conditions.

.7 Tie Wire: Cold-drawn annealed steel to CSA-G30.3.

.8 Epoxy Coating: to ASTM A775/A775M.

.9 Galvanizing: to CAN/CSA-G164.

.10 Plain Round Bars: to CSA-G40.21.

.11 All other materials, not specifically described but required for a complete and proper installation of concrete reinforcement, shall be as selected by the Contractor and be subject to the approval of the Engineer.

.12 Supplementary cementing materials and their use to CAN/CSA-A3000.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1, ACI 315, unless otherwise stated.

.2 Protect epoxy and paint coated portions of bars with covering during transportation and handling.

Part 3 Execution

3.1 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by the Engineer.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.3 Replace bars that develop cracks or splits.

3.2 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on approved drawings and in accordance with CSA-A23.1.

.2 Place sufficient chairs, and supports to adequately maintain the position of the reinforcing steel during placement of concrete, to within tolerances specified in the referenced CSA/CAN guidelines. Use tie wire to prevent the moving or dislodging of reinforcing steel during placement of the concrete.

.3 Use plain round bars as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.

.4 Prior to placing concrete, obtain the Engineer’s approval of reinforcing material placement.

.5 Ensure cover to reinforcement is maintained during concrete pour.

.6 Reinforcing steel, anchor bolts, or other required inserts shall not be inserted into concrete during placement.

3.3 FIELD TOUCH-UP

.1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 – Cast In Place Concrete

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A90/A90M-13, Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

.3 ASTM A121-13, Standard Specification for Metallix-Coated Carbon Steel Barbed Wire.

.4 ASTM A123/A123M-15, Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

.5 A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.6 ASTM C618-15, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

.7 ASTM F1664-08(2013), Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-138.1-96, Fabric for Chain Link Fence.

.2 CAN/CGSB-138.2-96, Steel Framework for Chain Link Fence.

.3 CAN/CGSB-138.3-96, Installation of Chain Link Fence.

.4 CAN/CGSB-138.4-96, Gates for Chain Link Fence.

.3 CSA International

.1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A3000-13, Cementitious Materials Compendium.

.4 Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for concrete mixes, fences, posts and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan.

.2 Submit calculations of construction wastes diverted from the landfill.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and pre-consumer content, and total cost of materials for project.

.2 Submit evidence, when Supplementary Cementing Materials (SCMs) are used, to certify reduction in cement from Base Mix to Actual SCMs Mix, as percentage.

.3 Regional Materials: submit evidence that project incorporates regional materials for project.

.4 Shop Drawings:

.1 Submittal information indicating locations of fence, post, rails, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, elevations, sections, and details of post anchorage, attachment and bracing. Installation procedures and instructions by manufacturer describing all details for a typical fence and gates.

.2 Field Measurements: verify layout information for fences and gates shown on drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect fence and gate materials from damage.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 43 – Environmental Procedures.

.5 Packaging Waste Management: remove for reuse by manufacturer of padding, crates, packaging materials pallets, as specified in Construction Waste Management Plan in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Concrete mixes and materials: in accordance with CSA A23.1 Section 03 30 00- Cast-in-Place Concrete.

- .1 Nominal coarse aggregate size: 20-5.
- .2 Compressive strength: 20 MPa minimum at 28 days.
- .3 Additives: fly ash to CSA A3000 ASTM C618.
- .4 Recycled content: incorporate SCM's in concrete mix.

.2 Chain-link fence fabric: to CAN/CGSB-138.1. Steel Wire Fabric: polymer coated wire, 4.88mm core metal diameter.

- .1 Type 1, Class A, heavy style.
- .2 Height of fabric: full height of fence.
- .3 Mesh Size: 50mm

.3 Posts, braces and rails: to CAN/CGSB-138.2, galvanized steel pipe with black vinyl coating. Dimensions as indicated.

.4 Bottom and Top tension wire: to CAN/CGSB-138.2, single strand, vinyl coated steel wire, black.

.5 Tie wire fasteners: vinyl coated.

.6 Tension bar: to ASTM A653/A653M, 5 x 20 mm minimum galvanized steel.

.7 Gate frames: to ASTM A53/A53M, galvanized steel pipe, standard weight 45 mm outside diameter pipe for outside frame and interior bracing.

- .1 Fabricate gates as indicated with electrically welded joints, and painted with zinc pigmented paint after welding.
- .2 Fasten fence fabric to gate with twisted selvage at top.
- .3 Furnish gates with galvanized malleable iron hinges, latch and latch catch with provision for padlock which can be attached and operated from either side of installed gate.
- .4 Furnish double gates with chain hook to hold gates open and centre rest with drop bolt for closed position.

.8 Fittings and hardware: to CAN/CGSB-138.2, ductile cast iron galvanized steel cast aluminum alloy malleable.

- .1 Tension bar bands: 3 x 20 mm minimum galvanized steel or 5 x 20 mm minimum aluminum.
- .2 Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail.
- .3 Include projection with clips or recesses to hold 3 strands of barbed wire spaced 100mm apart.
- .4 Projection of approximately 300mm long to project from fence at 45 degrees above horizontal.
- .5 Turnbuckles to be drop forged.

.9 Organic zinc rich coating: to MPI #18 CAN/CGSB-1.181.

2.2 FINISHES

.1 Vinyl coating: to ASTM F1664.

.1 0.045mm dry film thickness minimum, colour black.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for fence and gate installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent sediment and erosion control drawings requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

.2 Grading:

.1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.

.1 Provide clearance between bottom of fence and ground surface of 30mm to 50mm.

3.3 ERECTION OF FENCE

.1 Erect fence along lines as indicated as directed by Consultant and to CAN/CGSB-138.3.

.2 Excavate post holes to dimensions indicated Space line posts 3m apart, measured parallel to ground surface.

.3 Space straining posts at equal intervals not to exceed 150m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade, is greater than 150m.

.4 Install additional straining posts at sharp changes in grade and where directed by Consultant.

.5 Install corner post where change in alignment exceeds 10 degrees.

.6 Install end posts at end of fence and at buildings.

.7 Place concrete in post holes then embed posts into concrete to depths indicated.

.1 Extend concrete 50mm above ground level and slope to drain away from posts.

.2 Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.

.8 Install fence fabric after concrete has cured, minimum of 5 days.

.9 Install brace between end and gate posts and nearest line post, placed in centre of panel and parallel to ground surface.

.1 Install braces on both sides of corner and straining posts in similar manner.

.10 Install top rail between posts and fasten securely to posts and secure waterproof caps and overhang tops.

.11 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.

.12 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 300mm intervals.

.1 Knuckled selvedge at bottom.

.2 Twisted selvedge at top.

.13 Secure fabric to top rails, line posts and bottom tension wire with tie wires at 450mm intervals.

.1 Give tie wires minimum two twists.

3.4 TOUCH UP

.1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas as indicated in accordance with Section 09 91 13- Exterior Painting.

.1 Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1

Part 2

Part 3

Part 4

Part 5

Part 6

Part 7

Part 8

Part 9

Part 10

Part 11

Part 12

Part 13

Part 14

Part 15

Part 16

Part 17

Part 18

Part 19 General

19.1 RELATED REQUIREMENTS

.1 Section 03 30 00 – Cast In Place Concrete

19.2 REFERENCES STANDARDS

.1 ASTM International:

.1 ASTM A641/A641M-09a(2014), Standard Specification for Zinc-Coated (Glavanized) Carbon Steel Wire.

.2 ASTM A787/A787M-15a, Standard Specification for Electric-Resistance-Welded Metallic-Coated Carbon Steel Mechanical Tubing.

19.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: Submit manufacturer's instructions, material descriptions, construction details, dimensions of individual components and profiles, and finishes for each of the fencing components.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan.

.2 Submit calculations of construction wastes diverted from the landfill.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and pre-consumer content, and total cost of materials for project.

.2 Submit evidence, when Supplementary Cementing Materials (SCMs) are used, to certify reduction in cement from Base Mix to Actual SCMs Mix, as percentage.

.3 Regional Materials: submit evidence that project incorporates regional materials for project.

.4 Shop Drawings:

.1 Submittal information indicating locations of fence, post, rails, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, elevations, sections, and details of post anchorage, attachment and bracing. Installation procedures and instructions by manufacturer describing all details for a typical fence and gates.

.2 Field Measurements: verify layout information for fences and gates shown on drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

19.4 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Handling Requirements: Store materials to permit easy access for review and identification; keep components off ground by using pallets, platforms, or other supports; protect posts, fences and packaged materials from erosion and deterioration, and as follows:

.1 Store fasteners in a protected place

.2 Do not store materials on structure in manner that might cause distortion or damage to members or supporting structures

.3 Repair or replace damaged materials or structures as directed

Part 20 Products

20.1 COATINGS

.1 The wire meshes is coated with 150 g/m2 (0.5 on./ft.2) zinc in conformity with ASTM A641.

.2 Fence posts are zinc coated (galvalume process) – 0.27kg/m2 (0.90 oz/ft.2) as per ASTM A787.

.3 A polyester surface coating shall be a standard color black. Polyester coating to be minimum 4 mils applied by an electrostatic method. Coating shall cover all components and surfaces of the wire fence, post sections, etc.

.4 Finishes indicated are applicable to both fence material and gate material and gate frame.

20.2 MATERIALS

.1 "OMEGA ARCHITECTURAL" or approved substitution

.2 Steel Mesh Fence Panels: 2464 mm high x 2356 mm wide c/w 3 folds, welded 6 gauge - 4.9 mm pre-galvanized steel wire, welded at each crossing to form rectangles of 50 mm x 150 mm. The cold rolled wire shall have a tensile strength of at least 515 Mpa and a 985 kg break strength. Applied on wire, 150g/m2 zinc coating conforming to the ASTM A641, Class 1. One end of the vertical wires of the panel shall exceed 25 mm from the last or first horizontal wire thereby creating a spiked top or bottom depending of its position when installed. The other end is cut flush. A 4-mil polyester powder coating is applied on the mesh panel after fabrication. Panels shall have a number of folds according to the table below depending on the respective height of the panel:

.3 Profile Posts: 76 mm x 76 mm x 2440 mm high above finished grade, set in concrete pile, "Omega" profile flange post of 16 gauge cold-rolled pre-galvanized steel and powder coated finish. Provide Special Panel Fitting "SPF" kits to connect panels to adjacent materials.

.4 Provide custom gate posts 152 mm x 152 mm x 2440 mm. Match look of adjacent fence construction as detailed on drawings. Gate posts to be installed in locations and concrete pile construction required for future gate installation as per recommendations of the manufacturer. Three (3) gate posts and piles required for single cantilever slide gate. Four (4) gate posts and piles required for double cantilever slide gate.

.5 Future gates to be power sliding cantilevered gates with one operator per sliding gate. South gate will be a single cantilever sliding gate. Northwest gate will be double cantilever sliding gates.

.6 Conduits to be roughed in below grade for future power requirements for gates. Provide junction box at top of concrete piles for future gate access. Provide wiring rough-in between gate related control stations to junction box on pile.

Part 21 Execution

21.1 INSTALLATION

.1 Set in undisturbed or compacted soil.

.2 Post Setting: Set posts in concrete pile footing - Refer to Details. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during placement and finishing operations until concrete is sufficiently cured.

.1 Dimensions and Profile: As indicated on drawings.

.2 Space line posts uniformly at centre to centre.

.3 Exposed concrete footings: extend concrete 50 mm above grade, smooth and shape to shed water.

.3 Terminal Posts: Locate terminal end and corner posts at changes in vertical alignment.

.4 Fasten to concrete standards where indicated using manufacturer standard brackets and concrete anchors.

.5 Post holes shall be minimum 250 mm diameter and 1850 mm deep. Once concrete is set, install mesh sections with Omega bracket. Space posts in accordance with manufacturer's requirements, coordinate with Drawings.

.6 Mesh Panels: Vertical wire extensions pointing down for safety. The fence panel shall be installed a distance of a minimum of 30 mm and maximum of 50 mm above the ground surface.

.7 Upon cutting or trimming, a post or a wire mesh section, apply a zinc rich primer to the exposed ends and finish with the matching touch-up paint supplied by the manufacturer.

.8 Apply all fence installation instructions equally to installation of fence mesh panels to power operating gates and gate frames.

.9 Install gate operators and accessories specified in layout configuration indicated on drawings. Complete installation in accordance with manufacturers recommendations and instructions. Provide rough-ins for power and central control rough-in provisions.

21.2 CLEANING

.1 Clean in accordance with Section 01 74 11 Cleaning.

.1 Remove waste materials and transport packaging from site.

.2 Waste Management: separate waste material in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

END OF SECTION

1. General

1.1 RELATED REQUIREMENTS

.1	Section 32 92 19	Seeding
.2	Section 32 92 23	Sodding
.3	Section 32 93 00	Landscape Planting

1.2 SUBMITTALS

.1 Submittal Procedures. Submit the following, for Consultant's review and approval as applicable:

.1 Imported Topsoil: provide samples from each source intended for use. Samples shall weigh about 500 g and be packaged in clean containers. Provide the following information with topsoil sample: location of topsoil source, previous land use, and date of sampling. Sample shall be typical of the topsoil lot to be supplied and provide an accurate indication of colour, texture and organic content.

.2 Original copy of each soil analysis report for approval before delivering any topsoil to site.

.3 Copies of all permits and licenses as applicable to work of this contract.

.4 Site supervisor's credentials submitted prior to commencement of work.

1.3 SOIL ANALYSIS

.1 Imported Soil: Contractorwill arrange and pay for services of accredited testing laboratory to perform horticultural soil analysis on each source of topsoil supplied by Contractor.

.2 Contractor shall be responsible for ensuring all samples of imported soil are submitted for testing well in advance of commencement of work. Imported topsoil shall not be placed on site until approved by Consultant.

.3 Soil analysis for horticultural use shall include results for: existing major soil nutrients; soil pH value; total soluble salts (electrical conductivity); percentage of organic matter; soil texture and percentage of sand, silt and clay; nutrient recommendations; and recommendations for soil amendments.

.4 Consultant reserves the right to inspect and evaluate all sources of soil selected by Contractor.

.5 Submit original copy of soil analysis report to Owner as required.

.6 Perform and pay for additional soil tests to confirm compliance with recommendations of soil analysis for soil amendments, where applicable. Owner will randomly select various locations to be tested.

1.4 SOURCE OF TOPSOIL SUPPLY

.1 Only use imported topsoil meeting specified requirements.

1.5 QUALITY ASSURANCE

.1 Contractor experienced and knowledgeable in landscape work of contract.

.2 Site Supervisor: competent, experienced and knowledgeable to direct and supervise all staff and work of contract. Supervisor shall possess a Landscape Journeyman Gardner certification or other similar qualification acceptable to Owner. Submit supervisor's credentials for Owner's approval prior to commencement of work.

.3 Staffing: provide experienced, competent and trained landscape personnel who will perform all tasks and services in a knowledgeable and professional manner. Workers shall act safely and professionally at all times while working on site. Contractor shall not assign any worker that the Owner deems incompetent, careless, insubordinate, or otherwise objectionable to work on site.

.4 Contractor shall be responsible for ensuring that contract specifications are being adhered to. Failure of the Owner to immediately reject unsatisfactory workmanship or to notify the Contractor of their deviation from the specification shall not relieve the Contractor of their responsibility to repair and/or replace unsatisfactory work.

.5 Contractor shall obtain approvals as required by contract for suppliers, sub-contractors, and all materials.

.6 Pre-Construction Conference: prior to commencement of work, Contractor shall meet with Owner to review overall work of contract.

1.6 EXAMINATION

.1 Contractor shall advise Owner, in writing, of any conditions or defects encountered on site before or during construction upon which the work of this section depends and which may adversely affect its performance.

.2 Do not commence work until these conditions or defects have been evaluated by the Owner and corrective measures taken.

.3 Commencement of work shall imply acceptance of existing surfaces and conditions. No claims for damages or extras resulting discovering such conditions or defects will be accepted later, except where such conditions could not have been known prior to commencing work.

2. Products

2.1 MATERIALS

.1 Topsoil: fertile natural loam, capable of sustaining healthy growth. Topsoil to be loose and friable, free of subsoil, clay lumps, stones in excess of 20 mm, live plants, roots or any other deleterious material greater than 20 mm diameter, free of litter, foreign matter and toxic materials harmful to plant growth. Topsoil containing construction debris, sod clumps, quackgrass or other noxious weeds is not acceptable. Topsoil to meet the following requirements:

.1 Minimum 6% organic matter.
.2 Acidity/alkalinity shall range from 5.9 pH to 7.0 pH.
.3 Electrical Conductivity (E.C.) - level of soluble salts shall not exceed 1.5 dS/m.
.4 Texture: "Loam Topsoil" in accordance with *Canadian System of Soil Classification*. Topsoil to fall within an allowance of ±2% of the values stated in the table below:

Soil	Sand (%)	Silt (%)	Clay (%)	Class
Topsoil	35	35	30	Loam

.2 Peat Moss: decomposed plants, fairly elastic and homogeneous, free of decomposed colloidal residue, wood, sulphur and iron. Minimum of 80% organic matter by mass, pH value between 4.5 and 6.0. Furnished in an air-dry state, packed in standard bags or bales showing name of manufacturer.

.3 Sand: washed course sand, medium to course textured, free of impurities, chemical or organic matter.

.4 Lime: dry ground agricultural limestone containing minimum 85% of total carbonates meeting gradation requirements: percentage passing by weight – 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

.5 Sulphur: finely crushed agricultural elemental sulphur, free of impurities.

3. Execution

3.1 VERIFICATION OF CONDITIONS

.1 Inspect and verify that rough subgrade preparation and elevations conform to specified requirements before proceeding with work of this section.

.2 If discrepancies occur, notify Owner. Do not commence work until base conditions are corrected as instructed by Owner.

3.2 PROTECTION OF EXISTING WORK

.1 Exercise caution against injury to, or defacement of, existing conditions. Repair or replace all items and site features damaged from installation operations to original or better condition at Contractor's own expense.

.2 Locate utility lines before commencement of work and protect from damage.

3.4 PREPARATION OF SUBGRADE

.1 Remove foreign material, debris, roots, branches, stones in excess of 25 mm diameter, and other deleterious materials. Remove subsoil contaminated with toxic materials or petroleum products. Remove foreign debris that protrudes above subsoil surface.

.2 Dispose of removed materials off site. Do not bury any foreign material beneath areas to be landscaped.

.3 Grade and finish subgrade to required levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas. Eliminate uneven areas and low spots, ensuring positive drainage. Finish subgrades to:

.1 150 mm below final grade for seeded / sodded areas.

.4 Cultivate subgrade area to minimum depth of 75 mm where topsoil will be placed. Scarify or till subsoil using discs, harrows or other suitable equipment that will loosen subsoil before placing any topsoil. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted subgrade soil.

3.5 PLACEMENT AND SPREADING OF TOPSOIL

.1 Do not place and spread topsoil until Owner has approved subgrade preparation.

.2 Place topsoil in dry weather on loose, friable, and graded subgrade surface. Do not spread topsoil when ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the Work, as determined by Owner.

.3 Evenly spread topsoil to a uniform depth, which, after settlement and compaction, shall provide a minimum depth of:

.1 150 mm depth for seeded / sodded areas.

.4 Manually spread topsoil around trees, plants and surface obstacles to prevent damage.

3.6 PREPARATION OF FINAL GRADE

.1 Remove all surface debris, stones in excess of 20 mm diameter, soil clods, vegetation, roots, grass and weeds, litter and other foreign debris. Dispose of collected materials off site.

.2 Fine grade and loosen topsoil. Eliminate rough spots and low areas to ensure positive drainage away from building faces and walkways. Prepare a loose friable bed by means of cultivation and subsequent raking. Maintain levels, profiles and contours of subgrade.

.3 Float and leave surfaces smooth, uniform, and sufficiently firm against deep foot printing with a fine loose texture. Finish surface shall be clean, even and free from irregular surface changes.

.4 On larger surfaces, use hydraulic power box rake or similar mechanical equipment that will effectively and efficiently remove soil lumps, rocks and debris; fill and level low areas; and correct other grading deficiencies.

.5 Keep topsoil 25 mm below finish grade for sodded areas adjacent to walkways, curbs, edging materials, other hard surfaces and crown of adjacent existing turf. Elsewhere, bring topsoil up to finished grade.

.6 Do not cover catch basins, valve covers or manholes. Cut smooth falls to catch basin rim, finish flush. Provide smooth transitions at top and bottom of slopes.

.7 Grading work shall not be performed when moisture content of soil is such that excessive compaction will occur, or when soil is so dry that clods will not break readily or dust will form in

the air. Apply water as required to prevent the formation of an airborne dust nuisance and to provide ideal soil moisture content for tilling.

.8 Ditches: finish ditches and swales to ensure proper flow and drainage. Conduct final rolling operations to produce a hard, uniform and smooth cross-section.

3.7 SOIL AMENDMENTS

.1 Apply and evenly spread soil amendments at specified rate as recommended in soil analysis report.

.2 Mix soil amendment well into full depth of topsoil. Retest amended topsoil to confirm compliance with soil analysis report.

3.8 PROTECTION OF GRADED AREAS

.1 Protect newly graded areas from traffic and erosion. Keep site clean.

.2 Repair and reestablish grades in settled, eroded and rutted areas.

3.9 ACCEPTANCE

.1 Owner will inspect and test topsoil in place and determine acceptance of material, depth and finish grading.

3.10 CLEAN-UP

.1 Clean up, immediately, any soil or debris spilled onto roads, walkways and other finished surfaces. Keep site clean and tidy at all times.

.2 Excess topsoil not required for landscape use on site shall be removed off site by Contractor.

END OF SECTION

1. General

1.1 RELATED REQUIREMENTS

.1 Section 32 91 19 Topsoil Placement and Grading
.2 Section 32 99 00 Exterior Landscape Maintenance

1.2 SUBMITTALS

.1 Submit the following for Consultant's review and approval as applicable:

.1 Submit 500 g sample of each seed mixture intended for use. Submit samples in clean containers with label identifying project, seed sample and lot number, supplier and date. Seed mix sample shall match tested seed lots.

.2 Certificate(s) of analysis of each seed sample. Seed analysis report shall be current and show specie and variety of seed, date and results of all tests.

.3 All original seed labels and seed bags at completion of seeding to confirm amount of seed used on site.

.4 Submit other required information and documents as requested or specified.

.5 Fibre mulch and tackifier manufacturer's product data, installation instructions and application rate for approval.

.6 Written documentation for approval before commencing work regarding:

.1 Type and volume capacity of hydraulic seeding and mulching equipment in litres.
.2 Amount of each material in kilograms and including water in litres to be used per tank based on volume to achieve required application rate.
.3 Number of tankloads required per hectare to apply specified slurry mixture per hectare.

1.3 QUALITY ASSURANCE

.1 Contractor: experienced and knowledgeable in landscape work of contract.

.2 Site Supervisor: competent, experienced and knowledgeable to direct and supervise all staff and work of contract. Supervisor shall possess a Landscape Journeyman Gardner certification or other similar qualification acceptable to Consultant. Submit supervisor's credentials for Consultant's approval prior to commencement of work.

.3 Staffing: experienced, competent and trained landscape personnel who will perform all tasks and services in a knowledgeable and professional manner. Workers shall act safely and professionally at all times while working on site. Contractor shall not assign any worker that the Consultant deems incompetent, careless, insubordinate, or otherwise objectionable to work on site.

.4 Contractor shall be responsible for ensuring that contract specifications are being adhered to. Failure of theConsultant to immediately reject unsatisfactory workmanship or to notify the Contractor of their deviation from the specification shall not relieve the Contractor of their responsibility to repair and/or replace unsatisfactory work.

.5 Contractor shall obtain approvals as required by contract for suppliers, sub-contractors, and materials.

1.4 EXAMINATION

.1 Contractor shall advise Consultant, in writing, of any conditions or defects encountered on site before or during construction upon which the work of this section depends and which may adversely affect its performance.

.2 Do not commence work until adverse conditions or defects have been evaluated by the Owner and corrective measures taken.

.3 Commencement of work shall imply acceptance of existing surfaces and conditions and no claims for damages or extras resulting from such conditions or defects will be accepted later, except where such conditions could not have been known prior to commencing work.

1.5 DELIVERY AND STORAGE

.1 Fertilizer: shall be delivered in sealed packages, clearly marked with contents, weight, analysis and name of manufacturer.

.2 Grass seed: deliver in original package and store in dry location protected from the elements and rodents. Each seed package to contain suppliers label indicating:

.1 Analysis of seed mixture.
.2 Percentage of pure seed by weight.
.3 Year of production.
.4 Net mass.
.5 Date tagged and location of seed supplier.

.3 Mulching material: deliver and store in original packages and protect from the elements.

1.6 SEED TESTING

.1 Consultant may appoint and pay for services of testing laboratory to verify seed conformance to specified requirements.

1.7 MAINTENANCE PERIOD

.1 Maintain seeded areas from time of seeding until minimum one year after Date of Interim Acceptance of the landscape portion of Work in Contract.

1.8 WARRANTY

.1 Contractor shall provide warranty for all seed, related works and other materials for a minimum period of one year. Warranty period shall commence from date of Interim Acceptance of the landscape portion of Work in Contract.

2. Products

2.1 MATERIALS

.1 Fertilizer: synthetic fertilizer, granular in composition, minimum 50% of elements derived from organic sources.

.2 Grass seed: certified Canada No. 1 seed, free of disease, weed seeds or other foreign materials in accordance with the Canada "Seeds Act" and "Seeds Regulations" and having minimum purity of 97% and germination of 75%.

.3 Water: clean, fresh, and free of substances or matter that would inhibit vigorous and healthy growth of grass.

.1 Contractor shall supply clean water, equipment, methods of transportation, water tanker, hoses, attachments, and other accessories as necessary for all seeding requirements, maintenance and other related work.

.2 All costs for supply of water incurred during the contract period shall be borne by Contractor.

.3 Tackifier: non-toxic, water dilutable, liquid dispersion, mulch binder free of growth or germination inhibiting factors.

.4 Fibre mulch: wood or wood cellulose fibre meeting following requirements:

.1 Free of growth or germination inhibiting ingredients.
.2 Specially manufactured for use in hydraulic seeding and mulching equipment.
.3 Minimum organic matter content of 95%.
.4 Minimum moisture content of 12%.
.5 Water absoption potential of 800-900% for wood cellulose fibre mulch and 1200-1350% for wood fibre mulch.

.5 Erosion Control Blanket:

.1 Coconut blanket: made from natural coconut fibers, stitch-bonded between two photodegradable natural organic fiber nettings.

.6 Staples: 25 mm wide by 200 mm deep by 3 mm diameter steel wire.

.7 Biodegradable Pins: biodegradable pins 13 mm wide and 150 mm long.

2.2 GRASS SEED MIXTURE

.1 Seed mixture 'B'
35% Kentucky bluegrass blend,
40% Creeping red fescue blend,
15% Chewing red fescue,
10% Perennial ryegrass blend.

.2 Substitutions to specified seed species and variety require approval of Consultant before sowing. Contractor shall submit documentation from seed supplier verifying unavailability of any specified seed specie and variety with recommendations.

.3 Consultant may adjust specified seed mixture after topsoil test analysis results are received, with no change in Contract Price.

3. Execution

3.1 FERTILIZING

.1 Apply fertilizer prior to seeding after final grade is approved by Consultant.

.2 Apply 16-32-6fertilizer evenly at 3 kg/100 m^2 with calibrated mechanical distributor.

.3 Lightly rake and incorporate fertilizer into upper 50 mm of topsoil.

3.2 MECHANICAL SEEDING

.1 Obtain Consultant's approval of seedbed finish grades, final tilth, surface flatness and fertilizer application before seeding.

.2 No seeding shall be done on frozen soil or when conditions are not favourable for successful seed germination.

.3 Sow at minimum rate of 3 kg/100 m^2, during calm weather and when soil moisture content is adequate for germination.

.4 Drill Seeding: apply seed using a mechanical dry spread "Brillion Seeder" that places seed at specified depth and rate and rolls in a single operation.

.5 Broadcast Seeding: use manually operated broadcast seeder only for small specific locations and areas inaccessible to brillion seeding.

.6 Sow seed in two directions, 50% of seed in one direction and remaining 50% of seed at right angles to first seeding pattern, using same method of seeding.

.7 Cover broadcasted seed by raking and chain harrowing.

.8 Roll seeded grass with roller not exceeding 50 kg where uneven soil conditions warrant.

.9 Water entire area with fine spray after each area has been sown. Apply water where application of water is practical and will not interfere with other work.

.10 Apply enough water to ensure penetration of at least 50 mm, avoid washing out seeds.

3.3 HYDRO-MULCHING

.1 Proceed with hydromulching of seed areas after all mechanical seeding has been completed. Obtain Consultant's approval prior to hydro-mulching.

.2 Mix fibre mulch with clean water, according to manufacturer's recommendations, and apply to seeded areas at minimum rate of 2250 kg/ha or 22.5 kg/100m2.

.3 Add and mix tackifier into slurry of water and fibre mulch and apply according to manufacturer's instructions and recommendations.

.4 Using hydro-mulching equipment, apply fibre mulch slurry mixture within 24 hours of mechanical seeding. Achieve uniform coverage after application.

3.4 HYDRO-SEEDING AND MULCHING

.1 Proceed with hydro-seeding only after final grade has been approved by Consultant.

.2 No hydro-seeding shall be performed when wind speeds exceed 10 km/h, over frozen soil, or on ground covered in snow, ice or standing water. Hydro-seed only when conditions are favourable for successful seed germination.

.3 One-Step Hydraulic Seeding and Mulching:

.1 Throughly mix grass seed, fertilizer, fibre mulch and water to obtain following slurry mixture and application rates per hectare:

.1 Grass Seed – minimum 300 kg/ha.
.2 Fertilizer -12-51-0at 300 kg/ha.
.3 Fibre Mulch – minimum 1600 kg/ha2250 kg/ha.
.4 Clean Water – minimum 32,000 litres and to fibre mulch manufacturer's recommendations.

.2 Add tackifier directly into slurry mixture and thoroughly mix at rate recommended by manufacturer. Apply tackifier as required according to manufacturer's instructions.

.3 Using appropriate hydraulic hydro-mulching equipment, apply slurry mixture uniformly at optimum angle of application.

.4 Use proper nozzles for application and provide hose extensions to propel mulch slurry to inaccessible areas.

.5 Re-apply slurry mixture where application is not uniform.

.6 Agitate slurry mix constantly during spraying to keep it homogeneous and avoid blockage to pipes.

.4 Alternative - Two-Step Hydraulic Seeding and Mulching:

.1 Mix grass seed and fertilizer with sufficient water and apply with hydraulic seeder to obtain same rate of application as one-step method of hydro-seeding.

.2 Apply fibre much immediately following seeding. Mix fibre mulch in water for minimum application of 1600 kg/ha or 2250 kg/ha as directed.

.3 Add and mix tackifier into slurry of water and fibre mulch and apply as required according to manufacturer's instructions.

.4 Using hydraulic hydro-mulching equipment, apply fibre mulch slurry mixture to form a uniform and strong moisture retaining mat.

.5 Avoid spraying structures, signs, fences, utilities and plant material. Clean and remove mulch sprayed where not intended.

.6 Area seeded shall not exceed area which can be mulched on same day.

3.5 PROTECTION OF SEEDED AREAS - GENERAL

.1 Contractor shall provide adequate protection to protect seeded areas from all damage, disturbance, or other construction activity after seeding operations are complete. Remove protection after seed areas are properly established or as directed by Consultant.

.2 Damaged seed areas resulting from inadequate protection shall be promptly repaired with topsoil, fertilizer and seed at Contractor's expense. All damages shall be repaired prior to final acceptance.

.2 Keep site well drained and landscape excavations dry.

3.6 SEED PROTECTION ON SLOPES AND DITCHES

.1 Cover all prepared and seeded slopes 3:1 or steeper with erosion control blanket.

.2 Unroll blanket either horizontally or vertically to the slope without stretching or pulling.

.3 Lay blanket smoothly on soil surface. Overlap adjacent sections of blanket minimum 100 mm and staple.

.4 Secure blanket to ground with staples in accordance with erosion control blanket manufacturer's instructions.

.5 Minimize damage to seedbed during installation of blanket. Regrade by hand raking as required, to correct any damage.

.6 In ditches and swales, unroll blanket in direction of flow. Overlap adjacent sections of blanket minimum 100 mm with upstream section on top and stapled. Follow manufacturer's installation recommendations.

3.7 FINAL ACCEPTANCE AND TERMINATION OF MAINTENANCE

.1 Consultant may accept work at end of maintenance period provided:

.1 Seeding work meets requirements of specifications.
.2 Seeded areas are properly, uniformly and well established.
.3 Seeded grass areas are free of dead, unhealthy or deteriorated areas; bare, burnt or thin spots; and rutted or eroded areas.
.4 Seeded areas are free of all noxious weeds and reasonably free of all other weed growth.
.5 Minimal surface soil is visible when grass cut to height of 70 mm or as otherwise required for native grass.
.6 Seeded grass areas have been fertilized as specified.
.7 Seeded grass areas are clean and free of all debris, litter and other foreign matter.

.2 Contractor shall use specified materials to reestablish seed installations that do not comply with requirements for acceptance and continue with specified maintenance/establishment until deemed acceptable by Consultant.

3.8 CLEAN-UP AND REPAIRS

.1 During work of contract, keep all hard and soft surfaces clean and tidy. Sweep and wash all walkways and other pavement surfaces to maintain clean appearances. Clear soil and rubble from catch basins, manholes, valves and other hard surface features.

.2 Collect all litter and other debris from site during work of contract.

.3 Remove and dispose of excess materials, litter, plant debris at approved disposal site. Contractor shall be responsible for all disposal costs.

.4 Repair all damages resulting from Work of this Contract.

END OF SECTION

1. General

1.1 RELATED REQUIREMENTS

.1 Section 32 91 19 Topsoil Placement and Grading
.2 Section 32 99 00 Exterior Landscape Maintenance

1.2 REFERENCE DOCUMENTS

.1 *Canadian Standards for Nursery Stock - (Nursery Sod)*: latest edition by the Canadian Nursery Landscape Association (CNLA).

1.3 SUBMITTALS

.1 Submit the following, for Consultant's review and approval as applicable:

.1 Name and location of sod supplier including certification for grass species.

.2 Site supervisor's credentials for approval. Submit information minimum two weeks prior to commencement of work.

.3 Work schedule showing approximates dates for commencement and completion of each item of work. Submit prior to commencement of work.

.4 Copies of all permits and licenses as applicable to work of this contract.

.5 Submit all other required information and documents as requested or specified.

1.4 QUALITY ASSURANCE

.1 Contractor: experienced and knowledgeable in landscape work of contract.

.2 Site Supervisor: competent, experienced and knowledgeable to direct and supervise all staff and work of contract. Supervisor shall possess a Landscape Journeyman Gardner certification or other similar qualification acceptable to Consultant. Submit supervisor's credentials for Consultant's approval prior to commencement of work.

.3 Staffing: experienced, competent and trained landscape personnel who will perform all tasks and services in a knowledgeable and professional manner. Workers shall act safely and professionally at all times while working on site. Contractor shall not assign any worker that the Consultant deems incompetent, careless, insubordinate, or otherwise objectionable to work on site.

.4 Contractor shall be responsible for ensuring that contract specifications are being adhered to. Failure of the Consultant to immediately reject unsatisfactory workmanship or to notify the Contractor of their deviation from the specification shall not relieve the Contractor of their responsibility to repair and/or replace unsatisfactory work.

.5 Contractor shall obtain approvals as required by contract for suppliers, sub-contractors, and materials.

1.5 EXAMINATION

.1 Contractor shall advise Consultant, in writing, of any conditions or defects encountered on site before or during construction upon which the work of this section depends and which may adversely affect its performance.

.2 Do not commence work until adverse conditions or defects have been evaluated by the Consultant and corrective measures taken.

.3 Commencement of work shall imply acceptance of existing surfaces and conditions and no claims for damages or extras resulting from such conditions or defects will be accepted later, except where such conditions could not have been known prior to commencing work.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Use all means necessary to protect all materials before, during and after installation, and to protect the installed work and materials of other contractors.

.2 Packaged materials shall be delivered in sealed containers clearly marked with contents, weight, analysis and name of manufacturer.

.3 Schedule deliveries in order to keep storage at site to a minimum without causing delays.

.4 Protect sod during transportation with tarpaulin from drying out. Unload and store sod on pallets. Keep sod moist and cool until installed

.5 Deliver sod to site within 24 hours of being harvested. Install all sod within 36 hours of being harvested.

.6 Dried out, damaged, deteriorated and unhealthy sod is not acceptable. Broken or irregular pieces of sod are not acceptable. Promptly remove all unacceptable sod from site.

1.7 WARRANTY

.1 Contractor shall provide warranty for all sod, related works and other materials for a minimum period of one year. Warranty period shall commence from date of Interim Acceptance of the landscape portion of Work in Contract.

2. Products

2.1 MATERIAL

.1 Fertilizer: synthetic fertilizer, granular in composition, minimum 50% of elements derived from organic sources.

.2 Nursery Sod: certified number one turfgrass sod of premium grade. Sod shall comply with standards outlined in current edition of “Canadian Standards for Nursery Stock - (Nursery Sod)”, published by the Canadian Nursery Landscape Association.

.1 Permeated with a strong fibrous root system; be freshly cut and in good healthy condition with no decay or bare spots; be uniform in texture and free from weeds, undesirable native grasses and foreign debris; and contain adequate moisture to maintain its vitality during transportation and placement.

.2 Grown on fertile topsoil, by a sod producer specializing in sod production and harvesting. Sod shall be 18 to 24 months in age prior to harvesting. Submit sod certification for grass species and location of source.

.3 Broken, dry, deteriorated, damaged and discoloured sod shall be rejected.

.4 Thickness of soil portion of nursery sod shall be 15 mm.

.3 Water: clean, fresh, and free of substances or matter that would inhibit vigorous and healthy growth of grass.

.1 Contractor shall supply clean water, equipment, methods of transportation, water tanker, hoses, attachments, and other accessories as necessary to adequately apply water to all sodded areas and for other work in contract.

.2 All costs for supply of water incurred during the contract period shall be borne by Contractor.

.4 Staples: u-shaped steel wire staples, 150 mm to 200 mm in length as recommended by manufacturer of geotextile fabric material.

.5 Geotextile Fabric: biodegradable square netting for slope reinforcement.

.6 Biodegradable Pegs: 17 mm x 8 mm x 200 mm.

.7 Wood Pegs: of sufficient size and length to ensure anchorage of sod on slope.

2.2 SOD TYPE

.1 Drought Tolerant Fescue Sod: Sod grown from certified Canada No. 1 fescue grass seeds. Seed mixture shall be a 100% mixture of Creeping red fescue, Chewing fescue, Hard fescue and Sheep fescue grass seeds.

3. Execution

3.1 FERTILIZING

.1 Apply fertilizer prior to sodding, after final grade is approved by Consultant.

.2 Apply 16-32-6]or other similar granular starter fertilizer evenly at 3 kg/100 m^2 using a calibrated mechanical distributor.

.3 Lightly rake and incorporate fertilizer into topsoil.

3.2 LAYING SOD

.1 During progress of work, Consultant will inspect Contractor's workmanship and performance to ensure compliance with specifications.

.2 Obtain Consultant's approval of sodbed finish grades, final tilth, surface flatness and fertilizer application before laying sod.

.3 Firm sodbed by rolling before laying sod as necessary. Lightly moisten and rake soil prior to laying sod.

.4 Do not perform work during hot and dry conditions, or when ground is frozen or covered in snow or during times of unfavourable climatic conditions.

.5 Lay sod smooth and even; butt sod pieces close and tight with no open joints visible. Stagger end joints 30 cm minimum between adjacent rows to avoid continuous seams. Do not stretch or overlap sod pieces.

.6 Finish sod edges at walks, curbs, planting, mulch edges, manholes, and other vertical surface by cutting neatly and fitting tightly to edge and line.

.7 Lay sod smooth and flush with adjoining grass areas, curbs, walk and pavement. Where new sod abuts existing turf, cut edge of existing grass with sharp tool to form a straight line. Level subgrade and butt new sod tight and flush with existing grass. Adjacent to hard surfaces, finish grade of new sod installation shall match finish grade of existing hard surface.

.8 Protect subgrade and sod from damage during installation.

.9 Where large big rolls of sod are placed, remove reinforcement netting used to assist in harvesting and/or placement of sod roll before final sod placement.

.10 Cut and remove all irregular, unhealthy and thin sections of sod with a sharp knife and install new replacement sod.

.11 Water in sufficient quantities to obtain moisture penetration through sod and into upper 100 mm of topsoil immediately after laying sod.

.12 After sod and soil have dried from initial watering, roll newly laid sod using a mechanical roller having adequate weight. Roll sod to ensure good contact with topsoil, to eliminate air pockets, remove minor depressions and irregularities, and to form a smooth even surface. Heavy rolling to correct irregularities in grade is not acceptable. Sod adjacent to existing fixtures shall be thoroughly tamped.

3.3 LAYING SOD ON SLOPES

.1 On sloped areas 3:1 and steeper, lay sod perpendicular to slope and secure with wooden pegs. Place 4 to 6 wooden pegs/m^2, to prevent shifting of sod. Drive pegs flush with sod surface. Initiate sod installation from bottom of slope.

.2 Prior to placing sod on steep slopes where erosion may occur, place geotextile fabric netting over graded topsoil for reinforcement. Install and securely anchor sod in place over fabric with metal staples in accordance with manufacturer's instructions.

3.4 PROTECTION OF SODDED AREAS

.1 Contractor shall provide adequate protection to protect sodded areas from all damage, disturbance, or other construction activity after sodding operations are complete. Remove protection after sod areas are properly established or as directed by Consultant.

.2 Damaged sod resulting from inadequate protection shall be repaired with topsoil, fertilizer and new sod at Contractor's expense. All damages shall be repaired prior to final acceptance.

.3 Keep site well drained and landscape excavations dry. Remove excess water from sodded areas.

3.5 MAINTENANCE / ESTABLISHMENT

.1 Work of maintenance period shall be performed each week and as frequently during the week to enable the proper establishment of all new sod and other landscaping installed to ensure that required services and tasks are satisfactorily completed and sustainable.

.2 Watering: apply water with sufficient frequency to maintain adequate soil moisture, promote root development and prevent sod shrinkage during maintenance/establishment period. During hot dry weather increase frequency of watering to maintain sod health.

.3 Provide clean water, equipment, water tanker, methods of transportation, hoses, sprinklers, and labour necessary to adequately and efficiently apply water to all sodded areas. Record quantity of water supplied and applied on site in maintenance log.

.4 Supply all necessary equipment, accessories and labour in use of building water sources where available. Operate existing irrigation facilities, where applicable, to ensure adequate watering of sodded areas.

.5 Cut grass at regular intervals and maintain at height of 70 mm. Do not cut more than 30% of leaf blade at any one mowing. Remove clippings.

.6 Pick and remove all litter, debris, and animal waste from lawn areas before mowing. Dispose of collected debris off site.

.7 Repair areas which show root growth failure, deterioration, bare or thin spots, or which have been damaged by any means or cause, including replacement operations by installing new sod. Ensure all repairs are completed prior to final acceptance.

.8 Correct any erosion and settlement that results from faulty workmanship and/or material. Restore areas by removing sod, adding topsoil as necessary and laying new sod. Repair ruts resulting from maintenance equipment and personnel. Produce a uniformly smooth surface by removing rutted turf areas and placing new topsoil and sod.

.9 Apply second application of 20-5-10or similar slow release granular turf fertilizer five to six weeks after sodding. Spread evenly at rate of 3 kg/100 m^2 and water in well after application. Postpone fertilizing until spring if application will occur after August 15th.

.10 Apply fertile topsoil to fill all minor open joints to prevent sod edges from drying.

.11 Control weeds, disease, insects and other pests using acceptable integrated pest management practices to reduce pesticide use. However, when necessary, apply chemical pesticides in accordance with manufacturer's instructions and government regulations.

.12 Repeat rolling of sod as necessary to maintain a smooth grass surface.

.13 Maintenance Inspections: during progress of the maintenance period, the Contractor and the Consultantwill conduct site inspections every 30 days or less to determine whether ongoing maintenance activities have been performed in accordance with specifications. Any maintenance not performed by Contractor in a satisfactory manner shall be immediately completed to Consultant's satisfaction.

3.6 FINAL ACCEPTANCE AND TERMINATION OF MAINTENANCE

.1 Consultant may accept work at end of maintenance period provided:

- .1 Sod is properly anchored into underlying topsoil, well established, vigorously growing and healthy.
- .2 Sod is green, even coloured, free of weeds and other pests.
- .3 Sod is free of bare and dead spots, visible joints, ruts, undulations and settlement.
- .4 Sod areas have been recently mowed and thoroughly watered.
- .5 Sod areas are clean and free of all debris.
- .6 Sod areas have received all required applications of turf fertilization.

.2 Contractor shall use specified materials to reestablish sod installations that do not comply with requirements for acceptance and continue with specified maintenance/establishment until deemed acceptable by Consultant.

3.7 CLEAN-UP AND REPAIRS

.1 During work of contract, keep all hard and soft surfaces clean and tidy. Sweep and wash all walkways and other pavement surfaces to maintain clean appearances. Clear soil and rubble from catch basins, manholes, valves and other hard surface features.

.2 Collect all litter and other debris from site during work of contract.

.3 Remove and dispose of excess materials, soil, litter, debris, and grass clippings at approved disposal site. Contractor shall be responsible for all disposal costs.

.4 Repair all damages resulting from Work of this Contract.

END OF SECTION

1. General

1.1 RELATED REQUIREMENTS

.1	Section 32 91 19	Topsoil Placement and Grading
.2	Section 32 92 19	Seeding
.3	Section 32 92 23	Sodding
.4	Section 32 99 00	Exterior Landscape Maintenance

1.2 REFERENCE DOCUMENTS

.1 Nomenclature: to "*International Code of Nomenclature for Cultivated Plants*".

.2 *Canadian Standards For Nursery Stock*: latest edition by Canadian Nursery Landscape Association (CNLA).

.3 *Clean Plants Standard (latest version):* program administered by the Canadian Nursery Certification Institute with approval and support of the Canadian Food Inspection Agency.

.4 *Alberta Yards & Gardens, What to Grow:* published by Alberta Agriculture and Rural Development, Agdex 200/32-1.

.5 *Canadian System of Soil Classification:* latest edition by Agriculture and Agri-Food Canada.

.6 *ANSI A300:* pruning standards and practices of the International Society of Arboriculture.

1.3 SUBMITTALS

.1 Submit the following, for Consultant's review and approval as applicable:

.1 Copies of all permits and licenses required by regulatory authorities prior to commencement of work.

.2 Samples of all topsoil, soil mix, mulch, and other organic materials intended for use. Samples to weigh between 500 g and 1 kg and be packaged in clean containers with label indicating source of material, date of sampling and project name. Samples to be typical of the lot of material to be supplied and provide an accurate indication of colour, texture and organic content.

.3 Submit list of all plant nursery sources. Where applicable, provide "Clean Plants Certification Number" of each Clean Plants certified nursery for approval. Submit information minimum two weeks prior to commencement of work.

.4 Samples of planting accessories and materials including source of supply as specified or as directed by Consultant.

.5 Site supervisor's credentials prior to commencement of work.

.6 Work schedule showing approximate dates for commencement and completion of each item of work. Submit prior to commencement of work.

.7 Submit all other required information and documents as requested or specified.

1.4 QUALITY ASSURANCE

.1 Contractor: experienced and knowledgeable in landscape work of contract.

.2 Site Supervisor: competent, experienced and knowledgeable to direct and supervise all staff and work of contract. Supervisor shall possess a Landscape Journeyman Gardner certification or other similar qualification acceptable to Consultant. Submit supervisor's credentials for Consultant's approval prior to commencement of work.

.3 Staffing: experienced, competent and trained landscape personnel who will perform all tasks and services in a knowledgeable and professional manner. Workers shall act safely and professionally at all times while working on site. Contractor shall not assign any worker that the Consultant deems incompetent, careless, insubordinate, or otherwise objectionable to work on site.

.4 Contractor shall be responsible for ensuring that contract specifications are being adhered to. Failure of the Consultant to immediately reject unsatisfactory workmanship or to notify the Contractor of their deviation from the specification shall not relieve the Contractor of their responsibility to repair and/or replace unsatisfactory work.

.5 Contractor shall obtain approvals as required by contract for suppliers, sub-contractors, and all materials.

.6 Pre-Construction Conference: prior to commencement of work, Contractor shall meet with Consultant to review overall work of contract and this section.

1.5 EXAMINATION

.1 Contractor shall advise Consultant, in writing, of any conditions or defects encountered on site before or during construction upon which the work of this section depends and which may adversely affect its performance.

.2 Do not commence work until adverse conditions or defects have been evaluated by the Consultant and corrective measures taken.

.3 Commencement of work shall imply acceptance of existing surfaces and conditions and no claims for damages or extras resulting from such conditions or defects will be accepted later, except where such conditions could not have been known prior to commencing work.

1.6 PERMITS, CODES AND REGULATIONS

.1 Contractor shall obtain and pay for all permits and fees as required by Local Authority and prevailing ordinances and/or codes to fully complete the Work.

.2 Contractor shall comply with all existing laws, codes, ordinances and regulations which in any way affect the conduct of the work.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Handle plants with care and skill to prevent injuries to trunk, branches, roots, rootballs and containers. Trees with damaged, broken or abraded trunks or branches may be rejected.

.2 Protect plants during shipment with windscreen or other suitable covering. Carefully tie in all branches before transporting. Take all precautions to prevent excessive drying from sun and wind and breakage from wind and equipment during transport. All points of contact between plant and equipment shall be protected with pads.

.3 Adequately protect plants in storage from drying out, frost damage, exposure of roots to sun, injury and breakage resulting from equipment and severe winds, site vandalism and other damages.

.4 Install plants within 24 hours of delivery to site. Store and heel plants in with topsoil or mulch in suitable location when planting cannot be completed on time. Keep all plants moist until planted. Plants not planted within required timeframe, weather permitting, may be deemed unacceptable by Consultant.

.5 Do not install plants whose soil balls have been cracked or broken or when burlap ropes used in connection with transplanting have been removed. Do not use plants damaged during contact with equipment, or plants that are wilted, windburned or stressed.

.6 Replace damaged or rejected plants at no cost to Consultant.

.7 Do not transport trees in open trucks when the temperature is in excess of 25^{o}C, or at speeds in excess of 60 km/h.

1.8 SOIL ANALYSIS

.1 Imported Soil: Contractor will arrange and pay for services of accredited testing laboratory to perform horticultural soil analysis on each source of soil mix and topsoil supplied by Contractor.

.2 Contractor shall be responsible for ensuring all samples of imported soil are submitted for testing well in advance of commencement of work. Imported topsoil and/or soil mix shall not be placed on site until approved by Consultant.

.3 Soil analysis for horticultural use shall include results for: existing major soil nutrients; soil pH value; total soluble salts (electrical conductivity); percentage of organic matter; soil texture and percentage of sand, silt and clay; nutrient recommendations; and recommendations for soil amendments.

.4 Consultant reserves the right to inspect and evaluate all sources of imported soil selected by Contractor.

.5 Contractor to submit original copies of soil analysis reports to Consultant as required.

1.9 MAINTENANCE PERIOD

.1 Maintain plant material from time of planting until minimum one year after Date of Interim Acceptance of the landscape portion of Work in Contract.

1.10 WARRANTY

.1 Contractor shall provide warranty for all plant materials, related works and other materials for a minimum period of one year. Warranty period shall commence from date of Interim Acceptance of the landscape portion of Work in Contract.

2. Products

2.1 PLANT MATERIALS

.1 Source Quality Control:

.1 All plants to be true to genus, species and cultivar specified and grown in a recognized nursery in accordance with good horticultural practices as advocated by the Canadian Nursery Landscape Association.

.2 Plants grown in a "Clean Plants Certified Nursery" to have been grown and handled in accordance with the *Clean Plants Standard* developed by the Canadian Nursery Certification Institute and the Canadian Food Inspection Agency. Submit "Clean Plants Certification Number" of each certified nursery for verification.

.3 Supply ball and burlapped trees that have been nursery grown in Alberta for a minimum of five years to ensure hardiness.

.4 Supply container grown shrubs, herbaceous perennials, ground covers and other plants that have been nursery grown under a similar climatic zone to those in locality of project.

.5 Plant supply to conform to federal and provincial regulations.

.6 Trees and other plants will be inspected and selected by Consultant from local nursery source of supply or place of growth prior to digging and delivery to site. Contractor's representative shall be present during inspection. Consultant will tag acceptable plants with cargo seal tags or other suitable tagging material.

.7 Where formal arrangements or consecutive order of trees or other plants are required in plan, all required plant material shall be selected for a uniform height and spread. Consultant reserves the right to reject all plants at source if available plant quantity is inadequate.

.8 Consultant reserves the right to reject any plant where tags have been removed before plants have been planted on site and approved by Consultant.

.9 Approval of plants at source does not impair the right of Consultant inspect plants on site during progress of work. Any plant which has been damaged by pests or mechanical equipment; substituted without authorization; injured by any means or cause; or does not conform to specifications must be removed from site whether in place or not and replaced with acceptable plant material as directed by Consultant.

.10 Plant substitutions are not permitted unless approved by Consultant. Contractor shall submit verifiable and adequate proof that specified plants are not available or of unacceptable quality before requesting plant substitutions.

.2 Condition and Quality:

.1 Plants shall be of specimen No. 1 grade and quality, exceptionally heavy, and so trained or favoured in development and appearance as to be unquestionably and outstandingly superior in form, compactness, branching and symmetry. Plants shall exhibit vigorous growth, be well branched and densely foliated when in leaf; free of disease, insects, eggs, or larvae; free of dead branches and dead branch tips; and have healthy, well developed root systems.

.2 Trees with multiple leaders;,with damaged, broken or crooked leader, weak "Y" crotches, bark abrasions or scars, sun-scald, frost cracks, disfiguring knots, insect damage or infestations are not acceptable.

.3 Tree trunks shall be clean and free of stubs, decay, splits or other damage. Root collar shall be free of defects, including circling, kinked and stem girdling roots.

.4 Specific tree requirements include:

.1 Deciduous Trees: straight bodied trees according to their natural habit of growth; having a balanced and well branched head; and with leaders intact, undamaged and uncut. Height of branching shall be consistent.

.2 Coniferous Trees: straight central leaders with a dense, heavy and uniform crown; well branched to ground level; and having outstanding natural colour. Trees with a sparse or thinly layered branched structure or with a unnaturally sheared appearance are not acceptable.

.3 Clump Form Trees: three or more trees planted as a group that have grown together to form a single tree having three or more main stems or trunks. Clump trees shall be low-branched; have a unified and well established root system; and have well developed crowns.

.4 Multi-Stem Trees: with three or more main stems originating from a single root crown or from a point just above the root crown. Trees shall be low-branched; have a unified and well established root system; and have well developed crowns.

.5 Shrubs: natural form, typical of genus, species and variety; minimum of four canes or primary stems that start from the ground.

.6 Herbaceous Perennials: healthy and vigorous crowns, well rooted and established, not less than two years old and twice transplanted.

.7 Vines: healthy, vigorous and well rooted in container, not less than 3 runners at 50 cm length or more.

.8 Ground Covers: healthy, vigorous, well rooted and established in container. Size proportionate to root development.

.9 Heeled-in plants or plants from cold storage are not acceptable. Plants that have been top worked, unnaturally sheared or colour treated are not acceptable.

.10 Collected Plants: native plants indigeneous to area. Plants designated as collected plants on plan shall be dug with root balls minimum 20% larger than for nursery grown stock. Well developed crowns and branching.

.3 Plants – Container Grown Nursery Plants:

.1 Container grown plants shall conform to measurements and container size specified. Measure height and spread, in centimetres, with branches in their normal positions in accordance with *Canadian Standards For Nursery Stock*. Plants shall possess normal balance between height and spread.

.2 Plants shall be grown in sufficiently sized containers for minimum of three months in accordance with *Canadian Standards For Nursery Stock*.

.3 Container grown stock shall be healthy, vigorous, well rooted and established in container. Container grown plants shall have a well established root system reaching sides of container to maintain a firm ball when container is removed but shall not have excessive root growth encircling the inside of container. Over established and root bound plants in containers are not acceptable.

.4 Plants shall have nursery labels containing the correct botanical name.

4 Plants - Balled and Burlapped:

.1 Supply balled and burlap trees in wire baskets that conform to plant measurements specified on plan. Measure height and spread, in centimetres, with branches in their normal positions in accordance with *Canadian Standards For Nursery Stock*.

.2 Caliper Size: caliper measurements, in millimetres, shall be the determining measurement. Measure deciduous tree caliper 15 cm above ground on trees up to 100 mm caliper size. Larger sized trees, 100 mm caliper and over, shall be measured 30 cm above ground.

.3 Clump Form / Multi-Stem Tree Measurement: caliper measurements shall be in accordance with *Canadian Standards For Nursery Stock*.

.4 Coniferous Height: height measurement shall be taken at midpoint between the uppermost whorl and the tip of the leader.

.5 Trees shall be properly machine dug with firm and natural root balls at minimum size and shape as specified in *Canadian Standards For Nursery Stock*. Root balls shall be placed, firmly wrapped and secured, in burlap lined wire baskets with rope or rottable twine. Root collar shall be apparent at surface of root ball. Plant trunks shall be in centre of root ball.

.6 Root ball size shall be sufficiently large to contain at least 75% of fibrous root system with a ball depth not less than 50% of ball diameter.

.7 Undersized, broken, loose, manufactured or other defective root balls will be rejected. Root balls shall be free from pernicious perennial weeds and grass and their roots.

.8 Adjust root ball size according to growing habits of plants. Clump form and multi-stem trees and coniferous pine trees shall be machine dug with root balls minimum two sizes larger than standard trees in accordance with *Canadian Standards For Nursery Stock*.

.9 Trees 150 mm caliper and over shall be root pruned during previous two successive growing seasons prior to delivery.

2.2 WATER

.1 Water: clean, fresh, and free of substances or matter that would inhibit vigorous and healthy plant growth.

.2 Contractor shall supply clean water, equipment, methods of transportation, water tanker, hoses, attachments, and other accessories as necessary to adequately apply water to all plant material and for other work in contract.

.3 All costs for supply of water incurred during the contract period shall be borne by Contractor.

2.3 SOIL

.1 Topsoil: fertile natural loam, capable of sustaining healthy growth. Topsoil to be loose and friable, free of subsoil, clay lumps, stones, live plants, roots or any other deleterious material greater than 20 mm diameter, free of litter, foreign matter and toxic materials harmful to plant growth. Topsoil containing construction debris, sod clumps, quackgrass or other noxious weeds is not acceptable. Topsoil to meet the following requirements:

.1 Minimum 6% organic matter.
.2 Acidity/alkalinity shall range from 5.9 pH to 7.0 pH.
.3 Electrical Conductivity (E.C.) - level of soluble salts shall not exceed 1.5 dS/m.
.4 Texture: "Loam" topsoil in accordance with *Canadian System of Soil Classification*. Topsoil to fall within an allowance of ±2% of the values stated in the table below:

Soil	Sand (%)	Silt (%)	Clay (%)	Class
Topsoil	35	35	30	Loam

.2 Peat Moss: decomposed plants, fairly elastic and homogeneous, free of decomposed colloidal residue, wood, sulphur and iron. Minimum of 80% organic matter by mass, pH value between 4.5 and 6.0. Furnished in an air-dry state, packed in standard bags or bales showing name of manufacturer.

.3 Sand: washed course sand, medium to course textured, free of impurities, chemical or organic matter.

.4 Bonemeal: finely ground commercial bonemeal with minimum analysis of 4% nitrogen and 20% phosphoric acid.

2.4 PLANTING MEDIA

.1 Soil Mix: 3 parts fertile topsoil; 1 part horticultural peat moss; 1 part sharp sand; bonemeal – apply at 0.6 kg/m3 soil mix or 50g/m2 soil mix and thoroughly mix into soil.

.2 Fertile Topsoil: fertile natural loam, capable of sustaining healthy growth. Supply topsoil as specified. Mix bonemeal fertilizer into topsoil at 0.6 kg/m3 of soil.

2.5 PLANTING ACCESSORIES

.1 Support posts: T-rail studded 40 mm x 40 mm metal stakes, minimum 2.1 m long. Stakes shall be scaled, primed and painted

.2 Guy wire: #12 or #14 pliable galvanized steel wire.

.3 Guy wire anchors: T-rail metal stakes, minimum 700 mm long. Paint minimum top 200 mm of stake with an orange fluorescent spray paint for visibility.

.4 Bark protector: 12 mm diameter new reinforced soft black rubber hose. Hose shall be cut of adequate length to completely encircle tree trunk to ensure no wire contacts tree bark. High grade flat grommeted fabric straps is acceptable in staking plants. Hard plastic hose protectors are not acceptable.

.5 Flagging: fluorescent orange flagging tape.

.6 Tree trunk guard: flexible, expandable and self opening plastic spiral wrap manufactured for horticultural use. Guard shall be of adequate length up to 60 cm high.

.7 Bark mulch: premium shredded coniferous bark mulch. Shredded bark mulch shall be approximately 50 mm or less in size. Mulch shall be free of non-organic materials, wood preservatives, diseased wood, moulds, fungi and insect infestations.

.8 Plant protection: materials to protect plants from rodent, animal and sun damages. Install galvanized wire mesh with fasteners; plastic perforated spiraled horticultural strips; burlap plant wrap with fasteners; or other approved materials in accordance with manufacturer's instructions.

3. Execution

3.1 SITE PREPARATION

.1 Locate and stake locations of all subsurface utility lines and underground irrigation lines, where applicable.

.2 Protect bench marks and hubs which form part of legal site survey.

.3 Stake out locations of all trees and other major planting including outlines of plant beds with wood stakes or other acceptable material.

.4 Where conflict exists between underground services and proposed plantings, promptly notify Consultant for instruction. Adjustments to plant locations require Consultant's approval.

.5 Maintain offset distances when locating trees near underground services, adjacent to walkways, property lines, curbs, intersections, entrances, light standards, site signage and buildings or as directed by Consultant. Do not locate any tree within minimum 1.5 m of a ditch line.

.6 Obtain Consultant's approval of plant locations before installing any plant material. Plants installed by Contractor without Consultant's approval of location shall be relocated at Contractor's expense.

3.2 PREPARATION OF PLANT BEDS AND TREE PITS

.1 Planting Beds: excavate plant beds minimum of 600mm deep.

.2 Trees: excavate tree planting pits minimum twice the diameter of the root ball and to full depth of rootball. Excavation shall be large enough to provide placement of minimum 300 mm of fertile topsoil backfill around root ball.

.3 Obstructions: notify Consultant if underground construction debris, rock, hardpan soil stratum or other obstructions are encountered during plant pit excavations.

.4 Remove all excavated subsoil and foreign debris material from site. Do not mix with planting soil or use as backfill.

.5 Do not excavate plant pits unless trees are scheduled for installation the same day. Cover and/or clearly flag all excavated plant pits left unattended for any length of time that may present a hazard.

.6 Scarify: scarify and roughen sub-grade soil within sides of excavated tree pit to minimum depth of 100 mm to eliminate smooth glazed walls. In planting beds, scarify and loosen sub-grade soil within excavated plant bed to minimum depth of 150 mm. Complete scarification of subsoil before placing any planting soil in tree pit or plant bed.

.7 Soil Mix-Plant Beds: place soil mix in planting beds to full depth of excavation and approximately 50 mm higher than adjacent finish grade. Soil mix to be placed in appropriate layers and tamped to eliminate any settlement. Slope grade away from building.

.8 Keep plant pit and plant bed excavations dry. Remove excess water before planting.

.9 Obtain Consultant's approval for all excavation and soil placement requirements before proceeding with installation of plant material.

3.3 PLANTING

.1 During progress of work, Consultant will review condition and quality of plants delivered to site and inspect Contractor's workmanship and performance to ensure compliance with specifications.

.2 Set plants plumb in centre of pits and face for best appearance and relationship to adjacent structures.

.3 Container Grown Plants: set plants in pit at same relation to grade as originally grown, after settlement has taken place. Remove containers and gently separate or split roots before planting to ensure proper root development. Plants installed below finish grade are not acceptable. Thoroughly water plants after planting.

.4 Ball and Burlap Trees: place plant straight in pit on undisturbed soil Root ball shall be placed so that top of root flare is slightly above finish grade after settlement has occured. Trees planted too deep with root flare below grade will be rejected by Consultant.

.5 Backfill with fertile topsoil around rootball in layers of 150 mm and firmly tamp to eliminate voids and air pockets. Ensure all trees have minimum 300 mm of topsoil surrounding the sides of the root ball.

.6 When tree pit is approximately 1/2 full of topsoil, thoroughly water planting hole allowing water to completely penetrate planting soil.

.7 Wire Basket: cut and remove all wire, burlap, rope or twine from minimum upper top one-half (1/2) of root balls. Remove all wire basket debris from site; do not bury in tree pit. Trees planted without removal of wire basket will not be accepted by Consultant.

.8 Complete backfilling around root ball to final grade in layers only after wire basket and other materials have been removed. Firmly tamp topsoil in place.

.9 Construct a neat circular water retention saucer surrounded by a soil embankment at outside edge of root ball or as directed by Consultant . In boulevards, parking islands and other confined locations adjust size of saucer to suit location and maintenance issues. Fill saucer with water and allow it to be completely absorbed. Place additional planting soil as necessary where settlement occurs. Thoroughly deep root water all plants.

.10 Slope Planting: place top of root crown at or slightly above finish grade at centre of plant pit. Form a saucer on downhill side to catch and retain water and to control erosion.

.11 After water has been completely absorbed, cover tree watering saucer with 100 mm of shredded bark mulch. Taper mulch to ground level at trunk.

.12 Place bark mulch to 100 mm depth over planting beds. Keep mulch material away from trunks and stems of plants.

.13 Install tree trunk guard around base of deciduous tree trunks that are planted in turf areas to protect from mechanical damage.

3.4 SUPPORTING TREES

.1 Support trees immediately after installation. Install minimum two support posts on deciduous trees 80 mm in caliper and under and on coniferous trees 3.0 m in height and under. Place support posts on prevailing wind side of tree and directly opposite. Larger trees shall require additional support posts spaced equally around tree as necessary.

.2 Anchor support post minimum 450 mm into undisturbed ground. Ensure support posts are secure and vertical. Replace all damaged support posts.

.3 Locate support posts away from trunk and branches. Height of support shall correspond with tree height. Support posts to be installed in a consistent direction.

.4 Provide each tree support with a bark protector and tie secured at approximately 60% of tree height. Do not tie trees too tightly; allow tree to move in response to winds. Keep plant plumb.

.5 Deciduous trees over 100 mm in caliper and coniferous trees over 3.5 m in height may require adequate staking using metal anchors and guy wires as directed by Minister:

.1 Guy with three double guys and anchors spaced equally around plant.
.2 Provide guy looped around plant trunk, encased in hose or rubber belting.
.3 Attach guys at 60% of plant height at angle of 45 degrees.
.4 Top of anchor to be flush with finished grade.
.5 Keep guys taut and plant plumb.
.6 Attach flagging tape to guys as safety precaution.

3.5 PRUNING

.1 Perform pruning in accordance with proper practices and standards (ANSI-A300) of the International Society of Arboriculture**.** Pruning to be performed by a certified arborist unless approved otherwise by Consultant.

.2 Prune to provide natural branching structure and to encourage healthy natural growth. Do not prune terminal leader of plant or leave protruding stubs when pruning.

.3 Limit pruning to removal of dead or injured branches, stray branches, double leaders, water sprouts, suckers and to compensate for loss of roots as a result of transplanting.

.4 Do not strip lower branches, raise up crown of trees, top or shear any plant.

.5 Contractor shall remove improperly pruned plants and install acceptable replacement plants at Contractor's expense if directed by Consultant.

3.6 PROTECTION

.1 Take all necessary precautions to protect work in progress, all property, persons, hard surfaces, buildings and existing trees from any damage that might be incurred arising from this Contract.

.2 Protect all plant materials and other site work from all damage, disturbance, or other construction activity from date of commencement of work to final completion and acceptance of work. Remove protection only after plants are properly established and accepted or as directed by Consultant.

.3 Damaged or unhealthy plants and other work resulting from inadequate protection or watering shall be repaired or replaced as directed by Consultant at Contractor's expense. All damages shall be corrected prior to final acceptance.

3.7 MAINTENANCE AND PLANT ESTABLISHMENT

.1 Work of maintenance period shall be performed each week and as frequently during the week to enable the proper establishment of all new plants and other landscaping installed to ensure that required services and tasks are satisfactorily completed and sustainable.

.2 Watering: apply adequate water to maintain healthy and vigorous growing conditions. All plants shall be watered minimum twice per week depending on plant species, location, and weather conditions to maintain adequate soil moisture. During hot dry weather, increase frequency of plant watering to maintain good plant health. Apply water properly and sufficiently to root zone.

.3 Provide clean fresh water, water tanker, equipment, methods of transportation, hoses, sprinklers, and labour necessary to adequately and efficiently apply water to plants. Record quantity of water supplied and applied to plants in maintenance log.

.4 Supply all necessary equipment, accessories and labour when using of building water sources. Operate existing irrigation facilities, where applicable, to supplement other methods of watering plants.

.5 Deep root water all plants by October 15th for winter preparation.

.6 Cultivate non-mulched plant beds and tree pits in upper 40 mm of soil biweekly to maintain a loose friable soil. Do not damage plants roots when cultivating.

.7 Remove and dispose of all debris, rubbish, and animal waste each week. Eliminate perennial grass and weeds including their roots weekly. Provide clean and well maintained appearances within all planting beds, tree wells and other planted locations.

.8 Edge plant beds evenly to depth of 100 mm monthly or as required to maintain original line and shape. Replace or reinstall any damaged or loose edging material as necessary.

.9 Maintain plant accessories and soil saucers in proper condition. Keep stakes and guy wires in proper repair and adjustment. Maintain tree in an upright plumb condition. Remove tree stakes after trees are self supporting.

.10 Repair disturbed mulch or replace to maintain original mulch depth and coverage.

.11 Install and maintain appropriate plant protection materials as necessary for protection of plant material.

.12 Straighten all plants that lean or sag. Replant as directed by Consultant.

.13 Control disease, insects and other pests using acceptable integrated pest management practices to reduce pesticide use. However, when necessary apply chemical pesticides in accordance with manufacturer's instructions and government regulations.

.14 Replacement Plants: immediately remove all dead and unhealthy plants and install new healthy replacement plants during the maintenance and warranty period. Do not allow dead and unhealthy plants to remain on site. Place flagging tape on all replacement plants for identification. Replacement plant material shall be properly established before achieving final acceptance.

.15 Maintenance Inspections: during progress of the maintenance period, the Contractor and the Consultant will conduct site inspections every 30 days or less to determine whether ongoing maintenance activities have been performed in accordance with specifications. Any maintenance not performed by Contractor in a satisfactory manner shall be immediately completed to Consultant's satisfaction.

3.8 MAINTENANCE LOG REQUIREMENTS

.1 Maintain and complete a maintenance log for each day of maintenance activity throughout maintenance period.

.2 Record all maintenance activities including date/time of activities, quantity of water supplied and applied on site, materials used and quantity in maintenance of plants, location where activities were carried out, number of employees and name of supervisor on site.

3.9 FINAL ACCEPTANCE AND TERMINATION OF MAINTENANCE

.1 Consultant may accept work at end of maintenance period provided:

.1 Plants meet requirements of the specifications.
.2 Plants are properly and adequately established.
.3 Plants are alive, healthy and free of all pest infestations.
.4 Plants are properly planted, staked and pruned.
.5 Plants are recently and thoroughly watered.
.6 Plant pits and beds are cultivated and free of weeds, grass and debris.
.7 Planting accessories are properly installed and in good condition.

.2 Contractor shall use specified materials to correct plant installations that do not comply with requirements for acceptance and continue with specified maintenance/establishment until deemed acceptable by Consultant.

3.10 CLEAN-UP AND REPAIRS

.1 During work of contract, keep all hard surfaces clean and tidy. Sweep and wash all walkways and other pavement surfaces to maintain clean appearances. Clear soil and rubble from catch basins, manholes, valves and other hard surface features.

.2 Collect all litter and other debris from site as necessary during work of contract.

.3 Remove and dispose of excess soil and waste materials, including subsoil, foreign debris, pots, wire basket debris, plant wrapping debris, and unhealthy plant growth at approved disposal site. Contractor shall be responsible for all disposal costs.

.4 Remove all plant nametags, plant labels, cargo seal tags and flagging tape prior to final inspection or as directed by Consultant.

.5 Repair all damages resulting from Work of this Contract.

END OF SECTION

1. General

1.1 RELATED REQUIREMENTS

.1	Section 32 92 19	Seeding
.2	Section 32 92 23	Sodding
.3	Section 32 93 00	Landscape Planting

1.2 REFERENCE DOCUMENTS

.1 *Pruning in Alberta* published by Alberta Agriculture and Rural Development Agdex 270/24-1.

.2 *Alberta Yards & Gardens, What to Grow* published by Alberta Agriculture and Rural Development, Agdex 200/32-1.

.3 *Backyard Pest Management* published by Alberta Agriculture and Rural Development, Agdex 605-2.

.4 "*Manual for Maintenance of Grounds*" published by Alberta Infrastructure.

.5 *ANSI A300:* pruning standards of the International Society of Arboriculture.

1.3 HOURS OF WORK

.1 Perform maintenance work during regular working hours of 07:00 to 18:00, Monday to Friday unless directed otherwise by Owner.

.2 Obtain Owner's approval to perform maintenance outside of regular working hours.

1.4 MAINTENANCE PERIOD

.1 Maintain exterior landscape work for a minimum of one year after Date of Interim Acceptance of the landscape portion of Work in Contract.

.2 Maintenance services shall generally be performed during the landscape growing season May 1st to October 31st. Owner reserves the right to determine actual date of commencement and termination of maintenance based on existing climatic conditions, soil moisture and plant health.

.3 Any additional maintenance beyond the specified maintenance and warranty period required for Contractor to achieve final acceptance shall be provided at Contractor's own expense.

.4 Any incomplete weeks or months of maintenance shall be carried over to the following landscape growing season.

.5 Owner reserves the right to extend maintenance period and/or reduce monthly progress payments for maintenance services any time Contractor neglects to provide adequate maintenance services in accordance with contract specifications as determined by Owner.

1.5 QUALITY ASSURANCE

.1 **Site Supervisor:** competent, experienced and knowledgeable to direct and supervise all staff and maintenance work of contract. Supervisor shall possess a Landscape Journeyman Gardner certification or other similar qualification acceptable to Owner. Submit supervisor's credentials for Owner's approval prior to commencement of work.

.2 **Weekly Site Visits:** provide adequate site visits each week with sufficient staff to ensure that all required maintenance services are performed and completed on schedule in accordance with specifications.

.3 **Site Security:** Contractor's personnel shall carry personal identification at all times while on site. Identification shall be presented when requested by Owner or other site security staff. All employees must check in with Owner upon entering and leaving the premises where applicable.

.4 **Employee Attire/Safety Vests:** all workers shall be properly attired at all times. Each employee working on site shall wear a reflective brightly coloured safety vest for safety and visibility.

.5 **Submittals:** submit all required information and documents for Owner's approval where specified in contract documents and applicable to work of contract and as requested by Owner.

.6 **Safety Precautions:**

.1 Contractor shall supply and ensure that all workers use appropriate personal protective equipment as required by Alberta's Occupational Health and Safety Act, Regulations and Code.

.2 Contractor shall provide training and ensure all workers practice appropriate safety measures and safe use of tools and equipment in accordance with WHMIS (Workplace Hazardous Materials Information System).

.3 Owner reserves the right to have the Contractor remove any employee from site if not wearing personal protective equipment or if not practicing safe work procedures.

.7 **Regulatory Requirements:** perform work in accordance with all applicable laws, codes and regulations required by authorities having jurisdiction over such work and provide all permits required by local authorities.

1.6 SITE INSPECTION / MEETINGS

.1 During initial maintenance establishment period, site meetings and inspections shall be conducted every two weeks or less between Contractor and Owner. Contractor's workmanship and performance will be reviewed and other landscape concerns or issues addressed and evaluated.

.2 Subsequent site meetings and inspections shall be held every 30 days or less after landscape has adequately established, as determined by Owner.

.3 Owner shall, at his direction, conduct random site inspections throughout the maintenance period to evaluate work performed. Contractor shall promptly correct all deficient work within three days of Owner's notification.

1.7 MAINTENANCE LOG REQUIREMENTS

.1 Maintain and complete a maintenance log for each day of maintenance activity throughout maintenance period.

.2 Submit maintenance log data to Owner each week for verification and approval of services performed. Contractor shall ensure maintenance log data is true and accurate. Site supervisor must complete and sign maintenance log.

.3 Record all maintenance activities including date/time of activities, quantity of water supplied and applied on site, materials used and quantity during maintenance of landscape installations, location where activities were carried out, number of employees and name of supervisor on site.

.4 Maintenance Invoices: invoices submitted without verifiable maintenance log data to support invoice will not be accepted. Owner will defer payment of Contractor's invoice until all maintenance services are deemed acceptable and in compliance with specifications as determined by Owner.

1.8 SOIL ANALYSIS

.1 Perform one horticultural soil tests during the maintenance period at turf and planting locations randomly selected by Owner. Arrange and pay for services of an accredited testing laboratory approved by Owner.

.2 Submit original copy of each soil test to and review results with Owner.

.3 Soil analysis for horticultural use shall include results for: existing major soil nutrients; soil pH value; total soluble salts (electrical conductivity); percentage of organic matter; soil texture and percentage of sand, silt and clay; nutrient recommendations; and recommendations for soil amendments.

.4 Contractor shall amend soil conditions as recommended by soil analysis report and indicate all corrective measures taken, documenting final soil condition results in maintenance log.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Remove all equipment and materials off site each day unless on site storage is approved by Owner.

.2 Store tools, equipment and materials in a secure area when not in use during period of operation and at the completion of each scheduled task.

.3 Contractor shall be present on site to accept delivery of all equipment and/or material shipments. Acceptance of delivery by Owner shall not constitute acceptance or responsibility for any of the materials or equipment.

1.10 DAMAGE TO PROPERTY

.1 Contractor shall be held directly responsible for all damages to Owner's property, the personal property of all employees, staff and visitors and the property of adjacent land owners resulting from the actions of the contractor, the contractor's employees, subcontractors or representatives who provide service under this contract.

.2 Contractor shall immediately report all damages to Owner.

.3 Repair, replace or restore all damaged property to its original condition or better as directed by Owner. Damages shall be promptly corrected within seven days of approval unless directed otherwise by Owner.

.4 Scalping of turf, mechanical damage or injury to plant material, improper plant pruning, and damages resulting from improper use of chemical pesticides and fertilizers will be considered property damage.

1.11 PROTECTION

.1 Protect landscape plantings and turf areas at all times against damage of all kinds for duration of maintenance period. Maintenance includes temporary protections, fencing, barriers, and signs as required for protection. If any plant material or turf becomes damaged or injured because of insufficient protection, Contractor shall treat or replace plant material or turf at Contractor's sole expense.

1.12 FINAL ACCEPTANCE AND TERMINATION OF MAINTENANCE

.1 Work under this section may be accepted by Owner at end of maintenance period provided all requirements for acceptance as indicated under Section 32 92 19 - Seeding, Section 32 92 23 - Sodding, and Section 32 93 00 - Landscape Planting have been satisfactorily completed.

1.13 MAINTENANCE INSTRUCTIONS

.1 Provide two (2) copies of detailed written maintenance instructions detailing the maintenance and care of all turf areas and plant material installed in contract.

2. Products

2.1 FERTILIZER

.1 Synthetic Turf Fertilizer: apply a complete premium grade synthetic fertilizer, granular in composition, with over 50% of total nitrogen derived from a slow or controlled release nitrogen source to maintain turf in a healthy, vigorous, and green condition. Fertilizer shall contain all essential macronutrients plus 1%-2% iron and other micronutrients.

.2 **"Weed and Feed" fertilizers are not allowed.**

.3 Plant Fertilizer: apply controlled or slow release plant fertilizers in accordance with soil analysis where applicable.

2.2 TOPSOIL AND PEAT MOSS

.1 Topsoil: fertile natural loam, capable of sustaining healthy growth, loose and friable, free of subsoil, clay lumps, stones in excess of 20 mm, live plants, roots or any other deleterious material greater than 20 mm diameter. Topsoil shall be free of litter, foreign matter and toxic materials harmful to plant growth. Topsoil containing construction debris, sod clumps, quackgrass or other noxious weeds is not acceptable. Topsoil supplied to site shall meet the following requirements:

.1 Minimum 6% organic matter.
.2 Acidity/alkalinity shall range from 5.9 pH to 7.0 pH.
.3 Electrical Conductivity (E.C.) - level of soluble salts shall not exceed 1.5 dS/m.
.4 Texture: "Loam Topsoil" in accordance with *Canadian System of Soil Classification*. Topsoil shall fall within an allowance of ±2% of the values stated in the table below:

Soil	Sand (%)	Silt (%)	Clay (%)	Class
Topsoil	35	35	30	Loam

.2 Peat Moss: decomposed plants, fairly elastic and homogeneous, free of decomposed colloidal residue, wood, sulphur and iron. Minimum of 80% organic matter by mass, pH value between 4.5 and 6.0. Furnished in an air-dry state, packed in standard bags or bales showing name of manufacturer.

2.3 WATER

.1 Supply clean fresh water, water tanker, equipment, sprinklers, and labour necessary to adequately and efficiently apply water to all turf areas and plant materials.

.2 Record quantity of water supplied and applied on site in maintenance log.

2.3 PLANT PROTECTION MATERIALS

.1 Rodent, Animal and Sun Protection:

.1 Woven wire mesh: galvanized woven wire strands, 1.2 mm wire diameter or suitable alternative with an opening of 12.5 mm x 12.5 mm, c/w fasteners.
.2 Plastic: perforated spiralled strip for horticultural use.
.3 Burlap: clean, minimum 2.5 kg/m mass and 150 mm wide, and twine fastener.

2.4 PEST CONTROL

.1 Chemical Pest Control: supply and apply required chemical pesticides including herbicides, insecticides and fungicides, when Integrated Pest Management Principles (IPM) are considered ineffective in controlling or suppressing pest populations on site.

.2 Submit the following information for Owner's review and approval before applying any pesticide:

.1 Identification of specific pest(s) on site that require control.
.2 Trade name of chemical pesticide and manufacture's instructions for use.
.3 Manufacturer's material safety data sheets for each chemical pesticide.

.4 Name and credentials of licensed pesticide applicator(s).

.3 Pesticide Application Records: pesticide application record books shall be completed by the certified licensed applicator in accordance with Alberta Environmental Protection and Enhancement Act. Submit record books at completion of each pesticide application on site Provide information regarding target weed, insect or other pest, mode, type, and rates of application and results, including date, time, weather conditions and name of applicator.

2.5 MAINTENANCE SCHEDULE

.1 Schedule: submit a neat, legible and detailed maintenance schedule prior to commencement of maintenance period. List all daily, weekly, and monthly maintenance services and tasks to be performed. Review schedule with Owner for approval.

3. Execution

3.1 GENERAL WORKMANSHIP

.1 Owner will be the sole assesser of the Contractor's maintenance performance and workmanship.

.2 Schedule timing of operations to growth, weather conditions and use of site. Do each operation continuously and complete within reasonable time period.

.3 Do not perform work in any location or manner that may endanger the health and safety of the public.

.4 Collect and dispose of excess material and debris to approved municipal disposal site following collection.

.5 Coordinate maintenance practices with Owner. Alter maintenance schedules, when necessary, to accommodate Owner's site activities.

.6 Contact Owner when specified maintenance requirements cannot be met for any reason.

.7 Submit name and contact number of company representative for immediate or emergency service when necessary.

.8 Keep a copy of contract specifications and applicable reference documents on site at all times for employee use and reference.

.9 Contractor's site supervisor must attend all site meetings called by Owner to review workmanship and performance.

.10 Contractor shall promptly correct all maintenance deficiencies noted by Owner during site inspection meetings or following notification of Owner's own work inspection results.

3.2 SPRING CLEAN-UP

.1 Complete spring clean-up by May 15th or sooner, weather permitting.

.2 Remove and dispose of protective coverings and mulch used in winter protection.

.3 Clean, sweep, collect and remove sand, rock chips, salt and other debris accumulated during winter months from all maintained turf and hard surface areas. Re-sweep turf and hard surface areas until completely clean and acceptable to Owner. Dispose of all collected debris to approved municipal disposal site.

.4 Snow fence, stakes and sand storage containers supplied by Owner shall be removed and stored as directed by Owner. Winter protection materials supplied by Contractor shall be removed from site.

.5 Collect and remove all dead vegetation, leaves, litter, and other debris from turf areas. Rake clean snow mould, where existing, from lawn areas.

.6 Clean all plant beds, raised planters, tree wells, hedges and other landscaped areas of plant debris, leaves, litter, and other foreign matter. Remove collected debris from site.

.7 Loosen and lightly cultivate non-mulched planting soil without disturbing roots of permanent plantings. Reinstall all loose plant bed edging materials and replace where necessary.

.8 Sweep and clean hard surface areas and along curbs to remove all litter and debris to maintain clean and tidy site appearances.

.9 Roll turf areas lightly where grass has lifted due to frost action. Repair damaged or deficient turf areas.

3.3 TURF MAINTENANCE

.1 Watering – Turf Areas:

.1 Provide proper and adequate watering services to all turf areas to ensure healthy vigorous growing conditions.

.2 Seeded Areas: allow natural rainfall to germinate seed.

.3 Sodded Areas: regularly and adequately apply water to all sodded areas. Water shall be deeply and thoroughly applied to keep new sod and underlying soil from drying out and to ensure healthy vigorous growing conditions are maintained. Apply water during early morning or evening to achieve efficient use of water.

.4 Irrigated Areas: where underground irrigation systems exist on site, Contractor shall coordinate operation of irrigation system with Owner to ensure turf areas receive adequate water.

.5 Water Supply: where water is not available, Contractor shall supply clean water, water truck, pumps, portable sprinkler systems and labour and apply water as necessary to maintain healthy turf conditions.

.6 Supply hoses, sprinkler equipment, and other accessories when using [any available building hose bib to apply water

.7 Provide 25 to 40 mm of water weekly including natural rainfall to wet upper 100 to 150 mm of soil in maintained turf areas.

.8 During periods of drought stress, apply additional water to maintain healthy turf conditions if necessary.

.2 Topdressing and Reseeding:

.1 Topdress and reseed areas which show root growth failure, deterioration, bare, burnt and thin spots, ruts, wash outs and erosion or which have been damaged by any means or cause, including replacement operations.

.2 Mow grass to height of 40 mm. After mowing, rake thoroughly, removing loose and dead grass, stones and debris.

.3 Spread topsoil to maximum thickness of 15 mm, filling in low areas and bare spots. For severely damaged turf areas place sufficient topsoil and rake level with finish grade.

.4 Overseed areas with seed mixture equivalent to existing grasses and approved by Owner. Seed at rate of 4 kg/100 m^2.

.5 Rake seed into topsoil. Roll lightly.

.6 Water to ensure penetration of 80 mm and at frequent intervals to maintain vigorous growth.

.3 Sod Replacement:

.1 Cut out and remove all areas of dead, or unhealthy sod or which has been damaged by any means or cause and replace with new healthy sod. All repair areas to be square or rectangular.

.2 Rake existing topsoil before installing new sod. Add topsoil to fill uneven and low areas.

.3 Butt new sod tightly to adjacent existing sod. Topsoil open and exposed joints.

.4 Water to ensure penetration of 80 mm and at frequent intervals to maintain healthy growth.

.3 Turf Establishment and Erosion:

.1 Until turf areas are established, the Contractor shall be responsible for replacing soils that have eroded into hard surface areas. Residual soils on hard surfaces shall be removed and if not mingled with objectionable materials may be re-used in eroded areas. In the event this is a continuous problem, the Contractor shall install “jute mat” or other methods to prevent the erosion problem until the seeded turf areas are established.

.4 Fertilizing:

.1 Apply fertilizer as directed by Owner or as indicated in soil analysis. Use only mechanical equipment to spread fertilizer. Check spreader calibration to ensure specified application rate is used.

.2 Spread 50% of fertilizer in one direction, then 50% at right angles.

.3 Synthetic Fertilizer: apply the following slow release granular fertilizer unless approved otherwise by Minister. Indicate total quantity of fertilizer applied on site in Maintenance Log for each turf area.

.1 Spring Application: all turf areas. Apply 26-14-6 or similar slow release granular fertilizer at rate of 3 kg/100 m^2 by May 20th.

.2 Summer Application: all turf areas. Apply 24-5-11 or similar slow release granular fertilizer at rate of 3 kg/100 m^2 by July 15th.

.3 Fall Application: : all turf areas. Apply 12-3-18 or similar slow release granular fertilizer at rate of 2 kg/100 m^2 by September 30th.

.4 Water: apply water immediately after spreading fertilizer. Supply water, trucking and accessories and apply required water to all turf areas Alternatively, Contractor shall time fertilizer applications prior to natural rainfall that will activate the fertilizer and produce the desired response. Ensure moisture penetration of 50 mm minimum.

.5 Advise Owner prior to any application of turf fertilizer. Upon completion of service, provide documentation along with invoice to support type and quantity of turf fertilizer applied.

.5 Mowing - Maintained Areas:

.1 Mowing Height: cut and maintain turf areas at required variable minimum heights respective of the growing season. During periods of active growth turf shall be mowed at minimum required mowing height. During hot dry conditions and slow growth periods turf shall be mowed at increased or maximum heights to maintain turf health. Turf shall generally be cut and maintained as follows:

.1 Sodded Turf: cut and maintain turf at 60 - 80 mm height.

.2 Seeded Turf: during seed establishment, provide weed control in newly seeded areas by regularly mowing and maintaining weed growth to 100 mm height. Remove all weed and other plant debris from seeded turf areas. Provide initial cut when seeded grass growth is approximately 100 mm in height over 75% of the seeded area. Subsequently, mow seeded turf area at a height of approximately 80 mm.

.3 Native Grass**:** provide weed control during seed establishment by mowing weed growth to 100 mm height and remove from site. Mow native seed areas during the last two weeks of June and August or as directed by Owner. Mow tall growing native grass at a height of 135 to 150 mm and short growing native grass at a height of 90 to 100 mm. Do not mow native grass lower than specified. Provide an additional cut due to active and/or accelerated growth when directed by Owner.

.2 Mowing Schedule: mow turf areas on weekly intervals during periods of active growth and more frequently during accelerated growth periods to maintain turf at required height. During periods of hot dry seasonal climatic conditions and when turf growth is slow, turf shall be cut less frequently at an increased height to maintain turf health.

.3 Mowing shall generally be performed when **"**one-third**"** of grass blade can be removed during a single cutting to achieve required turf height. Schedule and complete mowing in one continuous operation, weather permitting. Do not mow turf when insufficient growth is evident or cut turf lower than specified height.

.4 Mow turf areas only when dry. Use mowers with sharp blades that will cut turf cleanly. Turf mowed when wet or with dull blades that tear and leaves ragged leaf edges are unacceptable. Owner will periodically inspect mowers for acceptance.

.5 During periods of extended moisture and excessive turf growth, increase mower blade height and pre-cut turf at an increased height. Remove clippings. After turf dries, lower blade height to specified height and mow turf a second time to achieve required height.

.6 Remove clippings after each turf mowing. Small and unnoticeable grass clippings may be left on lawns that are regularly mowed at the desired height.

.7 Remove papers, rocks, animal waste, and other foreign material before cutting.

.8 Change direction of cut with each mowing to avoid soil compaction and turf wear or ruts from mower wheels. In the event that turf damage or ruts result, the Contractor shall immediately repair all damaged turf.

.9 During each cutting operation, temporarily relocate movable site furnishings. Replace to approximate original location after mowing lawn.

.10 Edging: use a fixed steel blade mechanical power edger to cut and provide neat, uniform, and cleanly defined edges along all sidewalks, concrete curbs, and other hard surfaces on site. Do not use monofilament trimmers for edging. Provide monthly edging services during June, July, August and September. Remove all edging debris from site.

.11 Trimming: trim grass areas as follows:

.1 trim grass along fences, walls, sign posts, structures, monuments and other select lawn areas not accessible to mowers using a mechanical trimmer. Trim turf at a height no lower than 60 mm. Never scalp turf or damage any plant when using trimmers. Remove resulting plant debris from site.

.2 use hand trimmers to trim grass adjacent to trees and other plants to prevent damage to tree trunks, plant stems and roots. Do not use string line trimmers near live plants.

.3 cut and neatly trim grass around irrigation equipment, manholes, valves and other surface features in lawn areas. Remove resulting plant debris from site.

.12 Clean all sidewalks, stairs, roads, parking lots, curbs, hard surfaces, building walls and other required locations of all grass clippings after each mowing to maintain clean site appearances.

3.4 TREE AND SHRUB MAINTENANCE

.1 Monitoring:

.1 Regularly monitor and visually inspect the health and care of all plants on site to ensure proper plant care is provided in accordance with specifications that will enable plants to grow in a vigorous, healthy and non-stressed condition.

.2 Contractor shall indicate results of each plant monitoring inspection in maintenance log.

.2 Trees and Plant Beds:

.1 Maintain all planting locations each week during the maintenance period to ensure healthy and vigorous growing conditions and to ensure aesthetically clean and pleasing site appearances.

.2 Cultivate non-mulched plant beds and tree wells to maintain a loose friable soil free from perennial weeds and grass, including their roots. Pull weeds and roots by hand or spot spray with approved herbicide without damaging other plants. Do not mound soil around base of tree trunk following soil cultivation.

.3 Remove and dispose of all litter, debris, rubbish, and animal waste each week. Pick and remove all rocks larger than 15 mm from planted areas.

.4 Remove and eliminate perennial grass and weeds from all planted areas weekly. Maintain weed free appearances in all planted areas.

.5 Edge all plant beds evenly to depth of 100 mm monthly to maintain original line and shape using a sharp spade to make an angled cut. Remove all debris from site after edging.

.6 Rake, level and re-spread wood mulch as necessary to achieve a fresh appearance and to correct any disturbances. Clean mulch of all debris and litter weekly. Remove all perennial weeds and grass as necessary. Place additional mulch to match existing, to maintain original specified depth.

.7 Place specified planting media to correct settlement that occurs in planted areas and to correct all other grading deficiencies.

.8 Straighten all leaning or sagging plants. Replant if necessary.

.9 Maintain soil lips around outer edge of plant pit. After completion of warranty period level soil lips or remove excess soil from site.

.3 Soil Conditioning:

.1 Maintain specified soil conditions in plant beds to promote optimum growth and health for each plant.

.2 Supply and spread soil amendments or organic matter in accordance with soil analysis.

.4 Staking and Tree Protection:

.1 Keep stakes and guy wires taut and plants plumb for duration of maintenance period. Do not allow trees to be girdled from improper installation and maintenance of guy wires.

.2 Remove support stakes and staking accessories when plants become self-supporting or when directed by Owner.

.3 Install and keep plant protection materials in proper repair and adjustment as required or when directed by Owner.

.5 Pruning:

.1 Prune in accordance with proper standards and practices described in **"**Pruning in Alberta" and "ANSI A300". Owner will be the sole assesser of the quality of all pruning operations. Promptly correct all deficient work as directed by Owner.

.2 Prune to provide a natural branching structure and to encourage healthy natural growth patterns for each plant. Do not clip shrubs into balled or boxed forms as this type of pruning will be considered improper and unacceptable.

.3 Pruning shall be performed by Certified Arborists. Submit credentials of each individual who will perform plant pruning services for Owner's approval.

.4 Use sharp pruning tools and equipment to prune plants without tearing and ripping plant tissue.

.5 Do not shear or top any plant, strip lower branches, or raise crown of trees. Do not leave stub cuts when pruning any plant.

.6 Limit pruning to removal of dead, diseased or injured branches, stray branches, double leaders, water sprouts, suckers and to compensate for loss of roots as a result of transplanting. Remove undesirable, rubbing and crowded limbs and maintain an adequate clearance. Ensure coniferous trees have one dominant central leader.

.7 Replace improperly pruned plants if directed by Owner. Replacement plant shall match existing in size.

.6 Fertilization Requirements in Early Spring:

.1 Apply plant fertilizer or in accordance with soil analysis. Use controlled or slow release plant fertilizers only. Notify Ower prior to commencement of fertilization applications. Record all fertilization activities in maintenance log.

.2 Trees: apply 10-6-4 or similar plant fertilizer to all trees by June 1st each spring at rate of 18 g/25mm of tree caliper. Use a deep root feeder in application of plant fertilizer and water to ensure each plant is thoroughly fertilized and watered.

.3 Alternatively, place 16-10-9 or similar fertilizer spikes in ground at rate of one spike per 25 mm of caliper per tree around dripline of tree.

.4 Plant Beds: spread 14-14-14 or similar granular fertilizer by June 1st each spring at minimum rate of 5 kg/100 m^2 into upper surface of all planting beds. Lightly rake into soil if applicable and apply water. Record all fertilization in maintenance log.

.5 Supply clean water, water hauling equipment and all other accessories as necessary to apply adequate water after fertilizing to ensure penetration of fertilizer into soil and roots.

.7 Watering of Plants:

.1 Monitoring: regularly test and monitor soil moisture conditions and a plant's need for water to ensure adequate health and survival. Natural rainfall should be considered in determining amount and frequency of watering. Regularly review plant watering needs with Owner. Contractor, shall be responsible for ensuring that sufficient moisture is provided each week, as necessary, to maintain an adequate level of moisture within the root systems and ensure healthy plant growth and survival.

.2 Use moisture sensor devices to test and measure availability of moisture in plant soil areas throughout site. Record data in maintenance log.

.3 Water plants regularly each week as necessary to maintain healthy and vigorous growing conditions and to ensure survival. During periods of warm weather and dry soil conditions provide additional waterings to maintain plant health.

.4 Plant Watering: apply a minimum 40 liters of water per 25mm of tree trunk diameter (measure at 300mm above ground level) when watering. Apply sufficient water during each application to obtain moisture saturation of each plant's root ball. Record total quantity of water applied in maintenance log after each site visit to perform plant watering services.

.5 Supply clean fresh water, equipment, methods of transportation, water tanker, hoses and sprinklers, attachments and other accessories, including labour to adequately and efficiently apply water to all plants where other means of watering are inadequate, inefficient or not available.

3.5 PLANT REMOVAL AND REPLACEMENT

.1 Contractor shall immediately remove all dead, unhealthy and unappealing plants from site or when directed by Owner. Promptly supply and install healthy new replacement plants to ensure original landscape plan is maintained. Replacement plants shall meet specifications and be approved by Owner.

.2 Replacement plantings shall be performed in a timely manner and as soon as conditions permit. Contractor shall advise Owner when availability of any replacement plant will be delayed.

.3 All replacement plants must be fully established before termination of maintenanceby Contractor. Contractor shall continue to provide specified maintenance for replacement plants not fully established until deemed acceptable by Owner.

.4 All replacement plants shall be flagged or tagged by Contractor for identification.

.5 Contractor shall extend warranty on all plants not fully established by end of warranty period. Ower will determine the additional warranty period on replacement plants if deemed necessary.

.6 Required replacement plantings during the maintenance period resulting from theft and vandalism shall be the Owner's responsibility.

3.6 INTEGRATED PEST MANAGEMENT

.1 Integrated Pest Management (IPM):

.1 Manage and control pests using IPM principles that utilizes regular monitoring to identify pests, considers various control options (biological, physical, cultural, mechanical and chemical) before implementing an effective, economical and environmentally acceptable solution to prevent and suppress pests.

.2 Use IPM principles to reduce or eliminate a reliance on chemical pesticides.

.2 Contractor shall be knowledgeable regarding the identification of pests on site, controls to be implemented in management of pests and assessing outcome of treatment actions. Inform Minister of all pest concerns on site and controls to be implemented in management of pests. Record all information in maintenance log.

3.7 PESTS: WEED, INSECT AND DISEASE CONTROL

.1 Pest Monitoring:

.1 Pest Monitoring: regularly monitor and visually inspect all plants, turf and other landscape areas to identify potential pest problems and determine appropriate pest controls. Pest problems include insect, disease and weed infestations that pose a serious and on-going threat to plant life on site.

.2 Ensure proper, positive identification of infestations. Reference "Backyard Pest Management" for identification and control of pests.

.3 Indicate results of each monitoring inspection in maintenance log. Review all pest concerns with Owner. Record all actions taken to control pest problems in log.

.2 General Considerations:

.1 Use of chemical pesticides are restricted as Minister supports the use of IPM practices. Advise Owner on whether IPM practices are practical in managing and controlling any existing pests on site.

.2 Determine susceptibility of plant species to pesticide damage before requesting chemical pesticides. Request Owner's approval before use, where chemical pesticides are deemed necessary in the management and control of pest infestations.

.3 Applications of pesticides shall be performed in accordance with Alberta Environment's current legislation. Provide Owner with three days advance notification of intent to apply chemical pesticides on site.

.4 Use equipment and containers free of harmful residues not related to specific control measures applicable to situation.

.5 Certified Applicator: when pesticides are deemed necessary to control pests, the application of each pesticide on site shall be performed by a certified pesticide applicator. Personnel assisting the certified applicator on site shall be thoroughly trained and knowledgeable in pesticide applications and use of all equipment in accordance with Alberta Environment's Code of Practice for Pesticides. Applicator shall maintain pesticide application record books and submit at completion of each pesticide application.

.6 Prepare and apply pesticide according to manufacturer's specifications. Minimize drift at all times. Erect signs to notify building occupants and the public regarding pesticide use on site.

.7 Timing: pesticides shall be applied at times, which limit any possibility of contamination from climatic and other factors. Monitor weather conditions to avoid making application prior to inclement weather to eliminate potential runoff from treated areas. Confine all applications to outside of regular site operation hours to avoid contamination from drift and its effect on surroundings, occupants of nearby buildings and site users.

.8 Ineffective and improper application of pesticide shall be immediately terminated and corrected by Contractor. Additional application of pesticides shall be completed approximately two weeks after initial application is noted as visibly inadequate or deemed deficient by Owner.

.3 Pest Control:

.1 Weeds:

.1 Provide ongoing weed control and eradication methods during active growth and establishment, by cultivation, physical removal and use of approved chemical pesticides.

.2 completely eliminate and remove from site all noxious weeds in accordance with government regulations.

.3 control and elimination of weeds within soft and hard landscaped surfaces on site on an ongoing basis. Ensure weed seed heads are removed before maturity.

.2 Insects and Disease: apply pesticides based on development stage of insects' life cycles to prevent loss or damage to plant material. Monitor turf areas and plants and apply pesticides, if approved, to control pest infestations.

.3 Monitor effectiveness of each pesticide application and promptly correct any inadequate or deficient application.

.4 Repair and pay for damage caused by application of herbicides.

.5 Do not use soil sterilants.

.6 Eliminate rodents using controls and methods approved by Minister.

3.8 AUTUMN PREPARATION

.1 Leaf Removal: rake and vacuum fallen leaves weekly and remove from site to approved waste recycling depot. Continue until leaves cease to fall.

.2 Clean all plant beds, planters, tree wells, mulched areas, and other landscaped areas on site weekly. Keep catch basins and all road and parking curbs clean and free of all debris. Remove all collected leaves and other debris to approved waste recycling depot.

.3 Remove and dispose of annuals from plant beds and planters within one week after first killing frost or when directed by Owner. Deep cultivate plant beds and planters.

.4 Cut back foliage of perennial plants within one week after killing frost. Ornamental grass shall remain intact during winter and trimmed back the following spring unless directed otherwise by Owner. Stake locations of cut perennials and apply organic mulch around plants for winter protection as necessary. Thoroughly water all perennial plants for winter.

.5 Deep root water all plants between October 1st and 15th in preparation for winter. Supply water, trucking and other necessary accessories to adequately apply water to each plant. Trees to receive minimum 40 liters of water per 25 mm of trunk diameter (measure at 300 mm above ground level). Apply water throughout tree dripline area. Saturate root area of shrubs, perennials and other plants. Record total quantity of water applied in maintenance log after each day of plant watering activities. Indicate quantity of plants watered each day and their location in maintenance log. Provide additional deep root watering services when warm dry temperatures are experienced in late fall to maintain plant warranty.

.6 Protect plants from rodent, animal and sun damages by installing appropriate protective materials.

.7 Sweep and clean all walkways and other hard surface areas weekly. Remove all collected debris and litter from site.

.8 Supply and erect snow fencing, as necessary, in protection of new landscape installations and as directed by Minister.

3.10 CLEANLINESS OF GROUNDS

.1 Keep grounds in clean and tidy condition to ensure clean site appearances are continually maintained. Provide clean-up services as directed by Owner. Sweep, clean, collect and remove all debris, litter, rubbish and pests from site grounds.

.2 Provide prompt service when directed by Owner to correct or complete clean-up services deemed inadequate or incomplete.

.3 Pay all costs for collecting and disposing of excess material and debris to municipal disposal site following each site clean-up. Do not dispose of any debris in Owner's disposal bins on site.

.4 Empty garbage containers on a weekly basis or more often when filled based on usage. Supply and replace refuse bags after each removal.

.5 Sweep and clean all walkways and other hard surface areas as required. Provide mechanical power wash equipment to clean and wash paved surfaces near buildings if directed by Owner.

.6 Keep site furnishings clean and in safe condition. Pressure wash and clean furnishings when necessary to maintain clean and sanitary appearances. Regularly clean cigarette snuffers and other ashtray furnishings.

.7 Record all cleaning services performed each week in maintenance log.

.8 Make weekly inspections for vandalism and damage. Immediately report vandalism and damage to Owner. Note all findings in maintenance log.

.9 Provide same day response to Owner's request to correct, repair, adjust damage or disfacement of plant materials caused by vandalism, accident or weather.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 23 38 – Trench Excavation and Backfill.

.2 Section 33 31 00 – Sanitary and Storm Utility Piping.

.3 Section 33 05 16.13 – Concrete for Utility Structures.

1.2 SECTION INCLUDES

.1 This Section specifies requirements for constructing new manholes and catch basins, and adjusting existing manholes.

1.3 PRODUCT QUALITY ASSURANCE AND QUALITY CONTROL

.1 Precast Concrete:

.1 Upon request, submit manufacturer's test data and certification that materials meet the requirements of this Section. Include manufacturer's drawings, information, and shop drawings where pertinent.

.2 Frames and Covers:

.1 Upon request, submit manufacturer's test data and certification that materials meet the requirements of this Section. Include manufacturer's drawings, information, and shop drawings where pertinent.

Part 2 Products

2.1 CONCRETE

.1 Cast-in-Place Concrete: To Section 33 05 16.13 – Concrete for Utility Structures.

2.2 PRECAST MANHOLE AND CATCH BASIN SECTIONS

.1 Precast manhole sections, catch basins, adjusting neck rings, and manhole steps shall conform to CAN/CSA-A257.4 and be manufactured using Type 50 sulphate-resistant Portland cement. All manhole sections shall have flexible watertight joints using flexible joint sealants. All preformed flexible joint sealants shall meet ASTM C990, Section 6.2.1, butyl rubber sealants and contain 50% minimum butyl rubber (hydrocarbon blends), percent by weight.

.2 Manhole joints shall meet requirements of CAN/CSA-A257.3.

.3 All precast units shall be marked with manufacturer's identification, date of casting, type of cement, and CSA Standard.

.4 All pipe-to-structure connections shall meet the physical property and performance requirements of ASTM C923-02. In addition, all mechanical devices, including castings, bolt assemblies, and take up clamps shall be constructed of 300 Series stainless steel and use no plastic or plastic parts.

2.3 SAFETY STEPS

.1 Safety steps shall be of the shape and size as shown on standard Drawings, and material shall be either of the following:

.1 25mm diameter mild steel and deformed bar conforming to ASTM A615, hot bent at temperature of at least 8700°C and galvanized in accordance with ASTM A123/A123M.

.2 Minimum 20mm diameter aluminum forged from 6061-T6, 6351-T6, or equal alloy, having minimum tensile strength of 260 MPa.

2.4 FRAMES, GRATINGS, COVERS

.1 Frames, gratings, and covers as shown on the standard Drawings and complying with the following requirements:

.1 Castings shall conform to all requirements of ASTM A48 and ASTM A536.

.2 The material for gray iron castings shall have a minimum yield strength of the Class shown on the standard Drawings.

.3 The material for ductile iron castings shall have a minimum yield strength of the Grade shown on the standard Drawings.

.4 Castings shall be sandblasted or cleaned and ground to eliminate surface imperfections. All castings shall be free of defects, true to pattern, and free from cracks, porosity, flaws, and excessive shrinkage. Coated castings will not be accepted.

.5 Castings shall be marked with identification markings which will include series designation (local standard), foundry identification, and month and year of casting. These markings shall be located in such a manner that they are easily identifiable after installation.

.6 Cover castings shall be guaranteed not to rock when installed in corresponding mating frame.

2.5 RUBBER RISER RINGS

.1 Rubber riser rings used for final elevation adjustments of a manhole frame in the manhole neck area shall consist of recycled rubber and polyurethane elastomer, with the following physical properties:

.1 Density of 70 lbs / cu ft in accordance with ASTM C642.

.2 Tensile strength of minimum 145 psi in accordance with ASTM D412.

.3 Compression set less that 4% at 145 psi in accordance with ASTM D395.

.4 Thermal expansion coefficient of 6 x 10-5 in/in/oF.

.5 No loss of structural properties after exposure to fifty (50) cycles of de-icing chemical.

.6 No loss of hardness, compressive strength, tensile strength, or elongation properties when exposed to weathering of seventy (70) hours at 158°F, in accordance with ASTM D573.

.7 Maximum thickness of ring is 63.5mm (2 ½").

2.6 OTHER MATERIAL

.1 PVC stubs with factory-applied casting of silica sand to facilitate pipe connections to catch basins only.

.2 Mortar: **T**o requirements of CSA-A179, Type S, using Type 50 sulphate-resistant Portland cement.

.3 Washed Gravel: Washed, crushed, or screened stone or gravel consisting of hard and durable particles meeting the following gradation limits; and free from sand, clay, cementitious, organic, and other deleterious material:

Sieve Size (mm)	Percent Passing by Mass
25	100
5	maximum 10
0.08	maximum 2

.4 Sand Bedding Material: Sand, free of organic matter and graded within the following limits:

Sieve Size (mm)	Percent Passing by Mass
10	100
5	70 – 100
0.16	5 – 20
0.08	0 -12

Part 3 Execution

3.1 EXCAVATION AND BACKFILL

.1 Excavate and backfill in accordance with Section 31 23 38 – Trench Excavation and Backfill.

.2 Install manholes and catch basins in accordance with the design.

3.2 CONCRETE WORK

.1 Do cast-in-place concrete Work in accordance with Section 33 05 16.13 – Concrete for Water and Drainage Structures

.2 Place concrete reinforcement in accordance with Section 03 21 00 – Reinforcing Steel.

3.3 INSTALLATION

.1 Construct units plumb and true to alignments and grade.

.2 Complete units as pipe laying progresses.

.3 Pump excavation free of standing water and remove soft, frozen, and foreign material.

.4 Check all precast units for required stamps. Any precast unit without stamp is to be rejected.

.5 Inspect all precast units for damage in shipment. Reject all damaged units and advise the supplier.

.6 Manholes shall be installed without field cutting.

.7 Standard Manholes:

.1 Standard manholes shall be constructed as shown on the Construction Drawings and in accordance with the Standard Drawings.

.2 Set precast, pre-benched base on minimum 100mm to maximum 300mm of washed gravel material.

.3 As an exception, and subject to the Engineer's approval, cast-in-place manhole base can be used. Place concrete directly on undisturbed ground and embed the first manhole section in the concrete. A layer of reinforcement shall be placed above the midpoint and shall have a minimum cross sectional area of 250mm2 per linear meter of concrete, in both directions. Form the channel and benching by casting the sloping manhole floor

around the pipe to the spring line, cutting and trimming the pipe evenly with the concrete surface after the concrete has set sufficiently. Place additional concrete to form the upper channel sides and benching as shown on the Standard Drawings. Steel trowel finish required for benching. 'Perched' manholes are not permitted on new construction.

.4 Assemble manhole out of precast sections. Make each joint watertight by using gaskets.

.5 Manholes are to be oriented so safety steps are on the centerline perpendicular to the main floor channel. Safety steps should be aligned so that a person exiting from the manhole would face oncoming traffic, where this does not conflict with the previous requirement. The safety steps shall be installed in all precast manhole sections, including the neck and in the cast-in-place section to form a continuous ladder, with rungs equally spaced at a maximum of 410mm, from within 300mm below the cover, to within 600mm of the base or benching. The steps shall be cast firmly in place or secured with a suitable mechanical anchorage to prevent pullout and maintain water tightness.

.6 The neck section shall be within the height limits shown on the Standard Drawings. A manhole step is required in the appropriate joints within the neck section. The joint with a manhole rung shall be mortared. All other joints between precast rings within the neck section shall have a removable gasket installed.

.7 As required, install a maximum of one (1) rubber riser ring for a final elevation adjustment of the manhole frame and cover. Maximum allowable height of rubber riser ring is 63.5mm (2 ½"). Use a sealer / adhesive such as PL Premium or as recommended by the rubber ring manufacturer between the concrete and the rubber ring.

.8 The manholes shall be fitted with frame and cover specified on the Drawings.

.9 The Contractor shall follow the manufacturer's instructions for installation of the floating frame and covers (Type 80 and Type 90), ensuring that the frame is supported by the paving material and not by the manhole.

.8 Catch Basins:

.1 Catch basins shall be constructed as shown on the Drawings and in accordance with the Standard Drawings.

.2 Set the precast catch basin on 100mm of compacted granular course.

.3 All joints between precast components shall be sealed with Kent seal or equivalent.

.4 The neck section shall be within the height limits shown on the Standard Drawings.

.5 Rubber riser rings may be inserted as required, as outlined in Section 2.9.7 – Standard Manholes.

.6 The catch basins shall be fitted with frame and cover specified on the Drawings.

.9 Connecting Pipe to Manholes and Catch Basins:

.1 Pipes shall be connected to the manhole precast, pre-benched base with integral gasket for each connection. All pipe-to-structure connections shall be made with a resilient connector cast into the manhole in a manner that meets the performance requirements of ASTM C923-02. Not more than two (2) service connections are permitted to a standard sanitary manhole.

.2 Plug lifting holes with low-shrink grout set in cement mortar.

.10 Place and compact backfill in accordance with Section 31 23 38 – Trench Excavation and Backfill.

3.4 ADJUSTING TOPS OF EXISTING MANHOLES

.1 Remove existing grating, frames, and covers, without breaking; and store for re-use at locations designated by Engineer.

.2 Raise or lower by adjusting the number of concrete neck rings. Refer to the Standard Drawings for neck section height limits.

.3 Where raising or lowering with neck rings exceeds the neck height limits, rebuild the top section of the manhole by adding or removing precast sections as required, in accordance with the Standard Drawings.

.4 If required, install rubber riser ring as outlined in Section 2.9.7 – Standard Manholes.

.5 Install additional safety steps in adjusted portion of units as required.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 00 10 – Geotechnical Sitework Testing.

.2 Section 32 10 00 – Sitework Concrete Forms and Accessories.

.3 Section 32 20 00 – Sitework Reinforcing Steel.

1.2 SECTION INCLUDES

.1 Supply and installation of Portland cement concrete for water and drainage structures outside the building envelope, excluding precast concrete.

1.3 QUALITY CONTROL

.1 The Client shall retain and pay for the services of a testing laboratory to perform field tests on the concrete produced and installed. The minimum test requirements shall be:

.1 Air Content: Every batch delivered until air content is established to within Specifications, minimum once per day. Every third batch thereafter, unless specifications are not met.

.2 Slump: Every batch delivered until Specifications are met, minimum once per day. Every third batch thereafter.

.3 Strength: In accordance with CSA-A23-2, standard tests for strength will be conducted at a frequency of not less than one (1) strength test for each 50m3 poured, or portion thereof, with minimum of one (1) test per project. The standard strength test shall consist of three (3) cylinders, laboratory moist cured, except when temperature is below 5oC, when cylinders shall be field cured. Slump and air content taken with cylinders. One (1) cylinder shall be broken at seven (7) days, and one (1) cylinder at twenty-eight (28) days.

.4 Field Cured Cylinders: Two (2) additional cylinders shall be cast when the ambient temperature is 5oC, or lower. Field cured cylinders shall be cured on the job site under the same conditions as the concrete they represent. One (1) cylinder shall be broken at seven (7) days, and one (1) cylinder at twenty-eight (28) days.

.2 Failure to meet Specifications shall result in the Engineer requesting, at the Contractor's cost:

.1 A change in mix design or supplier.

.2 Additional testing (coring, etc.).

.3 Remedial work or replacement.

.4 Other work as deemed necessary.

Part 2 Products

2.1 MATERIALS

.1 Portland Cement: to CSA-A3000, Type HS, sulphate-resistant

.2 Aggregates: to CSA-A23.1

.3 Water: to CSA-A23.1

.4 Air Entraining Admixture: to ASTM C260

.5 Chemical Admixture: to ASTM C494. Engineer to approve accelerating or set retarding admixtures during cold and hot weather placing.

2.2 NON-SHRINK GROUT

.1 Premixed compound consisting of non-ferrous aggregate, cement, water reducing and plasticizing agents, capable of developing minimum compressive strength at 16.5 MPa at two (2) days and 48 MPa at twenty-eight (28) days.

2.3 CURING COMPOUND

.1 Non-membrane, colourless, non-yellowing chemical liquid curing compound conforming to CSA-A23.1 and to ASTM C309.

2.4 FLOOR HARDENER

.1 Non-metallic, natural aggregate surface hardener.

2.5 BONDING AGENT

.1 Two-component, epoxy resin.

2.6 WATERSTOPS

.1 PVC Waterstop: Extruded PVC of sizes as indicated in the Drawings, to conform to CGSB 41-GP-35M. Waterstop type and profile to be pre-approved by the Engineer.

2.7 DAMPROOFING FOR DRAINAGE STRUCTURES

.1 Emulsified asphalt, mineral colloid type, unfilled to CAN/CGSB-37.2.

2.8 WATERPROFFING FOR DRAINAGE STRUCTURES

.1 Cementitious waterproofing such as Xypex, Vandex, or approved equal.

2.9 JOINT SEALANT

.1 Control and expansion joints, on the interior and exterior of concrete walls as shown on drawings. Sealant to CAN/CGSB-19.13, one-component, elastomeric, chemical curing sealing compound. Refer to Drawings for joint details and sealants for other joint types.

2.10 OTHER MATERIALS

.1 All other materials, not specifically described but required for a complete and proper installation of all cast-in-place concrete, shall be as selected by the Contractor subject to the approval of the Engineer.

2.11 MIX DESIGN

.1 Submittals: In accordance with CSA-A23.1, Table 11, it is the intent that the Engineer follows Alternative 1 method of specifying concrete. The concrete supplier assumes responsibility for the concrete mix proportions, and in conjunction with the Contractor, shall submit a design to the Engineer for review that will comply with the requirements of the Geotechnical Engineer.

.2 As a minimum, and unless specified by the Engineer elsewhere, for concrete used in water and sewage facilities, the properties of the concrete shall be:

.1 The minimum 28-day compressive strength requirement is 32 MPa.

.2 The maximum water/cementing material ration is 0.50.

.3 Air content to be 5% to 8%.

.4 The slump for concrete shall be 80mm, ± 30mm, unless specified elsewhere by the Engineer. The specified slump for pumping of concrete may be increased with the use of superplasticizing admixtures, upon arrival of the mix design by the Engineer.

.5 Maximum aggregate size of 20mm, unless specified otherwise elsewhere. Concrete density shall be normal.

.3 Accelerating admixtures may be used in cold weather subject to approval of the Engineer. If approved, the use of admixture will not relax the cold weather placement requirements. Use of the chloride shall not be permitted.

.4 Set retarding admixtures may be used during hot weather to allow for proper finishing of concrete, subject to approval of Engineer.

.5 The ratio of supplementary cementitious materials to total cementitious materials shall not exceed 0.20.

Part 3 Execution

3.1 DELIVERY OF CONCRETE

.1 Concrete shall be delivered to the job site according to Clause 18, CSA-23.1 as supplemented or modified below.

.2 The drum shall be rotated on the job site at mixing speed for three (3) minutes just before discharge.

.3 Water shall not be added after initial introduction of mixing water at the plant except when the slump at initial discharge is less than specified. If water is added, it is the responsibility of the supplier to ensure that the specified slump is not exceeded, and the specified strength is attained. Slumps exceeding the specified slump will be a cause for rejection.

.4 Re-tempering with air on site shall be performed by a quality control technician working for the concrete supplier. The quality control technician shall perform an air content test on each load of concrete re-tempered with air and shall provide results upon request.

.5 The slump shall be measured in accordance with CSA-A23.2-5C.

.6 The total air content shall be measured in accordance with CSA-A23.2-4C.

.7 Concrete shall arrive at the work site with a temperature of not less than 10˚C and not greater than 30˚C.

.8 Concrete shall be delivered to the site and discharged within two (2) hours after introduction of the mixing water to the cement and aggregates.

.9 The delivery ticket shall show batch plan location, supplier's name, ticket and truck numbers, mechanically punched date and time of initial plant mixing, mix design designation, water added, volume of concrete, site arrival and discharge time and any other information requested by the Engineer. Non-compliance of any of the requirements above shall be reasons for rejection of concrete by the Engineer.

3.2 PREPARATION

.1 Obtain the Engineer's approval before placing concrete. Provide twenty-four (24) hours notice prior to placing concrete.

.2 Pumping of concrete is permitted only after approval of equipment and mix.

.3 Ensure reinforcement and inserts are not disturbed during concrete placement.

.4 Prior to placing of concrete obtain Engineer's approval of proposed method for protection of concrete during placing and curing.

.5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.6 Do not place load upon new concrete until authorized by the Engineer.

3.3 CONSTRUCTION

.1 Do cast-in-place concrete work in accordance with CSA-A23.1.

.2 Sleeves and Inserts:

.1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated or approved by the Engineer.

.2 Where approved by the Engineer, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 mm x 100 mm not indicated shall be approved by the Engineer.

.3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from the Engineer before placing of concrete.

.4 Check locations and sizes of sleeves and openings shown on drawings.

.5 Set special inserts for strength testing as indicated and if required by non-destructive method of testing concrete. Refer to 1.3 – Quality Control above.

.3 Anchor Bolts:

.1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.

.2 With approval of the Engineer grout anchor bolts in pre-formed holes or holes drilled after concrete has set.

.3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.

.4 Set bolts and fill holes with shrinkage compensating grout.

.5 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.

.4 Waterstops:

.1 Install waterstops in all construction joints as shown on detailed drawings, or located below finished grade. Install them to provide a continuous water seal. Do not distort or pierce waterstop in such a way as to hamper performance. Do not displace reinforcement when installing waterstops.

.2 Use only straight heat sealed butt joints in field. Use factory welded corners and intersections unless otherwise approved by the Engineer.

.5 Joints:

.1 Locate and form all isolation or expansion joints as indicated on the Drawings. Install joint filler, sealer and primer to manufacturer's instructions.

.2 Install a polyethylene strip over joint filler to prevent bonding to joint sealer.

.3 The Contractor shall submit a plan that shows the proposed location of joints and pour breaks to the Engineer for approval.

.4 Do not allow reinforcing steel to run through expansion joints or isolation joints unless otherwise indicated.

.6 Finishing:

.1 Finish concrete in accordance with CSA-A23.1.

.2 Use procedures acceptable to the Engineer or those noted in CSA-A23.1 to remove excess bleed water. Ensure surface is not damaged.

.7 Floor Finishes:

.1 Plain Floor Finish (all covered floors and roof):

.1 Finish concrete floors to CSA-A23.1 as specified below.

.2 Use two (2) passes of steel trowelling to produce smooth burnished surface to within 5mm tolerance when measured in any direction using 3m straight edge.

.3 At areas with floor drains, maintain floors level at walls, pitch floor uniformly to drains at a minimum rate of one half of one percent (5mm per m) or as shown on the Drawings.

.2 Hardened Floor Finish (all exposed floors):

.1 Finish concrete floors as per 3.3.7.1 above, and apply hardener at a rate specified by the manufacturer.

.3 Textured Non-Slip Finish (all exterior flatwork):

.1 Immediately after first trowelling of the 'Plain Floor Finish', swirl-trowel, brush or broom the surface to a uniformly textured non-slip finish, as described in CSA-A23.1, Clause 22.6.1.

.8 Wall Finishes:

.1 In accordance with CSA-A23.1, leave concrete with a rough form finish for use on surfaces not exposed to view in the structure. Chip off fins and irregular projections, and patch form tie holes.

.2 For walls and surfaces exposed to view, the Contractor shall provide a sack rubbed finish as described in CSA-A23.1.

.9 Protection and Curing:

.1 Cure all concrete in accordance with CSA-A23.1, Section 21.

.2 Loosen wall forms within twenty-four (24) hours as outlined in Section 03 10 00 – Concrete Forms and Accessories.

.3 Initial curing: ensure the concrete surface is kept continuously moist until the temperature produced by the heat of hydration of the cement has peaked and dropped at least 8°C.

.4 Final curing: immediately after initial curing, additional curing shall be applied and maintained for a period of seven (7) days, to ensure that the specified concrete strength and quality has been obtained.

.10 Damp-proofing and Waterproofing of Drainage Structures:

.1 Apply damp-proofing compound to exterior of structural wall below grade where shown on drawings, according to manufacturer's recommendations.

.2 Apply waterproofing material onto interior surfaces of structural base and wall as indicated on drawings, within seventy-two (72) hours of stripping forms, and as recommended by the manufacture of the waterproofing materials. Cure the waterproofing compound as recommended by the manufacturer.

.11 Repairing Concrete:

.1 Cut back metal form ties and voids not less than 20mm from surface and fill with non-shrink grout.

.12 Bonding New Concrete to Old:

.1 Clean old concrete surface and protruding reinforcing steel concrete for a distance shown on detailed drawings.

.2 Roughen cleaned surfaces to expose the coarse aggregate of the existing concrete.

.3 Immediately prior to placing new concrete, apply a coating of bonding agent to the existing surface, in strict accordance with the manufacturer's recommendation.

.4 In locations where new concrete is doweled to existing work, drill holes in existing concrete and insert steel dowels and pack solidly with non-shrink grout to positively position and anchor dowels, or as indicated on the Drawings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 00 10 – Geotechnical Sitework Testing.

.2 Section 31 05 16 – Aggregate Materials.

.3 Section 31 23 38 – Trench Excavation and Backfill.

.4 Section 32 05 23 – Sitework Cement and Concrete.

1.2 MATERIAL CERTIFICATION

.1 Upon request, submit manufacturer's test data and certification that pipe materials and other materials meet the requirements of this Section. Include manufacturer's drawings, information and shop drawings where pertinent.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Unload and store materials on site with care to prevent damage.

.2 Store materials so that they are left clean.

.3 Store pipe in accordance with manufacturer's recommendations.

1.4 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

.3 Notify building occupants a minimum of 24 hours in advance of any interruption in service.

.4 Notify fire department of any planned or accidental interruption of water supply to hydrants.

.5 Notify local municipality minimum of 48 hours in advance of any work on or in the vicinity of water infrastructure owned by the municipality.

1.5 SERVICE CONNECTIONS

.1 The 150mm water main service stub from Airport Road shall be constructed by the Contractor. All construction within the municipal rights-of-way shall adhere to the Municipal District Number 17 standards and specifications.

.1 The existing water main service shall be located and abandoned at the main, in accordance with the requirements of the Municipal District Number 17.

1.1 QUALITY CONTROL

.1 Pipe Zone Material:

.1 For pipe installed by trenching methods, the Contractor shall supply a sample of pipe zone material and associated moisture density curves to ASTM D698 and sieve analysis to ASTM C136.

.2 Contractor to perform field density tests to ASTM D2167 or to ASTM D2922.

.3 The Contractor shall perform as many tests as are necessary to ensure that the work conforms to the requirements of the contract. Under no circumstances shall the frequency of testing be less than 1 density test per straight section of water main.

.2 Concrete Thrust Blocks:

.1 Collect at minimum one set of concrete samples from representative concrete used for thrust blocks. Conduct quality assurance testing in accordance with Section 32 05 23.

1.2 **WARRANTY**

.1 All water main, plus appurtenances, constructed within the municipal rights-of-way (Airport Road) shall be subject to a two (2) year warranty from the date of Construction Completion approval from the Municipal District Number 17. A Final Acceptance inspection will be conducted with the Municipal District Number 17 to identify deficiencies at the end of the warranty period. The Contractor shall be responsible to undertake any identified repairs. The Consultant shall assign responsibility for payment of the repairs to the Contractor or the Owner.

Part 2 Products

2.1 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

.1 PVC water mains shall have standard nominal diameters as indicated on the drawings.

.2 Pipe materials and fabrication shall conform to AWWA C900 or C905, as applicable. An Affidavit of Compliance to the AWWA C900 or C905 standards must be provided to the Engineer upon request.

.3 PVC water mains 100 mm through 300 mm diameter shall conform to AWWA C900 and shall have a dimension ratio (DR) of 18, unless otherwise specified.

.4 PVC water mains greater than 300 mm in diameter shall conform to AWWA C905 and shall have a dimension ratio (DR) of 25, unless otherwise specified.

.5 Test PVC pipe in accordance with AWWA C900 or C905 and CSA B137.3. The manufacturer shall maintain a record of all quality control tests for a period of not less than two years and shall submit pertinent records to the Engineer upon request.

.6 Gasket material shall be in accordance with the physical requirements specified in ASTM F477.

.7 Joint lubricants must be certified for potable water use in accordance with National Sanitation Foundation Standard 61 and must:

.1 Impart no taste or odour to potable water containing free or combined chlorine disinfectants.

.2 Create no turbidity in potable water.

.3 Promote no bacterial growth.

.4 Be compatible with rubber and neoprene gasket materials.

.8 Pipe age must not exceed two years at the time of rehabilitation.

2.2 FITTINGS, VALVES AND HYDRANTS

.1 PVC Injection-Moulded and Fabricated Fittings:

.1 Use with PVC or ductile iron pipe.

.2 Injection moulded fittings to conform to AWWA C907 for C.I.O.D. pipe.

.3 Fabricated fittings to conform to CSA B137.3.

.4 Use “push-on” type ends complete with one gasket for each ball.

.2 Gate Valves:

.1 Use only for pipe 100 mm to 400 mm in diameter. Use a valve size equal to the pipe size, or as directed on the approved construction drawings.

.2 Conform to AWWA C500, or C509; non-rising stem, bell ends, single ring gasket, push-on joints for connecting to PVC pipe.

.3 All external nuts and bolts to be Type 304 stainless steel or better.

.4 Provide a 50 mm square operating nut; that turns clockwise to close.

.5 Valve stem to be Type 304 stainless steel or grade B, C, D, or E bronze as per Table 1 of AWWA C509.

.6 Provide Type B (Screw Type) valve casing set with plug.

.7 Provide Type B (Screw Type) middle extension for valves with depths in excess of 3.0 m from top of operating nut to surface grade of valve box.

.8 Castings to have no cracks, gas holes or flaws. Surfaces shall be reasonably smooth with no burnt on sand. Casting runners, risers and fins shall be removed.

.9 Castings shall be true to pattern and with industry standard dimensional tolerances with no excessive shrinkage or deformity. Gray iron castings shall conform to ASTM A48, Class 30B. Ductile iron castings (plugs and bonnets) shall conform to ASTM A536, grade 60-40-18.

.10 Depth of operating nut not to exceed 3.0 m to surface grade. Use valve stem risers (extensions) with stone catcher flange, as required.

.11 Minimum depth of valve operating nut or riser shall be 3.0 m to surface grade.

.3 Fire Hydrants:

.1 Conform to AWWA C502

.2 Provide compression type hydrants, which close with the line pressure, bottom connection with drip valve.

.3 The barrel of the hydrant to be a minimum of 150 mm inside diameter in two flanged section with the upper section being 300 mm in length and terminating at the ground flange, 50 mm above ground level. The lower section to be of sufficient length to provide a minimum of 3.0 m from ground surface to the invert of the inlet pipe. Flanges to have a minimum of 4 bolts.

.4 The hydrant head is to have one pumper connection and two hose connections at least 415 mm above the ground flange; hose connections must be at 90 degrees on each side of the pumper connection. Nipples to be provided with caps, without chains or cables. Valve stem in hydrant head to have "O" ring seals and to be equipped with a thrust bearing. Lubrication, where required, to be applied by regular automotive style grease gun.

.5 Hydrant connection nipples shall have threads conforming to local municipal standards.

.6 Nipples are to be threaded into the hydrant head, rather than leaded in, unless a positive locking device is provided to prevent blow-out of the nipples.

.7 The operating nut on the hydrant valve stem and on the hose and pumper nipple caps, to be 3 sided, each side being an arc 36.5 mm long. The hydrant valve, hose and pumper caps shall open counter-clockwise.

.8 All external nuts and bolts, excluding ground flange, are to be Type 304 stainless steel or better.

.9 Provide a bottom connection, flanged to the barrel, with a single gasket, push-on type joint for ductile iron or PVC pipe, 150 mm in diameter only, complete with harnessing lugs.

.10 Internal paint: Hydrant body, top section – to be painted to AWWA C502 or AWWA C550. Alternatively internal surfaces may be left bare.

.11 External paint: Hydrant bodies (top section, domes, nozzle caps and steamers) are to be painted to AWWA C550 – yellow, in accordance with NFPA 291 standards.

.12 Supply and install hydrant extensions, as required.

2.3 PIPE BEDDING MATERIAL

.1 Granular Materials:

.1 Gradation shall be within specified limits when tested to ASTM C136 and ASTM C117 and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart.

.1 Bedding Sand:

.1 Natural sand or crushed rock screening to following grading requirements:

ASTM Sieve Size	% Passing
9.50 mm	100
4.75 mm	50-100
2.00 mm	30-90
.425 mm	10-50
0.075 mm	0-10

.2 Liquid Limit: ASTM D423 – 66, maximum 25.

.1 Plasticity Index: ASTM D424-59, maximum 6.

.2 Drain Rock: Crushed stone or crushed gravel to follow grading requirements:

ASTM Sieve Size	% Passing
20.0 mm	100
14.0 mm	90-100
10.0 mm	45-75
5.0 mm	1-15
2.5 mm	0-5

.3 Concrete required for cradles, easement, supports:

.1 To Section 32 05 23.

.2 Concrete mix designed to produce 32 MPa minimum compressive strength at 28d using Sulphate resistant cement (Type 50) and containing 28 mm maximum size, 5 mm minimum size coarse aggregate, with water/cement ratio to CAN3-A23. A-M Table 7, and 80 mm maximum slump at time and point of deposit. Air entrainment to CAN3-A23.1M Table 8, 5-8%.

.3 Mix design to be approved by Engineer.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes, fittings, valves, hydrants and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

3.2 TRENCHING AND BACKFILL

.1 Do trenching and backfill in accordance with Section 31 23 38.

.2 Trench depth to provide minimum cover over pipe of 3.0 m from finished grade or as indicated.

.3 Trench alignments and depth require Engineer's approval prior to placing bedding material and pipe.

.4 Do not backfill trenches until installed work has been checked and accepted by Engineer.

3.3 CONCRETE AND ENCASEMENT

.1 Do concrete work in accordance with Section 32 05 23. Place concrete to details indicated or directed.

.2 Do concrete work in accordance with Section 32 05 23. Place concrete to details indicated or directed.

.3 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.4 Do not backfill over concrete within 24 hours after placing concrete.

3.4 GRANULAR BEDDING

.1 Place bedding sand to details indicated or directed.

.2 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.

.3 Shape transverse depressions in bedding as required to make joints.

.4 Compact full width of bed to at least 95% of Standard Proctor Density (ASTM D698). Testing frequency shall be a minimum of one test every 100m of trench length.

.5 Place bedding stone instead of sand bedding material when directed.

.6 Fill any excavation below level of bottom of specified bedding with crushed stone and compact as directed.

3.5 INSTALLATION TOLERANCES

.1 Lay pipes in accordance with AWWA C600 and manufacturer's standards instructions and specifications, as applicable. Do not use blocks to support pipe.

.2 Join pipes in accordance with AWWA C600 and manufacturer's recommendations, as applicable.

.3 Handle pipe by approved methods to avoid damage to machined ends of pipe. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.4 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe with is not true alignment or grade or pipe which shows undue settlement after installation.

.5 Face socket ends of pipe in direction of laying.

.6 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.7 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe in direction of laying.

.8 Position and joint pipes with approved equipment. Do not use excavating equipment to force pipe sections together.

.9 Cut pipes as required for specials, fittings or closure pieces, in a neat manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at tight angles to axis of pipe.

.10 Use 1 m maximum pipe lengths where 150 mm diameter watermain connects to fittings, valves or rigid structures.

.11 Use 2 m maximum pipe lengths where 200 mm or larger diameter water mains connect to fittings, valves or rigid structures.

.12 Align pipes carefully before jointing.

.13 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.14 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.

.15 Complete each joint before laying next length of pipe.

.16 Minimize deflection after joint has been made.

.17 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.18 Ensure completed joints are restrained by compacting bedding material alongside and over installed.

.19 When stoppage of work occurs, block pipes in an approved manner to prevent creep during downtime.

.20 Recheck plastic pipe joint assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.21 Do not lay pipe on frozen bedding.

.22 Protect hydrants, valves and appurtenances from freezing.

.23 Upon completion of pipe laying and after Engineer has inspected work in place surround and cover pipes between joints with approved granular material placed in the pipe zone to dimensions indicated or directed.

.24 Hand place granular material in uniform layers not exceeding 150 mm thick to minimum 300 mm over top of pipe. Dumping of material directly on top of pipe is not permitted.

.25 Place layers uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe.

.26 Compact each layer to at least 95% of Standard Proctor Density (ASTM D698). Testing frequency shall be a minimum of one test every 100m of trench length.

.27 When hydrostatic and leakage test results are acceptable to Engineer, surround and cover joints and fittings with granular material placed and compacted as specified herein. Backfill trench in accordance with Section 31 23 38.

3.6 FITTINGS INSTALLATION

.1 Install fittings to manufacturer's recommendations at locations indicated.

3.7 VALVE INSTALLATION AND VALVE BOX

.1 Install valves to manufacturer's recommendations at locations indicated.

.2 Support valves with 150 mm thick concrete pad. Valves shall not be supported by pipe.

.3 Install valve boxes plumb and support to prevent transmission of strain or shock to the valve.

.4 Set valve boxes flush with finish grade or as directed.

.5 Compact backfill for 1.5 m radius all around valves for full depth of trench.

.6 Mark location of each valve with 38 x 89 mm stake 1 m long driven 600 mm into ground at the property line opposite the valve. Paint marker stakes red.

3.8 HYDRANT INSTALLATION

.1 Install hydrants at locations indicated or directed.

.2 Install hydrants in accordance with AWWA Manual of Practice M17.

.3 Install 150 mm gate valve and cast iron valve box on hydrant service leads as indicated.

.4 Set hydrants plumb with hydrant bowl on 150 mm thick concrete pad, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with body flange set at elevation of 50 mm above final grade.

.5 Place concrete thrust blocks as indicated and specified ensuring that drain holes are unobstructed.

.6 Where hydrants can be drained, excavate a pit measuring not less than 1.0 x 1.0 x 0.5 deep and backfill with coarse gravel or crushed stone to a level of 150 mm above drain holes. Otherwise plug hydrant drain.

.7 Compact backfill for 1.5 m radius all around hydrants for full depth of trench.

3.9 PLUGGING OF DEAD ENDS

.1 Insert standard plugs into bell ends of fittings or pipe bells.

.2 Place caps over spigot ends of fittings or pipes.

.3 Ensure plugs and caps are watertight.

3.10 CONNECTION TO EXISTING WATER MAINS

.1 Connect to existing water mains at locations indicated.

.2 Exercise caution in uncovering existing pipe to ensure no damage occurs.

.3 Interrupt service in the existing system for a minimum period of time.

3.11 THRUST BLOCKS

.1 Do concrete work to Section 32 05 23.

.2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Engineers.

.3 Bearing area of thrust blocks to be as indicated.

.4 Keep joints and couplings free of concrete.

.5 Do not backfill concrete within 24 hours after placing.

3.12 CATHODIC PROTECTION FOR BURIED FITTINGS, VALVES AND HYDRANTS

.1 All buried metal fittings and valves shall be cathodically protected with 2.3 kg (5 lb.) zinc anodes and all hydrants shall be cathodically protected with 5.5 kg (12 lb.) zinc anodes.

.1 Zinc anodes shall conform to AASTM B418-73 Type II shall have the following composition:

Aluminum	0.005% maximum
Cadmium	0.003%
Iron	0.00%
Zinc	remainder

.2 The packaged zinc anode shall be supplied with 2 m of AWG #10/7 copper wire.

.3 Anodes shall be packaged in a permeable cloth bag or cardboard chip type tube containing acceptable backfill mixture.

.4 The shipping container shall be watertight plastic and is to be removed prior to installation. Anodes shall carry a label identifying the manufacturer, type of anode, metal and backfill composition and the set weight of the anode.

3.13 PRESSURE AND LEAKAGE TESTING

.1 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.2 Notify Engineer at least 24 hours in advance of all proposed tests. Perform tests in presence of Engineer.

.3 Where any section of system is provided with concrete thrust blocks, do not conduct tests until at least 5 d after placing concrete or 2 d if high early strength concrete is used.

.4 Apply a leakage test pressure of 1035 kPa, after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for a period of 2 h. Test every valve in the system for leakage in the closed position.

.5 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure of 2 h.

.6 Do not exceed allowable leakage determined from formula below or shown in following table:

$L = \frac{NDP}{128{,}300}$ in which
L = allowable leakage in litres per hour.
N = number of bolted, mechanical, or push-on joints in the test section
D = nominal diameter of pipe in mm
P = square root of average test pressure during leakage test in kilopascals
Each service connection included in the test section will be counted as one joint.

.7 Locate and repair defects if leakage is greater than amount specified.

.8 Repeat test until leakage is within specified allowance for full length of water main.

Leakage Allowance in Litres per 100 Joints Per Hour
Test Pressure (kPa)

Pipe Dia (mm)	345	515	690	860	1035	1380	1550
150	2.17	2.65	3.07	3.42	3.76	4.34	4.60
200	2.89	3.54	4.09	4.57	5.02	5.79	6.14
250	3.62	4.42	5.19	5.71	6.27	7.24	7.67
300	4.34	5.31	6.14	6.86	7.52	8.69	9.21
450	6.51	7.96	9.21	10.29	11.28	13.03	13.81
600	8.69	10.61	12.28	13.71	15.05	17.37	18.41
750	10.86	13.27	15.35	17.14	18.81	21.72	13.01
900	13.03	15.92	18.42	20.57	22.57	26.06	27.62
Allowable Leakage Allowances Calculated From The Above Formula From AWWA Manual No. M23 (Pvc Pipe – Design And Installation)							

3.14 FLUSHING AND DISINFECTING

.1 Boundary values are only to be operated by the Municipal District Number 17.

.2 All flushing, disinfection and bacteriological testing to be completed in accordance with Municipal District Number 17 practices. Provide a minimum of 48 hours' notice to Municipal District Number 17 prior to flushing.

.3 Disinfect watermains to AWWA C651-86.

.4 Provide connections and pumps as required.

.5 Flushing and disinfecting operations shall be witnessed by Engineer. Notify Engineer at least 4 d in advance of proposed date when disinfecting operations will commence.

.6 Flush water mains through available outlets with sufficient flow to provide a velocity of 1.5 m/s, within pipe for 10 minutes, or until foreign materials have been removed and flushed water is clear.

.7 Open and close valves, hydrants and service connections to ensure thorough flushing.

.8 When flushing has been completed, introduce a solution of chlorine while discharging water at end of section being disinfected and ensure that it is distributed throughout entire system to a concentration of 25-30 mg/l.

.9 Operate valves, hydrants and appurtenances while main contains chlorine solution.

.10 Measure chlorine residuals after 24 hours. If less than 10 mg/l, flush and rechlorinate.

.11 After satisfactory chlorination for 24 hour minimum, flush line to remove chlorine solution. Dechlorinate if required.

.12 High, low and residual chlorine levels shall be reported to the Engineer.

.13 Bacteriological samples to be obtained after chlorine solution has been flushed out. Flush each sampling point for 5 minutes before sampling. Perform sampling in presence of Engineer.

.14 Should contamination remain or recur during this period, repeat disinfecting procedure.

3.15 RESTORATION

.1 Upon completion of work, remove excess materials and debris and leave work site clean.

.2 Upon receipt of acceptable bacteriological sample results, the Engineer will contact Municipal District Number 17 and request that the boundary valve(s) be operated and left in the "on" position.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 00 10 – Geotechnical Sitework Testing.

.2 Section 31 23 38 – Trench Excavation and Backfill.

.3 Section 33 05 13 – Manholes and Structures.

.4 Section 33 05 16.13 – Concrete for Utility Structures.

1.2 SECTION INCLUDES

.1 This Section specifies requirements for supplying and installing sewers.

1.3 SUBMITTALS

.1 At least fifteen (15) working days prior to commencing work inform the Geotechnical Engineer of the proposed source of bedding material and provide access for sampling.

1.4 SERVICE CONNECTIONS

.1 The sanitary sewer service stub from Airport Road shall be constructed by the Contractor. All construction within the municipal rights-of-way shall adhere to the Municipal District Number 17 standards and specifications.

1.5 AS-BUILT DRAWINGS

.1 Provide as-built drawings on completion of contract. Give details of pipe material, strength and/or wall thickness designation, rim and invert elevations at manholes, catch basins and connections, location of tees, bends, cleanouts, manholes, service connections, laterals and caps.

.2 Record abandonments on the as-built drawings.

1.6 QUALITY CONTROL

.1 Pipe Zone Material:

.1 For pipe installed by trenching methods, the Contractor shall supply a sample of pipe zone material and associated moisture density curves to ASTM D698 and sieve analysis to ASTM C136.

.2 Contractor to perform field density tests to ASTM D2167 or to ASTM D2922.

.3 The Contractor shall perform as many tests as are necessary to ensure that the work conforms to the requirements of the contract. Under no circumstances shall the frequency of testing be less than 1 density test per MH-to-MH section.

1.7 WARRANTY

.1 All sanitary sewer, plus appurtenances, constructed within the municipal rights-of-way (Airport Road) shall be subject to a two (2) year warranty from the date of Construction Completion approval from the Municipal District Number 17. A Final Acceptance inspection will be conducted with the Municipal District Number 17 to identify deficiencies at the end of the warranty period. The Contractor shall be responsible to undertake any identified repairs. The Consultant shall assign responsibility for payment of the repairs to the Contractor or the Owner.

Part 2 Products

2.1 CONCRETE PIPE

.1 Production:

.1 Manufacturers producing circular concrete pipe shall possess a current Prequalification Certificate, issued under the Plant Prequalification Program as outlined in the publication, Prequalification Requirements for Precast Concrete Drainage Products.

.2 Markings:

.1 Markings for indirect design projects shall be according to CAN/CSA A257.2. In addition, pipes shall be marked with the Prequalification Stamp as outlined in the publication, Prequalification Requirements for Precast Concrete Drainage Products.

.2 Markings for direct design projects shall conform to ASCE Standard Practice 15 – Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations.

.3 Product:

.1 Non-Reinforced Circular Concrete Pipe and Fittings: to CAN/CSA-A257.1 Class 3, designed for flexible rubber gasket joints to CAN/CSA-A257.3 made with Type 50 sulphate resistant Portland cement to CSA-A3000.

.2 Reinforced Circular Concrete Pipe and Fittings: to CAN/CSA-A257.2 with flexible rubber gasket joints to CAN/CSA-A257.3, made with Type 50 sulphate resistant Portland cement to CSA-A3000. Elliptical reinforcement is not acceptable unless specific approval is given by the Engineer prior to the manufacture of the pipe.

.3 Lifting Systems:

.1 Pipe lifting systems shall be provided. However, the following rules shall be observed:

.1 Pipe 900 mm and less in diameter, no lift holes.

.2 Pipe greater than 900mm diameter; designed lifting systems with cast-in anchors that are compatible with a '*Swift Lift*' System shall be provided.

.2 Seal lift holes watertight after installation of pipe.

2.2 PLASTIC PIPE

.1 PVC (PSM Type) Pipe:

.1 Smooth wall PVC pipe products and fittings shall conform to Sections 4 and 5 of CSA Standard B182.2 for all basic material requirements and manufactured quality and dimensional tolerance.

.2 Materials used for pipe shall come from a single compound manufacturer and shall have a cell classification of 12454-B, 12454-C, or 12364-C as defined in ASTM Standard D 1784. Materials used for moulded fittings shall come from a single compound manufacturer and shall have a cell classification of 12454-B, 12454-C, or 13343-C as defined in ASTM Standard D 1784.

.1 Notwithstanding the requirements of Section 4 of CSA Standard B182.2, compounds with different cell classifications than that noted above shall not be used without the prior approval of the Engineer.

.2 Minimum wall thickness shall be as required for SDR 35 unless otherwise approved by the Engineer.

.3 Pipe shall be installed within two (2) years from the production date indicated on the pipe.

.2 Open Profile Wall PVC Pipe:

.1 Closed profile and dual-wall corrugated pipe and open profile PVC pipe products and fittings shall conform to Sections 4 and 5 of CSA Standard B182.4 for all basic material requirements and manufactured quality and dimensional tolerance.

.2 Materials used for pipe and fittings shall come from a single compound manufacturer and shall have a cell classification of 12454-B, 12454-C, or 12364-C as defined in ASTM Standard D 1784.

.3 Notwithstanding the requirements of Section 4 of CSA Standard B182.4, compounds with different cell classifications than that noted above shall not be used without the prior approval of the Engineer.

.4 Minimum waterway wall thickness shall conform to CSA-B182.4 Table 3 for pipe stiffness of 320 kPa.

.5 Pipe shall be installed within two years from the production date indicated on the pipe.

2.3 PIPE EMBEDMENT ZONE MATERIALS

.1 Materials for use as foundation, embedment, and backfill include natural, manufactured, and processed aggregates and the soil types classified according to ASTM Test Method D 2487.

.1 Class I, Class II, and Class III materials are suitable for use as foundation material and in the embedment zone subject to the limitations noted herein.

.2 Class IV-A materials should only be used in the embedment zone in special design cases, as they would not normally be construed as a desirable embedment material for flexible pipe.

.3 Class IV-B, Class V Soils, and Frozen Materials are not recommended for embedment, and should be excluded from the final backfill except where specifically allowed by project specifications.

.4 For ease of compactability and to facilitate proper placement of material in the haunch area of the pipe, a suggested gradation for sand within the pipe embedment zone are the following limits:

Sieve Size (mm)	Percent Passing by Mass
10	100
5	70 – 100
0.16	5 – 20
0.08	0 –12

The above material is an example of a Class B embedment material.

.5 Washed gravel: Where specifically specified for use, washed gravel shall consist of washed, crushed or screened stone or gravel consisting of hard and durable particles meeting the following gradation limits and free from sand, clay, cementitious, organic and other deleterious material:

Sieve Size (mm.)	Percent Passing by Mass
25	100
5	Maximum 10
0.08	Maximum 2

Washed gravel meets the technical requirements for classification as a Class I embedment material.

2.4 CONCRETE

.1 Concrete mixes and materials for bedding, cradles, encasement and supports to be in accordance with Section 33 05 16-13.

2.5 QUALITY CONTROL FOR PIPE, FITTINGS, AND APPUTENANCES MATERIAL

.1 Concrete Pipe:

.1 For indirect design projects the manufacturer of concrete pipe shall perform quality control and quality assurance testing in accordance with CAN/CSA-A257.0, CAN/CSA-A257.1, CAN/CSA-A257.2 and CAN/CSA-A257.3.

.2 For direct design projects the manufacturer of concrete pipe shall perform quality control and quality assurance testing in accordance with ASCE Standard Practice 15 – Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations. Hydrostatic joint integrity shall also be demonstrated in accordance with Section 7 of CSA A257.0.

.2 PVC (PSM Type) Pipe:

.1 The manufacturer of PVC (PSM Type) pipe shall perform quality control and quality assurance testing in accordance with CSA-B182.2.

.3 Profile Wall PVC Pipe:

.1 The manufacturer of Profile Wall PVC pipe shall perform quality control and quality assurance testing in accordance with CAN/CSA-B182.4 in conjunction with ASTM F794 with minimum waterway wall thickness as per Table 3.

Part 3 Execution

3.1 PREPARATION OF PIPE

.1 Clean pipes and fittings of debris, dirt, mud, ice and snow before installation. Inspect materials for defects before installing. Remove defective materials from site.

.2 Inspect every pipe for damage in shipment. Reject any damaged pipe and have it removed from the site.

3.2 PIPE EMBEDMENT ZONE CLASSIFICATION AND CONSTRUCTION

.1 The pipe embedment zone is detailed on the Engineering drawings. The pipe embedment zone consists of the foundation (where required), bedding and haunch, and initial backfill as detailed on the standard drawing.

.1 Construction requirements within the pipe embedment zone for both concrete pipe and flexible pipes (PVC pipes) shall be based on the following modified ASCE 15 Standard Installation Types as depicted on Drawings. Embedment installation shall be compacted to a minimum of 95% Standard Proctor. Testing frequency shall be a minimum of one test every 100m of trench length.

3.3 FOUNDATION ZONE REQUIREMENTS AND CONSTRUCTION

.1 The foundation soil shall be moderately firm to hard in situ soil, stabilized soil, or compacted fill material.

.2 When unsuitable or unstable material is encountered, the foundation shall be stabilized.

.3 Where groundwater and soil characteristics may contribute to the migration of soil fines into or out of the foundation, embedment soils, sidefill, and/or backfill materials, methods to prevent migration shall be provided.

3.4 VERIFICATION THAT PROPOSED CONSTRUCTION METHOD IS CONSISTENT WITH DESIGN INTENT

.1 Project specific design requirements for the in-place density of outside bedding material, haunch material, and initial backfill shall be noted on the plans or in the project specifications or as detailed herein. As the precise measurement of these densities in the bedding and haunch zones during construction is often not technically feasible, the contractor shall demonstrate to the Engineer for the project that their proposed method of placement of these materials is sufficient to achieve the specified results, through a trial compaction demonstration.

.2 Should the materials proposed for use in the embedment zone change during the course of the works the contractor shall notify the Engineer and carry out additional compaction trials, sufficient to demonstrate that their proposed method of placement is consistent with achieving the specified requirements.

.3 The trial compaction demonstration shall in no way relieve the contractor from their contractual requirement of meeting the minimum performance criteria for completed installations as specified herein.

3.5 BEDDING AND HAUNCH CONSTRUCTION

.1 The bedding shall be constructed as per the specified installation type and in accordance with the contractors proposed construction method as verified in the compaction trial demonstration. Bedding shall be placed in such a manner to maximize the bedding angle achieved, to provide uniform load-bearing reaction, and to maintain the specified pipe grade.

.2 Shape bedding true to grade and to provide continuous, uniform bearing surface for barrel of pipe. Do not use blocks when bedding pipe.

.3 Lay pipe on an uncompacted layer of pipe zone material of minimum depth as shown on the drawings. Place pipe zone material under haunches of pipe, tamping and compacting material to ensure that no voids remain in the haunch zone. Compact outer bedding and haunch zones to Standard Proctor density specified for appropriate installation Type.

.4 Bell holes shall be excavated in the bedding when installing pipe with expanded bells such that the barrel and not the pipe bells support the pipe.

.5 Placement of haunching materials shall be carried out by methods that will not disturb or damage the pipe.

.6 The haunching material shall be worked in and tamped in the area between the bedding and the underside of the pipe before placement and compaction of the remainder of the material in the embedment zone.

.7 Compaction equipment and methods used in the haunch zone shall be compatible with the materials used, the location in the trench, and the in-place densities required.

.8 Where groundwater and soil characteristics may contribute to the migration of soil fines into or out of the bedding and haunch zones with the native soils, foundation materials, and/or other backfill materials; methods to prevent migration shall be provided.

.1 When native soils conditions are adverse or where indicated by project specifications, use washed gravel in lieu of sand.

.2 When washed gravel used, use filter cloth to separate sand and washed gravel.

.9 Where trench bottom is rock, lay pipe on a 150 mm cushion of washed gravel or bedding sand.

.10 When concrete bedding is specified, the pipe may be positioned on concrete blocks to facilitate placing of concrete. Anchor or weight pipe to prevent flotation when concrete is placed. Do not backfill over cast-in place concrete within 24 hours after placing.

3.6 INITIAL BACKFILL

.1 Placement of initial backfill material shall be carried out by methods that will not disturb or damage the pipe.

.2 Compaction equipment and methods shall be compatible with the materials used, the location in the trench, and the in-place densities required.

.3 A primary purpose of initial backfill is to protect the pipe from any impact damage that may arise from the placement of overfill materials. Minimum thickness of the initial backfill layer shall be as indicated on the standard installation drawings. In instances where final backfill material contains large objects or is required to be deposited from very high heights, initial backfill shall be extended to such additional height above the pipe as is necessary to prevent damage from occurring to the pipe during backfilling operations.

.4 Before using heavy compaction or construction equipment directly over the pipe, ensure that sufficient backfill has been placed over the pipe to prevent damaging either the pipe or the embedment zone materials.

3.7 INSTALLATION OF PIPE

.1 Lay and join pipes in accordance with manufacturer's recommendations.

.2 Installation of PVC pipe and fittings shall conform to CSA-B182.11.

.3 Installation requirements for Direct Design concrete pipe shall conform to the supplemental construction requirements identified in with ASCE Standard Practice 15 – Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations

.4 Handle pipe with approved equipment. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.

.5 Lay pipes on prepared bedding, true to line and grade, with pipe invert smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.6 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.7 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.8 Do not allow water to flow through pipe during construction, except as may be permitted by Engineer.

.9 Whenever work is suspended, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.10 Position and join pipes by approved methods. Do not use excavating equipment to force pipe sections together.

.11 Block pipes as required when any stoppage of work occurs to prevent creep during down time.

.12 Plug lifting holes with non-shrink grout.

.13 Cut pipes as required for special inserts, fittings or closure pieces in a neat manner, as recommended by pipe manufacturer, without damaging pipe and to leave a smooth end at right angles to axis of pipe.

.14 Connect pipe to manholes in accordance with Section 33 05 13.

.15 Use approved field connections for connecting pipes to existing sewer pipes.

.16 When complete, the sewer must be thoroughly cleaned out of all dirt, stones and rubbish.

3.8 PIPE JOINTING

.1 Install gaskets in accordance with manufacturer's recommendations.

.2 Support pipes with hand slings or crane as required to minimise lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes carefully before jointing.

.4 Maintain pipe joints free from mud, silt, gravel and other foreign material.

.5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 At rigid structures, install the first pipe joints not more than 1.2 metres from the side of the structure.

.9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

3.9 TRENCH AND FINAL BACKFILL

.1 Trench and final backfill in accordance with Section 31 23 38.

.2 Do not allow contents of existing sewer or sewer connection to flow into trench.

.3 Trench line, depth and bottom of trench excavation require approval by the Engineer prior to placing bedding material and pipe.

.4 Do not use heavy vibratory equipment for compaction until at least 1 metre of backfill has been placed above the elevation of the top of the pipe.

3.10 TOLERANCE OF SANITARY SEWERS

.1 Alignment:

.1 The centre line of 900 mm and smaller diameter pipes shall not be more than 150 mm off the designated alignment. The centre line of pipe greater than 900 mm shall not be more than 50 mm per 300 mm of diameter off the designated alignment. Where the pipeline alignment is supposed to be straight between manholes a line of sight through the pipe shall exist from manhole to manhole.

.2 Grade:

.1 The invert of the sewer main shall not deviate from the designated grade by an amount greater than the total of 6 mm plus 20 mm per metre of diameter of sewer pipe.

.2 Sags with a water depth between 12.5 mm and 25.0 mm may need to be repaired, as the discretion of the Engineer. Sags with a water depth over 25.0 mm must be repaired.

.3 Joints:

.1 Deflections at joints of concrete pipe shall not exceed those as permitted in the specifications for concrete pipe CAN/CSA-A257. Deflections at the joints of other pipe material shall not exceed those recommended by the manufacturer.

3.11 VISUAL INSPECTION AND ACCEPTANCE CRITERIA

.1 Carry out visual walk-through inspection of the completed sewers.

.2 Perform inspection after all mains, manholes and service connections have been installed.

.3 Repair all defects which will impair the structural integrity or the performance of the sewer system including, but not limited to improper joints, cracked, sheared or excessively deflected pipe, sags and rises which pond water in excess of twice the allowable deviation from grade, protruding service connections and visible infiltration or exfiltration.

.4 Flexible Pipe Defects:

.1 Where there is visual evidence of excessive or non-symmetrical deflection (e.g. a non-elliptical deformation pattern), formal deflection tests shall be conducted.

.2 For DR35 PVC pipe or profile pipe with equivalent pipe stiffness, the maximum allowable deflection shall be 5% of the CSA base inside diameter (BID) for short term observations (i.e. more than 30 days and less than 1 year) and 7.5% of CSA BID for long term observations (1 year or greater).

.3 Excessive or non-symmetrical deflection shall be reviewed by the Engineer and a determination shall be made as to whether the deformation is in excess of the strain limits for the pipe. Deformation less than the allowable strain limits can be re-excavated and have the embedment zone re-built to resolve the deficiency.

.4 Deformation in excess of the strain limit of the pipe material shall have the corresponding section of pipe removed and replaced.

.5 Under circumstances where the excavation of a pipe to resolve an excessive deformation deficiency is not technically feasible due to its depth or its location relative to other utilities and the amount of deformation is determined by the Engineer to be within the strain limits of the pipe, the contractor may make special application to the Engineer to achieve resolution of the deficiency through the use of an approved re-rounding device specially designed for use in the re-round of flexible pipes. Approval for the use of re-rounding devices will only be made in special circumstances on a case-by-case basis and will always be subject to an increased monitoring period for acceptance at the contractor's expense. The length of the monitoring period shall be determined by the Engineer on a case-by-case basis. Only re-rounding devices that work on the principle of imparting vibration to the surrounding embedment zone as a means of stabilizing the pipe-soil structure will be considered for use.

.6 Defects in flexible pipe that involve cracks and fractures to the pipe structure shall be cut out and replaced. Minor scratches from handling or inspection activities that are less than 10% of the wall thickness of the pipe are not defective, while pronounced scratches and scratches deeper than 10% of the wall thickness shall be deemed to be defective and shall be cut out and replaced.

.5 Rigid Pipe Defects:

.1 Cracks in concrete pipe shall be reviewed by the Engineer to make a determination as to whether they are in excess of the design crack width for service cracking. While project specific requirements may vary, acceptable service cracking is generally deemed to be cracks that measure 0.25 mm (0.01") in width at a distance of the lesser of 25 mm away from the inner pipe surface or at the interface with the reinforcing steel. This may result in cracks at the surface that are slightly in excess of the service crack width limit. A crack comparator or other suitable means shall be used to aid in the determination.

.2 Cracks in excess of the service crack limit shall be deemed to be defective and shall be repaired while cracks within service crack limit tolerances shall be deemed to be acceptable. In making their determination, the Engineer shall also consider the time-history of loading on the pipe. Full long term loading conditions shall not be deemed to have occurred until after 1 year after completion of backfilling. Therefore, very minor cracks can be determined to be acceptable but cracks near the limit of service crack tolerance shall be re-inspected to confirm whether they are acceptable or not after full loading is deemed to have developed on the pipe.

.3 For cracks deemed to be defective, the Engineer shall also make a determination as to whether the nature of the cracks compromises the structural integrity of the pipe. Cracks that are deemed to compromise the structural integrity of the pipe shall be taken out and replaced while non-structural cracks may be reviewed for alternate repair methods. Where alternate repair methods are proposed, the contractor shall make a specific proposal for the Engineer's review and approval.

.4 Under circumstances where the excavation of a pipe to resolve a structural performance deficiency is not technically feasible due to its depth or its location relative to other utilities and the nature of the deficiency is determined by the Engineer to be feasible for repair by trenchless methods, the contractor may make special application to the Engineer to achieve resolution of the deficiency by effecting an appropriately designed trenchless point repair. Approval for the rectification of structural deficiencies will only be made in special circumstances on a case-by-case basis and will always be subject to an increased monitoring period for acceptance at the contractor's expense. The length of the monitoring period shall be determined by the Engineer on a case-by-case basis.

.6 Joint Defects:

.1 Significant joint defects, cracked or offset joints shall be cut out and replaced in a manner acceptable to the Engineer.

.2 Joint defects such as hanging or improperly installed or improperly functioning gaskets shall be reviewed on a case-by-case basis to establish the most feasible means of repair. In all cases the joint may be cut out and replaced as a suitable means of repair. For minor joint deficiencies alternate repair methods may be considered. Where alternate repair methods are considered the contractor shall seek the approval of the Engineer.

.3 Under circumstances where the excavation of a pipe to resolve a joint deficiency is not technically feasible due to its depth or its location relative to other utilities and the nature of the joint deficiency is determined by the Engineer to be feasible for repair by trenchless methods, the contractor may make special application to the Engineer to achieve resolution of the deficiency by effecting an appropriately designed trenchless point repair and by the use of an appropriately selected grouting technology. Approval for the rectification of joint deficiencies by trenchless point repair or by the use of grouting technologies will only be made in special circumstances on a case-by-case basis and will always be subject to an increased monitoring period for acceptance at the contractor's

expense. The length of the monitoring period shall be determined by the Engineer on a case-by-case basis.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 33 31 00 – Sanitary and Storm Utility Piping.

1.2 SECTION INCLUDES

.1 This section specifies requirements for the inspection of gravity sewer lines, including:

.1 Closed circuit television (CCTV)

.2 Manhole Inspection

.2 The purpose of the sewer inspection is for the requirements of construction completion The Inspection Service Levels are defined herein, and the requirements for this project shall be Level 2.

.3 The work of this section includes:

.1 Supply of all materials, equipment, labour and supervision.

.2 Cleaning of sewers immediately before inspection.

1.3 DEFINITIONS

.1 Inspection Service Levels: The description of the various levels of service required for complete CCTV inspection of sewer pipes. Levels are further defined below:

.1 Level 1: Refers to performing CCTV inspection with sewers in existing condition, with no cleaning or flushing.

.2 Level 2: Refers to performing CCTV inspection with sewers being cleaned with one pass by flushing and cleaning equipment prior to televising.

.3 Level 3: Refers to performing CCTV inspection with sewers cleaned to Level 2, plus removal of sediments, solids, roots, encrustations and protruding services to allow passage of CCTV equipment.

.4 Level 4 Refers to performing CCTV inspection with sewers cleaned as specified in Section 02953. This is a level associated with preparations of sewers prior to CIPP relining. It includes a Level 3 cleaning plus any requirement of the lining design and installation, including close fit of the lining, removal of grease, removal of water, etc.

1.4 SAFETY PROCEDURES

.1 The Contractor shall pay strict attention to the Alberta Occupational Health and Safety Act and Regulations and other construction safety measures as outlined in Section 00800 – Occupational Health and Safety Regulations, Volume 1 General.

.2 Contractors shall provide a copy of their confined space entry procedures prior to commencing work.

.3 All documents and safety equipment required shall be available for inspection on demand.

Part 2 Products

2.1 CLOSED CIRCUIT TELEVISION INSPECTION EQUIPMENT

.1 Television equipment shall consist of a self-contained camera and a monitoring unit connected by a coaxial cable. This equipment shall be specifically designed and constructed for such inspection purposes. The camera shall be mounted on adjustable skids, or wheels, or have a height adjustment to facilitate the inspection of different sizes of pipe and to allow for visual judgment of ovality, by centring the camera within the pipe. The camera shall be waterproof and shall have a remote controlled self-contained lighting system capable of producing effective illumination for all sizes of pipe. The lighting system shall be capable of lighting the entire periphery of the pipe.

.2 For inspection of existing sewers and new sewers the camera shall have pan and tilt capabilities.

.3 Recorded picture quality and definition shall be to the satisfaction of the Engineer.

.4 Location measurement of defects shall be made by devices having a proven accuracy of plus or minus 1.5% or 2 metres, whichever is greater.

.5 Equipment shall be mounted in an appropriate vehicle. Electrical power for the system shall be self-contained and shall not require removal for each set-up. External power sources from public or private residences shall not be permitted. Sound dampening shall be applied to the vehicle and equipment.

.6 Stub lines and other locations where access is limited to one manhole shall be televised using a crawler equipped camera.

.7 The Engineer shall not be responsible for any loss or damage to the Contractor's equipment. The Contractor shall carry all necessary insurance to cover loss, damage, and/or retrieval during inspection. The Contractor shall be responsible for any damages due to sewer back-up or flooding that are caused by his cleaning or inspection operations. The Contractor shall promptly inform the Engineer if any such damages occur.

2.2 CCTV INSPECTION REPORTS

.1 A digital video shall be provided accompanied by an inspection report. This report shall be in accordance with the local municipality standards. It shall be a record of the exact location of each leak or fault discovered by the television - e.g. open joints, broken, cracked, deformed or collapsed pipe, presence of grease, roots, debris, accumulation, obstruction, infiltration, water depth variations and other points of significance. The reference location for distance measurements shall be the centreline of the launch manhole (chainage 0+00). If the inspection includes an intermediate manhole, chainage shall be reset to 0+00 in the centre of the intermediate manhole.

.2 All videos shall be in digital mpeg2 format at a minimum resolution of 640 x 480 and a data rate of 6000 kbps. CCTV reports submitted in digital media shall not contain any Player software or other embedded programs.

.3 The report shall include the location of all service connections together with a statement of opinion as to whether or not the service connections are subject to joint infiltration. Protrusions of service connections into the main line shall be noted with reference to the degree of protrusion.

.4 Photographs of sewer defects shall be taken. The photographs shall be co-ordinated with the written report by reference numbers. A minimum of one photograph per line or manhole to manhole segment shall be taken to show a representative view of the workmanship.

.5 Each manhole to manhole section of pipe shall be located on the report form in such a way as to be readily identifiable. Identify such items as name of subdivision, street names, manhole numbers, type of pipe, joint length, direction of flows, pipe diameter, manhole depth, inspection date, names of the inspection technician, persons viewing, and videotape identification numbers.

.6 Two copies of the final CCTV report with corresponding video shall be provided to the Engineer within two weeks after the completion of the inspection. The report shall be submitted on DVD. Media submitted shall become the property of the Client.

.7 All DVD's shall be numbered and cross-indexed to the written report. Video footage shall indicate the size of the sewer, the manhole to manhole segment being inspected, plus the street address or location.

.8 To insure photographic quality in reports, colour video printers shall be used.

Part 3 Execution

3.1 GENERAL

.1 The Engineer will supply all maps and drawings required for locating the manholes on the lines to be inspected. The Contractor will be responsible for locating and identifying the manholes and lines in the field. The Contractor shall advise the Engineer of buried or non-locatable manholes in writing. Any discrepancies found should be noted and reported to the Engineer.

3.2 CLEANING

.1 Prior to inspection, sewer lines are to be cleaned utilizing low pressure flushing.

.2 Sludge, dirt, sand and other debris resulting from the cleaning operations shall be removed from the downstream manhole of the section being cleaned. Passing material from the section being cleaned to the downstream sewer section shall not be permitted.

.3 Where the initial CCTV inspection indicates the presence of sags greater than 25% of the internal diameter of the sewer, the Contractor shall high-pressure flush that section of line. The section shall then be re-televised twice, firstly with a flusher a short distance ahead of the camera and then without a flusher active. All three records shall be forwarded to the Engineer.

.4 All debris flushed from the lines shall be removed and the Contractor shall be responsible for the proper disposal of the material.

.5 Water for flushing shall be made available from fire hydrants located on the job site or from a source approved by the Engineer or local municipality.

3.3 TRAFFIC CONTROL

.1 Interference to the normal flow of traffic shall be kept to a minimum.

.2 Traffic control, barricades, guards, and other safety precautions shall be used as necessary.

3.4 CLOSED CIRCUIT TELEVISION INSPECTION

.1 The CCTV inspection shall provide a full record of the condition of the pipes, manholes, and appurtenances along the designated section of sewer.

.2 The Contractor shall not attempt a CCTV inspection if water levels in the pipe obstruct the camera's view, unless instructed by the Engineer.

.3 When required, a small diameter polyethylene rope or similar line shall be installed in the sewer in advance of the inspection in order that the camera traction cable may be drawn through the sewer. This line shall be installed on a manhole to manhole basis with the line being tied off at each individual manhole to facilitate the quick removal of the equipment should the need arise due to mainline sewer blockages or other emergency situations.

.4 Direct communication shall be established between the monitoring station and the camera towing device operator. No loudspeaker devices shall be allowed.

.5 The camera advance rate shall not exceed 40 metres per minute to allow adequate time for operator interpretation. The advance rate shall normally not be less than 15 meters per minute in a sewer with minimal defects. This is shall ensure digital files are not excessively large. A uniform rate of speed shall prevail.

.6 The CCTV inspection shall document a complete visual survey of the sewer line from manhole to manhole, except as directed by the Engineer.

.7 If, during the inspection procedures the television camera will not pass through the entire pipe section between manholes, the Contractor will reset the equipment in such a manner so that the inspection can be performed from the opposite manhole.

.8 The camera operator shall, during the inspection, pan the camera to focus on observable deficiencies in the pipe that may be located off-center to the direction of camera travel. This shall include all services, joints to the top, left or right, cracks and fractures or surface deterioration of the pipe walls.

.9 On completion the Contractor shall provide television reports and digital media as detailed in Section 2.2 above.

END OF SECTION

1 General

1.1 REFERENCES

.1 ASTM International:
- .1 ASTM A325-14: Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- .2 ASTM A325M-14: Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength [Metric].
- .3 ASTM D698-12e2: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.2 CSA Standards:
- .1 CSA-A3000-13: Cementitious Materials Compendium.
- .2 CAN/CSA-A23.1-14/A23.2-14: Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .3 CAN/CSA A23.3-14: Design of Concrete Structures.
- .4 CSA-B72-M1987 (R2013): Installation of Lightening Rods
- .5 CSA-C22.1-12: Canadian Electrical Code, Part 1
- .6 CSA-G4-15: Steel Wire Rope for General Purpose and Mine Hoisting and Mine Haulage
- .7 CSA-G12-14: Zinc Coated Steel Wire Strand
- .8 CAN/CSA-G30.18-09 (R2014): Billet-Steel Bars for Concrete Reinforcement.
- .9 CAN/CSA-G40.20-13: General Requirements for Rolled or Welded Structural Quality Steel.
- .10 CAN/CSA-G40.21-13: Structural Quality Steels.
- .11 CAN/CSA-S16-14: Design of Steel Structures.
- .12 CSA S37-13: Antenna Towers and Antenna Supporting Structures.
- .13 CSA S269.3: Concrete Formwork.
- .14 CSA W47.1-09(R2014): Certification of Companies for Fusion Welding of Steel.
- .15 CSA W48-14: Filler Metals and Allied Materials for Metal Arc Welding.
- .16 CSA W55.3-08(R2013): Certification of companies for resistance welding of steel and aluminum.
- .17 CSA W59-13: Welded Steel Construction (Metal-Arc Welding).
- .18 CSA W178.1-14: Certification of Welding Inspection Organizations.
- .19 CSA W178.2-14: Certification of Welding Inspectors (Developed in cooperation with the Canadian Welding Bureau).
- .20 CSA Z259.16-04 (R2014): Design of Active Fall Arrest Systems.
- .21 CSA Z259.13-04 (R2014). Flexible Horizontal Lifeline Systems.
- .22 CSA Z259.2.2-14: Self Retracting Lifelines.

.3 Canada Labour Code

.4 Health and Welfare Canada

.5 Safety Code 6Limits of Exposure to Radio-Frequency Fields at Frequencies from 10 kHz-300kHz.

.6 Provincial Occupational Health & Safety Act and Regulations

.7 Codes:
- .1 ABC: Alberta Building Code 2014.
- .2 NBCC: National Building Code of Canada 2010.

.8 EIA/TIA 222: Structural Standard for Antenna Supporting Structures and Antennas.

.9 Canadian Aviation Standards Document CARs 621.19 Tower Obstruction Markings

.10 RCMP Safety Regulations.

.11 RCMP Standards and Guidelines for Communication Sites.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Provide shop drawings indicating plans, elevations, details, connections, materials, lateral supports, concrete foundations, tower details, antennas, electrical connections, conduits, grounding, anticlimb panels, lightning protection, fall arrest equipment, top and all other details and requirements to completely describe antenna tower and accessories for this project.

.3 Shop drawings are to be signed and sealed by a Professional Engineer registered in the Province of Alberta.

1.3 DESIGN REQUIREMENTS

.1 Completely design and engineer antenna tower and accessories. Coordinate all design requirements with RCMP Tower and related structures guidelines. Design tower to be minimum 80'-0" high.

.2 Engage a Professional Engineer registered in the Province of Alberta, to design the complete antenna tower, including concrete base, tower, lateral supports, and all electrical and antenna components as required for a complete installation.
- .1 The tower design engineer shall have a minimum of 5 years of communication tower design experience and shall be prepared to fully support all assumptions made with regard to the tower design. These assumptions shall be clearly stated on correspondence, which accompanies the design drawing, complete with back up information, calculations, and the like. The design engineer of record shall be clearly stated on all shop drawings.

.3 Design antenna tower to withstand all superimposed loading, including wind loads for the Elk Point area as outlined in the Alberta Building Code 2014 and National Building Code of Canada 2010 and based on the Qh site specific profile provided by Environment Canada.

.4 Design Ice Load: design the tower for a minimum ice loading of 50 mm of radial ice on all exposed surfaces, including members, guys, all attachments, and antenna components. The density of the ice shall be taken as 900 kg/m^3.

.5 Base the loading imposed on the tower by transmission lines and auxiliary lines - feeder lines, attached to it, on the actual dimensions of the lines as determined from the manufacturer's specifications.

.6 Design tower for a maximum twist / tilt not exceeding 1.5°. Maximum twist / tilt at each antenna level must be indicated on all preliminary and final tower designs.

.7 The value of Cd shall be taken as 1.5 for flat feeders and 1.0 for round feeders.

.8 Provide shielding of the transmission lines by the tower members, other feeders or attachments as required. When feeder lines are mounted on the inside of one face of the tower, shielding of the leeward lines may be considered, following the procedures outlined in "Commentary on Part 4 of ABC 2014". Shielding assumptions by the design engineer must be clearly stated, in writing, to the Departmental Representative.

.9 Take into consideration loading from auxiliary facilities and attachments such as ladders, fall arrest rails, rest and transfer platforms, antenna mounts, ice guards, feeder line supports, lighting and the like, in a similar fashion as to that of the transmission lines and feeders.

.10 Submit detailed design calculations to support tower and foundation designs.

.11 Design all foundations and anchors based on the attached Geotechnical Report.

.12 Design ice shields for all antennas, lights and photocells below the top mounted antenna. Take into consideration all loads imposed by all ice shields (both initial and future).

.13 Where requested by the Departmental Representative, the design engineer must provide additional information to verify design adequacy or respond to Technical Authority queries. This information shall be provided at the Contractor's cost, in written form under the professional seal of the engineer of record.

.14 Design all antenna and electrical components to provide a 700 MHz base antenna and VHF base antenna and addition 700 for AFRRCS system expansion.

.15 Provide all bonding and grounding provisions conforming to CSA C22.1.

.16 Provide all Antenna Tx/Rx cables and the like.

1.4 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for antenna tower and equipment for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

2 Products

2.1 MATERIALS

.1 Concrete and reinforcing: as specified in Division 03.

.2 Steel requirements: to the requirements specified in Division 05 and as indicated on the reviewed shop drawings.

.3 Guy wires and supports: as detailed on the reviewed shop drawings.

.4 Antennas, electrical components and accessories: as detailed on the reviewed shop drawings.

.5 Fall Arrest equipment: as indicted on the reviewed shop drawings.

3 Execution

3.1 INSTALLATION

.1 Install antenna tower, concrete foundation, guy wires, antennas, electrical components and accessories, to locations indicated on the drawings and reviewed shop drawings.

.2 Install plumb and true to line to withstand all superimposed loading.

.3 Install fall arrest equipment in strict accordance with manufacturer's requirements, and adjust as required for proper operation.

.4 Coordinate underground conduit pathways, with Division 26.

.5 Ensure that antenna tower and all electrical and antenna equipment operate properly.

3.2 FIELD QUALITY CONTROL

.1 Inspections:

.1 Inspection and testing of tower, concrete, cables, and equipment will be carried out by testing agencies designated by Departmental Representative.

.2 Contractor will pay for tests out of the Cash Allowance as specified in Section 01 21 00 - Allowances and Section 01 29 83 - Payment Procedures for Testing Laboratory Services.

END OF SECTION