Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

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Serving GOVERNMENT, Serving CANADIANS.

SPECIFICATION (Issued for Construction Submission, 20 November 2015)

Canada School of Public Service Fit-Up
Public Works and Government Services Canada (PWGSC)
Project No. R.060508.003

Stanley Knowles Building
Winnipeg, Manitoba

www.pwgsc-tpsgc.gc.ca

Pages

Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

Division 01 - GENERAL REQUIREMENTS

Division 02 – EXISTING CONDITIONS

Division 05 – METALS

Division 06 – WOOD, PLASTICS, AND COMPOSITES

Division 07 – THERMAL AND MOISTURE PROTECTION

Division 08 – OPENINGS

Division 09 – FINISHES

Division 10 – SPECIALTIES

Division 12 – FURNISHINGS

Division 21 - FIRE SUPPRESSION

Division 22 - PLUMBING

Division 23 - HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

Division 26 - ELECTRICAL

Division 27 - COMMUNICATIONS

Division 28 – ELECTRONIC SAFETY AND SECURITY

END OF TABLE

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract is as indicated in the Contract Documents and summarized as follows:

.1 Demolition/removal of existing interior finishes including flooring, walls, and ceiling tile. Supply and installation of new walls, doors for meeting rooms and offices. Supply and installation of floor, ceiling, and wall finishes. Supply and install of mechanical and electrical work to suit new workstation, office, and meeting room layout. Relocation of furnishings, fixtures, and equipment from existing facility to new facility.

1.2 CONTRACT METHOD

.1 Construct Work under single, stipulated price contract.

.2 Division of the Work among Subcontractors, suppliers, or vendors is solely the Contractor's responsibility. The Departmental Representative assumes no responsibility to act as an arbiter to establish subcontract terms between sectors or disciplines of work.

.3 Coordinate installation of Departmental Representative-supplied and vendor-supplied systems, and all associated equipment.

1.3 WORK BY OTHERS

.1 Cooperate with other Contractors in carrying out their respective works and carry out instructions from Departmental Representative.

.2 Coordinate 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 Departmental Representative, in writing, any defects which may interfere with proper execution of Work.

.3 Work of this Project must include provisions for co-ordinating related work, identified in Contract Documents, for following principal items.

.1 Coordinate with Departmental Representative for Departmental Representative supplied and installed furniture, identified as “new” in the Contract Documents and related electrical and IT Work.

.2 Coordinate with Shared Services Canada for IT connections and Work.

.3 Refer to the Drawings.

1.4 WORK SEQUENCE

.1 Coordinate with Departmental Representative Progress Schedule and Building Occupancy during construction.

.2 Coordinate with Departmental Representative’s Building Manager, requirements of ongoing Building Occupancy of other areas of the Buildings during construction.

.1 Provide sequence plan of operations and signage/partitions to be provided to allow ongoing Building Occupancy to the approval of the Departmental Representative’s Building Manager prior to commencing the Work.

.3 Maintain fire access/control.

1.5 DEPARTMENTAL REPRESENTATIVE FURNISHED ITEMS

.1 Department Representative Responsibilities:

- .1 Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor.
- .2 Deliver supplier's bill of materials to Contractor.
- .3 Arrange and pay for delivery to site in accordance with Progress Schedule.
- .4 Inspect deliveries jointly with Contractor.
- .5 Submit claims for transportation damage.
- .6 Arrange for replacement of damaged, defective or missing items.
- .7 Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Contractor.

.2 Contractor Responsibilities:

- .1 Designate submittals and delivery date for each product in progress schedule.
- .2 Review shop drawings, product data, samples, and other submittals. Submit to Departmental Representative notification of observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
- .3 Receive and unload products at site.
- .4 Inspect deliveries jointly with Departmental Representative; record shortages, and damaged or defective items.
- .5 Handle products at site, including uncrating and storage.
- .6 Protect products from damage, and from exposure to elements.
- .7 Assemble, install, connect, adjust, and finish products.
- .8 Provide installation inspections required by public authorities.
- .9 Repair or replace items damaged by Contractor or subcontractor on site (under their control).
- .10 Coordinate electrical and IT requirements for Departmental Representative Furnished Items.

1.6 ALTERATIONS, ADDITIONS, OR REPAIRS TO EXISTING BUILDING

.1 Execute work with least possible interference or disturbance to building operations, occupants, public, and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

.2 Use only elevators existing in building for moving workers and material.

- .1 Protect walls of passenger elevators, to approval of Departmental Representative, prior to use.
- .2 Accept liability for damage, safety of equipment, and overloading of existing equipment.

1.7 DOCUMENTS REQUIRED

.1 Successful bidding Contractor is to obtain required sets of Contract Documents for construction purposes, which includes two (2) sets for "as-built" and record purposes.

- .1 Contractor is responsible for costs of printing, handling, and shipping of Contract Documents.

.2 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 Other documents as specified.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 ACCESS AND EGRESS

.1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.2 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.

.2 Maintain existing services to building and provide for personnel and vehicle access.

.3 Where security is reduced by work provide temporary means to maintain security.

.4 Departmental Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.

.5 Use only elevators existing in building for moving workers and material.

.1 Protect walls of passenger elevators to approval of Departmental Representative prior to use.

.2 Accept liability for damage, safety of equipment, and overloading of existing equipment.

.6 Closures: Protect work temporarily until permanent enclosures are completed.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

.1 Execute work with least possible interference or disturbance to building operations, occupants, public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.4 EXISTING SERVICES

.1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.

.3 Provide for personnel, pedestrian, and vehicular traffic.

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

1.5 SPECIAL REQUIREMENTS

.1 Carry out disruptive work Monday to Friday between 5:30 pm to 7:00 am only. This includes:

.1 Work using odourous products, such as paints and adhesives.

.2 Noisy work.

.3 Removal of large amounts of waste.

.4 Unloading of large amounts of new building materials.

.5 Unloading of building materials or systems that must be brought in through the front entrance of the building.

.2 Obtain key to shunt alarm, and maintain building security when using loading dock after regular building hours.

.3 Submit schedule in accordance with Section 01 32 16 - Construction Progress Schedule - Bar (GANTT) Chart.

.4 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic, and security regulations.

.5 Keep within limits of work and avenues of ingress and egress.

1.6 SECURITY

.1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.

.2 Security clearances:

.1 Personnel will be checked daily at start of work shift and provided with pass that must be worn at all times. Pass must be returned at end of work shift and personnel checked out.

.3 After-hours work: Arrange for Commissionaire security services with Departmental Representative when performing after-hours work.

.1 Provide minimum 72 hours notice to, and coordinate with, Departmental Representative for after-hours Commissionaire service.

1.7 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. Smoking is not permitted.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 Schedule and administer project meetings bi-weekly throughout the progress of the work.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting four days in advance of meeting date to Departmental Representative.

.4 Provide physical space and make arrangements for meetings.

.5 Preside at meetings.

.6 Record meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.7 Reproduce and distribute copies of minutes within three days after meetings and transmit to Departmental Representative.

1.2 PRECONSTRUCTION MEETING

.1 Within 15 days after award of Contract, request a meeting with Departmental Representative to discuss and resolve administrative procedures and responsibilities.

.2 Establish time and location of meeting minimum 5 days before meeting.

.3 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

.4 Agenda to include:

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

.2 Schedule of Work: In accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Chart.

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

.4 Requirements for temporary facilities, offices, and utilities, in accordance with Section 01 52 00 – Construction Facilities.

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

.6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.

.7 Record drawings in accordance with Section 01 78 00 – Closeout Submittals.

.8 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.

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

.10 Monthly progress claims, administrative procedures, and hold backs.

.11 Appointment of inspection and testing agencies or firms.

.12 Insurance, transcript of policies.

1.3 PROGRESS MEETINGS

.1 During course of Work and 2 weeks prior to project completion, schedule progress meetings bi-weekly.

.2 Contractor, major Subcontractors involved in the Work, Departmental Representative, Consultants to attend.

.3 Notify affected parties minimum 4 days prior to meetings.

.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.

.5 Agenda to include the following:

.1 Review and approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, and conflicts.

.4 Problems that 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 effect on construction schedule and on completion date.

.12 As-builts.

.13 Security issues.

.14 Other business.

Part 2 Products

Not used.

Part 3 Execution

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 approved scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide five 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 Departmental Representative 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 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 Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

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

.2 Submit to Departmental Representative within 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 Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

1.4 MASTER PLAN

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

.2 Departmental Representative will review and return revised schedules within 5 working days.

.3 Revise impractical schedule and resubmit within 5 working days.

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

1.5 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

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

.1 Award.
.2 Shop Drawings, Samples.
.3 Permits.
.4 Mobilization.
.5 Interior Architecture (Walls, Floors and Ceiling).
.6 Plumbing.
.7 Lighting.
.8 Electrical.
.9 Piping.
.10 Controls.
.11 Heating, Ventilating, and Air Conditioning.
.12 Millwork.
.13 Fire Systems.
.14 Testing and Commissioning.
.15 Supplied equipment long delivery items.
.16 Engineer-supplied equipment required dates.

1.6 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on weekly basis reflecting activity changes and completions, and 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.

1.7 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 approved dates shown on baseline schedule.

.2 Weather related delays with their remedial measures to be discussed and negotiated.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 Submit items listed for review to Departmental Representative. 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 Departmental Representative. 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 examined and considered rejected.

.6 Notify Departmental Representative, 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 Departmental Representative's review of submittals.

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

.10 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data that 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 Province of Manitoba, 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 five days for Departmental Representative's review of each submission.

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

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

.7 Accompany submissions with transmittal letter, in duplicate, 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 Departmental Representative's review, distribute copies.

.10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.11 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative 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 Departmental Representative.

.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 Departmental Representative.

.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 Departmental Representative.

.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 Departmental Representative.

.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 Departmental Representative.

.18 Delete information not applicable to project.

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

.20 If upon review by Departmental Representative, 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.

.21 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

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

.2 Deliver samples prepaid to Departmental Representative's business address.

.3 Notify Departmental Representative 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 Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 Make changes in samples that Departmental Representative 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.

1.4 MOCK-UPS

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

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 REFERENCES AND CODES

.1 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender 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 HAZARDOUS MATERIAL DISCOVERY

.1 Asbestos: Demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately if material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Departmental Representative.

.2 Mould: Stop work immediately if material resembling mould is encountered during demolition work. Notify Departmental Representative.

1.3 BUILDING SMOKING ENVIRONMENT

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

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 INSPECTION

.1 Allow Departmental Representative 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 approvals by Departmental Representative 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.

.4 Departmental Representative will 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, Departmental Representative shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies may be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.

.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 Departmental Representative at no cost to Departmental Representative. Pay costs for re-testing 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 Departmental Representative 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 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 Departmental Representative 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 Departmental Representative, it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents.

1.6 REPORTS

.1 Submit 2 copies of inspection and test reports to Departmental Representative.

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

1.7 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

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 as directed by Departmental Representative.

.3 Prepare mock-ups for Departmental Representative’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 If requested, Departmental Representative will assist in preparing schedule fixing dates for preparation.

.6 Mock-ups may remain as part of Work.

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 and electrical systems.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA S269.2-M87, Access Scaffolding for Construction Purposes.

.2 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as of: May 14, 2004.

1.2 INSTALLATION AND REMOVAL

.1 Provide sequence plan of operations and signage/partitions to be provided to allow ongoing Building Occupancy to the approval of the Departmental Representative's Building Manager prior to commencing the Work. Identify:

.1 Coordinated use of building washroom facilities.

.2 Indicate use of supplemental or other staging area.

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

.3 Remove from site all such work after use.

1.3 SCAFFOLDING

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

.2 Provide and maintain scaffolding, ramps, ladders, and platforms as required.

1.4 SITE STORAGE/LOADING

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

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

.3 Locate tools, equipment, and materials on site in manner to cause least interference with work activities.

1.5 CONSTRUCTION PARKING

.1 Parking will not be provided on site.

.2 Delivery vehicles must vacate loading zone immediately after unloading.

1.6 SANITARY FACILITIES

.1 Departmental Representative will assign sanitary facilities for work force in accordance with governing regulations and ordinances.

1.7 CONSTRUCTION SIGNAGE

.1 Signs and notices for safety and instruction are to be in both official languages.

.2 Maintain approved signs and notices in good condition for duration of project, and dispose of off site upon completion of project, or earlier if directed by Departmental Representative.

1.8 PROTECTION AND MAINTENANCE OF ACCESS, EGRESS, AND TRAFFIC

.1 Provide measures for protection and diversion of pedestrian traffic and erection and maintenance of adequate temporary warning, danger, and direction signs as required.

.2 Protect public from damage to person and property.

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

1.9 CLEAN-UP

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

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

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May 14, 2004.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove all such work from site after use.

1.3 SITE ENCLOSURE AND HOARDING

.1 Provide temporary controls (including but not limited to signage and barriers) in order to execute Work expeditiously.

.2 Provide as required to maintain safety, egress, and exiting as required by governing authorities, Codes, and regulations. Erect and maintain as requested by Department Representative.

.3 Remove from site all such work after use.

1.4 DUST TIGHT SCREENS

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

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

1.5 ACCESS TO SITE

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

1.6 ACCESS, EGRESS AND FIRE ROUTES

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

.2 Design, construct, and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.7 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.

1.8 PROTECTION OF BUILDING FINISHES

.1 Adequately protect Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by Departmental Representative, at no increase in Contract Price or Contract Time.

.2 Protect areas of the site and building outside of the scope of Work from damage.

.3 Protect furniture and equipment to be moved from damage during removal, transportation, storage, and installation.

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

.5 Provide necessary screens, covers, and hoardings.

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

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Within text of each specifications Section, reference may be made to reference standards to which material or workmanship must conform.

.2 Conform to reference standards, in whole or in part, as specifically requested in specifications.

.3 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.

.4 Conform to latest date of issue of referenced standards in effect on date of submission of tenders, except where specific date or issue is specifically noted.

1.2 QUALITY

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged nor defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source, and quality of products provided.

.2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.

.3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.4 Should disputes arise as to quality or fitness of products, decision rests strictly Departmental Representative based upon requirements of Contract Documents.

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

.6 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.

1.3 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 Departmental Representative, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

1.4 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 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.

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

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

1.5 DELIVERY

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

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

1.6 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 Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.

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

1.7 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 Departmental Representative if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Departmental Representative 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 Departmental Representative, whose decision is final.

1.8 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.

1.9 CONCEALMENT

.1 In finished areas conceal pipes, ducts and wiring in floors, walls, and ceilings, except where indicated otherwise. Before installation, inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

1.10 REMEDIAL WORK

.1 Refer to Section 01 73 00 - Execution Requirements.

.2 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.

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

1.11 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.

1.12 FASTENINGS - EQUIPMENT

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

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

1.13 REQUEST FOR SUBSTITUTION

.1 Refer requests for substitution of materials to the Departmental Representative, supported by manufacturer's test data, proof of conformance to the specified standards, samples and installation manuals as may be required to carry out an assessment of substitutes. Drawings, diagrams, and manufacturer’s literature must be legible. In no event will the substitute deviate substantially from the original specified.

1.14 COMPATIBILITY

.1 Compatibility of components is essential. Ensuring that all items selected to use are compatible:

.1 When materials are to be installed in permanent contact with each-other, and the possibility of chemical or electrolytic reaction exists, causing material deterioration;

.2 When a component is to be incorporated within an assembly or system and must be compatible in order to fit in size, shape, etc., without any adverse effect to integrity or appearance of that system;

.3 When there is doubt about incompatibility, verify with and obtain manufacturer's recommendations in writing;

.4 When there is incompatibility, inform Departmental Representative of manufacturer's recommendations. Departmental Representative will determine course of action.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 EXISTING SERVICES

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

.2 Where unknown services are encountered, immediately advise Department Representative and confirm findings in writing.

.3 Notify Department Representative and utility companies of intended interruption of services and obtain required permission.

.4 When breaking into or connecting to existing services, give Department Representative 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities and approved by Department Representative with minimum disturbance to pedestrian, vehicular traffic, and tenant operations.

.5 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.

.6 Remove abandoned service lines within 2 metres of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

.7 Provide temporary services when approved by Department Representative to maintain critical building and tenant systems as required.

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

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

1.2 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 Departmental Representative of impending installation and obtain approval for actual location. Inform Departmental Representative of conflicting installation.

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

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submit 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 Departmental Representative 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 others.
- .7 Written permission of affected separate contractor.
- .8 Date and time when work will be executed.

Part 2 Products

Not used.

Part 3 Execution

3.1 EXAMINATION

.1 Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.

.2 After uncovering existing Work, assess conditions affecting performance of work.

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

3.2 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.

3.3 EXECUTION

.1 Execute cutting, fitting, and patching to complete Work.

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

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

.4 Employ experienced installer to perform cutting and patching for moisture-resistant elements and sight-exposed surfaces.

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

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

.7 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with authorities having jurisdiction and as indicted on the Drawings, to full thickness of the construction element.

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

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

3.4 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 21 – Construction Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions "C", In Effect as of: May 14, 2004.

1.2 REGULATORY REQUIREMENTS

.1 Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

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

1.3 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris.

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

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

.4 Provide and use containers for collection of waste materials and debris and marked separate bins for recycling.

.5 Dispose of waste materials and debris as directed by Departmental Representative.

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

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

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

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

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

1.4 FINAL CLEANING

.1 When Work is Substantially Performed, 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.

.5 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.

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

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

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

.9 Prepare floor finishes, as recommended by manufacturer.

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

.11 Sweep and wash clean paved areas soiled by construction.

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

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

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 STORAGE, HANDLING, AND PROTECTION

.1 Store materials to be reused, recycled, and salvaged in locations as directed by Departmental Representative.

.2 Unless specified otherwise, materials for removal become Contractor's property.

.3 Protect, stockpile, and store salvaged items.

.4 Protect structural components not removed for demolition from movement or damage.

.5 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.

.6 Separate and store materials produced during dismantling of structures in designated areas.

.7 Prevent contamination of materials to be salvaged and recycled. Handle materials in accordance with requirements for acceptance by designated facilities.

1.2 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of waste, volatile materials, mineral spirits, oil, nor paint thinner into waterways, storm, or sanitary sewers.

.3 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

1.3 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises.

.2 Coordinate with Departmental Representative for size and placement of contractor disposal bin.

.3 Building waste bin may not be used for construction waste disposal.

.4 Maintain security measures established by existing facility; where necessary, provide temporary security measures approved by Departmental Representative.

Part 2 Products

Not used.

Part 3 Execution

3.1 APPLICATION

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

3.2 CLEANING

.1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.2 Clean-up work area as work progresses.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Acceptance of Work Procedures:

.1 Contractor's Inspection: Contractor: Conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.

.2 Request Departmental Representative inspection.

.2 Departmental Representative Inspection:

.1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.

.2 Contractor to correct Work as directed.

.3 Completion Tasks: Submit written certificates in English, indicating that tasks have been performed as follows:

.1 Work: Completed and inspected for compliance with Contract Documents.

.2 Defects: Corrected and deficiencies completed.

.3 Equipment and systems: Tested, adjusted, balanced, and fully operational.

.4 Certificates required by Boiler Inspection Branch, Fire Commissioner, Utility companies: Submitted.

.5 Operation of systems: Demonstrated to Departmental Representative's personnel.

.6 Commissioning of mechanical systems: Completed in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and Section 01 91 31 – Commissioning (Cx) Plan, and copies of final Commissioning Report submitted to Departmental Representative.

.7 Work: Complete and ready for final inspection.

.4 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.

.2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

1.2 FINAL CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools, and equipment.

.2 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Pre-warranty Meeting:

.1 Convene meeting one week prior to contract completion with Contractor's Representative and Departmental Representative, in accordance with Section 01 31 19 – Construction Progress & Meetings to:

.1 Verify Project requirements.

.2 Review warranty requirements and manufacturer's installation instructions.

.2 Departmental Representative to establish communication procedures for:

.1 Notifying construction warranty defects.

.2 Determine priorities for type of defects.

.3 Determine reasonable response time.

.3 Contact information for bonded and licensed company for warranty work action: Provide name, telephone number, and address of company authorized for construction warranty work action.

.4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.2 CLOSEOUT PROCEDURES

.1 Notify Department Representative when Work is considered ready for Substantial Performance.

.2 Accompany Department Representative on preliminary review to determine items listed for completion or correction.

.3 Comply with Department Representative's instructions for correction of items of Work listed in executed certificate of Substantial Performance and for access to Departmental Representative occupied areas (as applicable).

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures and as indicated below.

.2 Two weeks prior to Substantial Performance of the Work, submit two final copies of operating and maintenance manuals, in English, to the Departmental Representative. Pay costs of delivery.

.1 Copy will be returned following final review, complete with Departmental Representative's comments.

.2 Revise content of documents as required prior to final submittal and resubmit.

.3 Ensure spare parts, maintenance materials, and special tools provided are new, undamaged, and of same quality and manufacture as products provided in Work. Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.4 Provide evidence, if requested, for type, source, and quality of products supplied.

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

1.4 CONTENTS – O&M MANUALS

.1 Binder Cover and Binder Edge

- .1 Include: Building Name, address, project name, project number (GOC#), completed date.

.2 Title Page

- .1 O&M Manual for... Building name, address, date, general contractor information: name address, phone number.
- .2 Consultant name address, phone number.
- .3 Table of contents indicates each binder's contents.

.3 Index and tabs

- .1 Dividers with permanently marked tabs separate each section and sub section.
- .2 Tab labels typed, not hand written.
- .3 Main tab for each specification section.

.4 Tab A: Signed Letter of Warranty, to include:

- .1 Date
- .2 Project name
- .3 Project number (GOC#)
- .4 Building Location
- .5 Warranty start date and end, to be from date of substantial, declared by Consultant.
- .6 Organization, names and phone numbers of persons to call for warranty services
- .7 All warranties to be included from all contractors in this section and extended warranties.

.5 Tab B: Contact Information for all Subcontractors and Suppliers, including:

- .1 Name, address, telephone number of manufacturer, installing contractor
- .2 24-hour number for emergency service for all equipment in this section identified by equipment.

.6 Tab C: All Reports and Permits

- .1 TAB reports.
- .2 Pre-functional tests.
- .3 Start up reports.
- .4 Completed performance verification forms (found in the Tender Documents).
- .5 Cabling verifications.
- .6 ESA certification.
- .7 TSSA certification.
- .8 Fire alarm certification.
- .9 Seismic certification.
- .10 All permits, including electrical, building, plumbing.

.7 Tab D: As-Built Drawings

.1 Marked up by contractor, changes marked in red to also be given to Consultant.

.8 Tab E: Operation and Shutdown

.1 Sequence of Operation-outline how the systems installed were designed to work.

.2 Accurate Sequence of Operation, with detailed instruction in proper sequence, for each mode of operation.

.3 Emergency Operation: Functions of equipment that can be operated while other functions disabled. Included only for alternate abnormal operations that can follow when there is a partial failure, malfunctioning of components, or other unusual condition.

.4 Shutdown Procedure: Instructions for stopping and securing the equipment after operation. If a particular sequence is required, step-by-step instructions given in that order.

.9 Tab F: CMMS Data Sheets

.1 All equipment that is to be deleted, removed, added, or replaced is to have a CMMS inventory sheet completed and included in the O&M Manual.

.10 Tab G: Shop Drawings

.1 Copy of all approved "by the Consultant" shop drawings.

.11 Tab H: Maintenance

.1 Copy of specific service and maintenance manuals.

.2 Preventative and corrective maintenance, with service procedures and schedules.

.3 Schedule for preventive maintenance in a printed format and electronic format compatible with Owner's system.

.4 Recommended frequency of performance for each preventive maintenance task, cleaning, inspection and scheduled overhauls or reconditioning.

.5 Cleaning: Instructions and schedules for all routine cleaning and inspection recommended, including recommended cleaners and lubricants.

.6 Inspection: Periodic inspection of equipment required for operation, cleaning or other reasons, with items to be inspected indicated and inspection criteria given for motors, controls, filters, and any other maintenance items.

.7 Instructions for minor repairs or adjustments required for preventive maintenance routines.

.8 Listing of any special tools required to service or maintain the equipment.

.12 Last Tab: Miscellaneous Items

.1 Health and Safety submittals including: site specific hazard assessment, safety manual TOC and company safety policy, MSDS sheets (if applicable) signed site orientations for worker, copy of first aid certificate, copy of emergency plan and muster location.

.2 Special requirements for equipment, not to be used for reports.

1.5 AS-BUILT DOCUMENTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative, 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.

.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 inspection by Departmental Representative.

.6 Specifications: 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.

1.6 AS-BUILT AND RECORD DOCUMENTS

.1 Record information on drawings and in designated copy of Project Manual provided by Departmental Representative.

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

.3 Use RED felt tip marking pens.

.4 Mark on one set of prints and at completion of project and prior to final inspection; neatly transfer notations to second set.

.5 Maintain information on project site drawings and record accurately, deviations of newly installed or existing works from Contract documents during construction.

.6 Ensure but do not limit recording of following information on original as-built drawings:

- .1 Locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.
- .2 Changes made by Change Order.
- .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
- .4 Field changes of dimension and detail.
- .5 Details not on original Contract Drawings.
- .6 References to related shop drawings and modifications.

.7 At substantial completion of project and prior to final inspection, submit as-built drawings and project manual to Departmental Representative.

.1 Departmental Representative will review and initial, to concur with content of the final mark-ups.

.8 Consultant will transcribe as-built information to electronic record drawings based on Contractor's site records.

1.7 EQUIPMENT AND SYSTEMS

.1 For each item of equipment and each system include description of unit or system, and component parts.

.1 Give function, normal operation characteristics, and limiting conditions.

.2 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, shut-down, 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 applicable).

.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.

.4 Additional requirements: As specified in individual specifications sections.

1.9 MAINTENANCE MATERIALS

.1 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, location as directed; place and store.
- .4 Receive and catalogue items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

.2 Extra Stock 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, location as directed; place and store.
- .4 Receive and catalogue items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

.3 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, location as directed; place and store.
- .4 Receive and catalogue items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.10 DELIVERY, STORAGE, AND HANDLING

.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 materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and for review by Departmental Representative.

1.11 WARRANTIES AND BONDS

.1 As directed by Departmental Representative.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Demonstrate scheduled operation and maintenance of equipment and systems to Departmental Representative's personnel two weeks prior to date of substantial performance.

.2 Departmental Representative: Provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.

.3 Preparation:

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

.2 Verify designated personnel are present.

.3 Ensure equipment has been inspected and put into operation.

.4 Ensure testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and equipment and systems are fully operational.

.4 Demonstration and Instructions:

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled 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 needed during instructions.

1.2 SUBMITTALS

.1 Provide 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 weeks prior to designated dates, for Departmental Representative's approval.

.3 Submit reports within one 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.

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

1.3 QUALITY ASSURANCE

.1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:

.1 Instruct Departmental Representative's personnel.

.2 Provide written report that demonstration and instructions have been completed.

.1 Use Training and Orientation Record form appended to this Section.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Training and Orientation Record

Portfolio	Portfolio Name	Date
Building ID	Building Name / Location	
Project Name	Project #	
System / Equipment	Specification Section	

Attendance. (Manager/ Supervisor signature and number of attendees from department)

Instructors.

Trainer	Company	Position/Qualifications

Type	Received	
Orientation of delivered project provided	Yes☐	No☐
Manufacturer training manuals and\or documentation provided	Yes☐	No☐
Site demonstration of equipment	Yes☐	No☐
Classroom presentation	Yes☐	No☐
Video presentation	Yes☐	No☐
Question and answer period	Yes☐	No☐

Participants

Consultant:	
Project Manager:	
Commissioning Oversight Specialist:	
General Contractor:	

Employee Name	Employee Department	Signature

Brookfield GIS Commissioning Oversight Manager / Specialist	Signature	Date

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to FPT of components, equipment, sub-systems, systems, and integrated systems.

.2 Acronyms:

.1 SOM - System Operation Manual.
.2 Cx - Commissioning.
.3 EMCS - Energy Management Control System.
.4 M&D – Maintenance and Data Manual.
.5 PI - Product Information.
.6 FPT - Functional Performance Testing.
.7 OPT – Optimization.
.8 CWS – Cold Water System.
.9 HWS – Hot Water System.
.10 CO_2 – Carbon Dioxide.

1.2 GENERAL

.1 Consultant Cx "Plan" and related project specific forms to be reviewed and accepted by Departmental Representative prior to commencement of construction.

.2 Commissioning will include, but not necessarily limited to, the following:

.1 Cx Structural and Architectural Systems:
.1 Door hardware.
.2 Commissioning Mechanical systems and associated equipment.
.3 Plumbing:
.1 Domestic CWS and HWS.
.2 Regular sanitary waste systems.
.3 Sanitary lift pump.
.4 Condensate pumps.
.5 Plumbing fixtures.
.4 HVAC and exhaust systems:
.1 General exhaust systems, including transfer fans.
.2 Split air conditioning systems.
.3 Test all existing fan coil and perimeter heating units.
.4 Test all new and existing variable air volume boxes.

.5 Test existing demand control ventilation systems including existing CO_2 sensor and ventilation supply fan.

.5 Fire and life safety systems:

.1 Wet pipe sprinkler systems.

.6 EMCS:

.1 Test all existing controls in the renovated area and verify controls are functioning as intended.

.2 Test all new controls in the renovated area and verify successful integration of all new equipment with the existing EMCS.

.7 Commissioning Electrical Systems:

.1 Lighting.

.8 Commissioning Communications Systems:

.1 Access Control System.

.2 Intrusion Alarm System.

.3 Sound Masking System.

.4 Intercom System.

.5 Classroom Audio System.

.6 Clock System.

.3 Cx is a planned program of tests, procedures, and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed and functional, and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems, and integrated systems operate in accordance with contract documents and design criteria and intent.

.2 Ensure appropriate documentation is compiled into the BMM.

.3 Effectively train M&D staff.

.4 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactive with each other as intended in accordance with Contract Documents and design criteria.

.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

.5 Design Criteria: Per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

.1 Section 01 91 31 - Commissioning (Cx) Plan.

.2 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.3 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages that are addressed during Construction and Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental, and occupancy conditions to meet functional and operational requirements. Cx activities include transfer of critical knowledge to facility operational personnel.

.4 Departmental Representative will issue Interim Acceptance Certificate when:

.1 Completed Cx documentation has been received, reviewed for suitability, and approved by Departmental Representative.

.2 Equipment, components, and systems have been commissioned.

.3 M&D training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the un-functional system, including related systems as deemed required by Departmental Representative, to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

.1 Before Construction:

.1 Review contract documents, confirm by writing to Departmental Representative.

.1 Adequacy of provisions for Cx.

.2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction:

.1 Co-ordinate provision, location and installation of provisions for Cx.

.3 Before start of Cx:

.1 Have completed Cx Plan up-to-date.

.2 Ensure installation of related components, equipment, sub-systems, and systems are complete.

.3 Fully understand Cx requirements and procedures.

.4 Have Cx documentation shelf-ready.

.5 Understand completely design criteria and intent and special features.

.6 Submit complete start-up documentation to Departmental Representative.

.7 Have Cx schedules up-to-date.

.8 Ensure systems have been cleaned thoroughly.

.9 Complete OPT procedures on systems, submit OPT reports to Departmental Representative for review and approval.

.10 Ensure "As-Built" system schematics are available.

.4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 COMMISSIONING DOCUMENTATION

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Functional Performance Testing (FPT) Forms for requirements and instructions for use.

.2 Departmental Representative to review and approve Cx documentation.

.3 Provide completed and approved Cx documentation to Departmental Representative.

1.8 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16 – Construction Progress Schedule – Bar (GANTT) Chart.

.1 Cx schedule to utilize critical path methods, identify interdependencies between contractor verifications and commissioning, and be fully integrated with the construction master schedule.

.2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

.1 Approval of Cx reports.

.2 Verification of reported results.

.3 Repairs, retesting, re-commissioning, re-verification.

.4 Training.

1.9 COMMISSIONING MEETINGS

.1 Convene Cx meetings following project meetings: 01 32 16 – Construction Progress Schedule – Bar (GANTT) Chart and as specified herein.

.2 Purpose: To resolve issues, monitor progress, and identify deficiencies relating to Cx.

.3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.

.4 At 60% construction completion stage, Section 01 32 16 – Construction Progress Schedule – Bar (GANTT) Chart. Departmental Representative to call a separate Cx

scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:

.1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.

.2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.

.5 Thereafter, Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.

.6 Meeting will be chaired by Departmental Representative, who will record and distribute minutes.

.7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.10 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections, including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.11 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days notice prior to commencement.

.2 Departmental Representative to witness of start-up and testing.

1.12 MANUFACTURER'S INVOLVEMENT

.1 Factory testing: Manufacturer to:

.1 Coordinate time and location of testing.

.2 Provide testing documentation for approval by Departmental Representative.

.3 Arrange for Departmental Representative to witness tests.

.4 Obtain written approval of test results and documentation from Departmental Representative before delivery to site.

.2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative

.1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.

.2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

.3 Integrity of warranties:

.1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.

.2 Verify with manufacturer that testing as specified will not void warranties.

.4 Qualifications of manufacturer's personnel:

.1 Experience in design, installation and operation of equipment and systems.

.2 Ability to interpret test results accurately.

.3 Ability to report results in clear, concise, logical manner.

1.13 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Conduct start-up and testing in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.

.2 Visual inspection of quality of installation.

.2 Start-up: Follow accepted start-up procedures.

.3 Operational testing: Document equipment performance.

.4 System FPT: Include repetition of tests after correcting deficiencies.

.5 Post-substantial performance verification: To include fine-tuning.

.3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.

.4 Document required tests on approved FPT forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:

.1 Minor equipment/systems: Implement corrective measures approved by Departmental Representative.

.2 Major equipment/systems: If evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.

.1 Field quality test result.

.3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.

.1 Rejected equipment to be removed from site and replaced with new.

.2 Subject new equipment/systems to specified start-up procedures.

1.14 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.

.2 Start-up documentation to include:

.1 Factory and on-site test certificates for specified equipment.

.2 Pre-start-up inspection reports.

.3 Signed installation/start-up check lists.

.4 Start-up reports,

.5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.15 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 With assistance of manufacturer, develop written maintenance program and submit Departmental Representative for approval before implementation.

.3 Operate and maintain systems for length of time required for commissioning to be completed.

.4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.16 TEST RESULTS

.1 If start-up, testing and/or FPT produce unacceptable results, repair, replace or repeat specified starting and/or FPT procedures until acceptable results are achieved.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.17 START OF COMMISSIONING

.1 Notify Departmental Representative at least 21 days prior to start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.18 INSTRUMENTS / EQUIPMENT

.1 Submit to Departmental Representative for review and approval:

.1 Complete list of instruments proposed to be used.

.2 Listed data including, serial number, current calibration certificate, calibration date, and calibration expiry date and calibration accuracy.

.2 Provide the following equipment as required:

.1 2-way radios.

.2 Ladders.

.3 Equipment as required to complete work.

1.19 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under actual operating conditions, and in all operating and programmed failure modes.

.2 On independent systems and interacting systems.

.2 Cx procedures to be repeatable and reported results to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

.4 EMCS trending to be available as supporting documentation for performance verification.

1.20 WITNESSING COMMISSIONING

.1 Departmental Representative to witness activities and verify results.

1.21 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing, or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.3 Provide copies to Departmental Representative within 5 days of test and with Cx report.

1.22 EXTRAPOLATION OF RESULTS

.1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.23 EXTENT OF VERIFICATION

.1 Provide personnel and instrumentation to test and verify all new and modified mechanical equipment including, but not limited to, new fans, VAV boxes, split air conditioners, existing fan coils and all associated controls.

.2 Provide manpower and instrumentation to test and verify all new and modified systems including but not limited to distribution equipment, life-safety systems, electrical power systems, including circuit testing, verifications, etc. Written certifications will be required. Commissioning will be performed by the Electrical Contractor in concert with the Commissioning Agent (Cx).

.3 Provide manpower and instrumentation to verify up to 30% of reported results, unless specified otherwise in other sections.

.4 Number and location to be at discretion of Departmental Representative.

.5 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.

.6 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.

.7 Perform additional commissioning until results are acceptable to Departmental Representative.

1.24 REPEAT VERIFICATIONS

.1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:

.1 Verification of reported results fail to receive Departmental Representative's approval.

.2 Repetition of second verification again fails to receive approval.

.3 Departmental Representative deems Contractor's request for second verification was premature.

1.25 SUNDRY CHECKS AND ADJUSTMENTS

.1 Make adjustments and changes that become apparent as Cx proceeds.

.2 Perform static and operational checks as applicable and as required.

1.26 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.

.2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.27 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.28 ACTIVITIES UPON COMPLETION OF COMMISSIONING

.1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.29 TRAINING

.1 In accordance with Section 01 79 00 – Training.

1.30 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.31 OCCUPANCY

.1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

1.32 INSTALLED INSTRUMENTATION

.1 Use instruments installed under Contract for OPT and FPT if:

.1 Accuracy complies with these specifications.

.2 Calibration certificates have been deposited with Departmental Representative.

.2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.33 PERFORMANCE VERIFICATION TOLERANCES

.1 Application tolerances:

.1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.

.2 Instrument accuracy tolerances:

.1 To be of order of magnitude higher than equipment or system being tested.

.3 Measurement tolerances during verification:

.1 Unless otherwise specified actual values to be within +/- 2 % of recorded values.

1.34 DEPARTMENTAL REPRESENTATIVE'S PERFORMANCE TESTING

.1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.

1.2 REFERENCES

.1 American Water Works Association (AWWA)

.2 National Fire Protection Association (NFPA)

.1 NFPA 13-2007, Installation of Sprinkler Systems Handbook.

.2 NFPA 14-2007, Automatic Sprinkler Systems Handbook.

.3 NFPA 20-2007, Standard for the Installation of Stationary Fire Pumps for Fire Protection.

.3 Canadian Standards Association

.1 CSA Z320-11 Building Commissioning.

.4 Underwriters' Laboratories of Canada (ULC)

1.3 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 M&D 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 M&D, process and administration of Cx.

.4 Describes process of verification of how built works meet Departmental Representative's and design 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 SOM - System Operation Manual.
.3 EMCS - Energy Management Control Systems.
.4 MSDS - Material Safety Data Sheets.
.5 M&D – Maintenance and Data Manual.
.6 PI - Product Information.
.7 FPT - Functional Performance Testing.
.8 OPT – Optimization.
.9 WHMIS - Workplace Hazardous Materials Information System.
.10 CWS – Cold Water System.
.11 HWS – Hot Water System.
.12 CO_2 – Carbon Dioxide.
.13 HVAC – Heating Ventilating and Air Conditioning.
.14 VOC – Volatile Organic Compound.

.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.

1.4 DEVELOPMENT OF 100% CX PLAN

.1 Cx Plan to be 99% completed before added into Project Specifications.

.2 Cx Plan to be 100% completed within 8 weeks of award of contract to take into account:

.1 Approved shop drawings and product data.
.2 Approved changes to contract.
.3 Contractor's project schedule.
.4 Cx schedule.
.5 Contractor's, sub-contractor’s, and suppliers' requirements.
.6 Project construction team's and Cx team's requirements.

.3 Submit completed Cx Plan for review and obtain Departmental Representative’s written approval.

1.5 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 Revise, refine, and update every 6 weeks during construction phase. At each revision, indicate revision number and date.

.3 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.

.4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

.1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.

.2 Project Manager will select Cx Team consisting of following members:

.1 PWGSC Design Quality Review Team: During construction, will conduct periodic site reviews to observe general progress.

.2 PWGSC 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 M&D personnel.

.4 Monitoring of Cx activities, training, and development of Cx documentation.

.5 Work closely with members of Cx Team.

.3 Consultant is responsible for:

.1 Organizing Cx.

.2 Monitoring operations Cx activities.

.3 Witnessing, certifying accuracy of reported results.

.4 Witnessing and certifying OPT and other tests.

.5 Developing SOM.

.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 OPT.

.3 Performance of Cx activities.

.4 Delivery of training and Cx documentation.

.5 Assigning one person as point of contact with Consultant and PWGSC 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.

.6 Property Manager: Represents lead role in Operation Phase and onwards and is responsible for:

.1 Receiving facility.

.2 Day-to-day operation and maintenance of facility.

1.7 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 Functional Performance Testing.

.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 M&D 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 M&D personnel.

.4 Redistribution of electrical services.

.5 Modifications of fire alarm systems.

.6 Modifications to voice communications systems.

.7 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.

1.8 EXTENT OF CX

.1 Cx Structural and Architectural Systems:

- .1 Architectural and structural:
  - .1 Accessibility and operational safety.
  - .2 Doors, related hardware:
    - .1 New door hardware.

.2 Commission mechanical systems and associated equipment:

- .1 Plumbing systems:
  - .1 Domestic CWS and HWS.
  - .2 Regular sanitary waste systems.
  - .3 Sanitary lift pump.
  - .4 Condensate pumps.
  - .5 Plumbing fixtures.
- .2 HVAC and exhaust systems:
  - .1 General exhaust systems, including transfer fan.
  - .2 Split air conditioning systems.
  - .3 Test all existing fan coil and perimeter heating units.
  - .4 Test all new and existing variable air volume boxes.
  - .5 Test existing demand control ventilation systems including existing CO_2 sensor and ventilation supply fan.
- .3 Fire and life safety systems:
  - .1 Wet pipe sprinkler systems.
- .4 EMCS:
  - .1 Test all existing controls in the renovated area and controls are functioning as intended.
  - .2 Test all new controls in the renovated area and verify successful integration of all new equipment with the existing EMCS. Commission electrical systems and equipment:
- .5 Low voltage below 750 V:
  - .1 Low voltage equipment.
  - .2 Low voltage distribution systems.
  - .3 Voice communications systems.
  - .4 Electronic data and communications information systems.
- .6 Lighting systems:
  - .1 Lighting equipment.
  - .2 Distribution systems.
  - .3 Emergency lighting systems, including battery packs.
  - .4 Fire exit emergency signage.
- .7 Fire alarm systems, equipment:
  - .1 Annunciators.

.2 Control panels.

.3 Fire alarm battery banks.

.8 Other systems and equipment:

.1 Intrusion and access security and safety systems as follows:

.1 Intrusion Alarm panel and devices.

.2 Access Control panel, devices and software.

.2 Sound masking equipment and devices.

.3 Intercom system.

.4 Classroom audio system.

.5 Clock system.

1.9 DELIVERABLES RELATING TO M&D PERSPECTIVES

.1 General requirements:

.1 Compile English documentation.

.2 Documentation to be computer-compatible format ready for inputting of 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.

.8 Copper and fibre optic cable test results.

1.10 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 Functional Performance Testing tests.

.3 Deliverables: provide:

.1 Cx Specifications.

.2 Start-up, pre-Cx activities and documentation for systems, and equipment.

.3 Completed installation checklists (ICL).

.4 Completed product information (PI) report forms.

.5 Completed Functional Performance Testing (FPT) report forms.

.6 Results of Functional Performance Testing Tests and Inspections.

.7 Description of Cx activities and documentation.

.8 Description of Cx of integrated systems and documentation.

.9 Training Plans.

.10 Cx Reports.

.11 Prescribed activities during warranty period.

.4 Consultant to witness and certify tests and reports of results provided to Departmental Representative.

.5 Departmental Representative to participate.

1.11 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Items listed in this Cx Plan include the following:

.1 Pre-Start-Up inspections: By Consultant prior to permission to start up and rectification of deficiencies to Departmental Representative's satisfaction.

.2 Consultant to use approved check lists.

.3 Departmental Representative will monitor some of these pre-start-up inspections.

.4 Include completed documentation with Cx report.

.5 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by Consultant and does not form part of Cx specifications.

.6 Departmental Representative will monitor some of these inspections and tests.

.7 Include completed documentation in Cx report.

.2 Pre-Cx activities - ARCHITECTURAL AND STRUCTURAL:

.1 Door 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 OPT on systems. OPT reports to be approved by Consultant.

.3 EMCS:

.1 EMCS trending to be available as supporting documentation for Functional Performance Testing.

.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 Consultant prior to start of 30 day Final Acceptance Test period.

.5 Perform final Cx and operational tests during demonstration period and 30 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, including but not limited to the following:

.1 Fire Alarm.

.2 Emergency Lighting.

.3 Exit Signage.

.2 Reports of test results to be witnessed and certified by Consultant before verification.

.5 Pre-Cx activities - ELECTRICAL:

.1 Lighting systems:

.1 Emergency lighting systems:

.1 Tests to include verification of lighting levels and coverage, initially by disrupting normal power.

.2 Fire alarm systems: Test after other safety and security systems are completed. Testing to include a complete verification of all devices and components belonging or not to the area of renovation but wired to corresponding loops serving the area of renovation in accordance with ULC requirements. Consultant to witness and certify report and submit to Departmental Representative.

.3 Low voltage systems: These include but is not limited to the following:

.1 Clock, communications, low voltage lighting control systems and data communications systems.

.2 Sound Masking system.

.3 Classroom audio system.

.4 Intercom system.

.4 Security, surveillance and intrusion alarm systems: To include verification by Consultant.

.5 Grounding system.

1.12 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 Electric Motors.

.2 Lighting Control System.

.3 Fire Alarm System.

.3 Consultant to monitor all of these start-up activities.

.1 Rectify start-up deficiencies to satisfaction of Departmental Representative.

.4 Functional Performance Testing (FPT):

.1 Approved Cx Agent to perform.

.1 Repeat when necessary until results are acceptable to Departmental Representative.

.2 Use procedures modified generic procedures to suit project requirements.

.3 Consultant to witness and certify reported results using approved PI and FPT forms.

.4 Consultant to approve completed FPT reports and provide to Departmental Representative.

.5 Departmental Representative serves the right to verify up to 30% of reported results at random.

.6 Failure of randomly selected item shall result in rejection of FPT report or report of system start-up and testing.

1.13 CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Perform Cx by specified Cx agency using procedures developed by Consultant and approved by Departmental Representative.

.2 Departmental Representative to monitor Cx activities.

.3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved FPT forms.

.4 Consultant to witness and certify reported results of Cx activities, and forward to Departmental Representative.

.5 Departmental Representative reserves right to verify a percentage of reported results at no cost to contract.

1.14 CX OF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION

.1 Cx to be performed by specified Cx specialist, using procedures developed by Consultant and approved by Departmental Representative.

.2 Tests to be witnessed by Consultant and documented on approved report forms.

.3 Upon satisfactory completion, Cx specialist to prepare Cx Report, to be certified by Consultant and submitted to Departmental Representative for review.

.4 Departmental Representative reserves right to verify percentage of reported results.

.5 Integrated systems to include:

.1 HVAC and associated systems forming part of integrated HVAC systems.

.2 Fire alarm systems.

.3 Emergency lighting systems.

.6 Identification:

.1 In later stages of Cx, before hand-over and acceptance, Departmental Representative, Consultant, Contractor, Project Manager, Property Manager, and Cx Manager to co-operate to complete inventory data sheets and provide assistance to PWGSC in full implementation of MMS identification system of components, equipment, sub-systems, systems.

1.15 INSTALLATION CHECK LISTS (ICL)

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Functional Performance Testing (FPT) Forms.

1.16 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Functional Performance Testing (FPT) Forms.

1.17 FUNCTIONAL PERFORMANCE TESTING (FPT) REPORT

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Functional Performance Testing (FPT) Forms.

1.18 DELIVERABLES RELATING TO ADMINISTRATION OF CX

.1 General:

.1 Because of risk assessment, complete Cx of occupancy, weather and seasonal-sensitive equipment and systems in these areas before building is occupied.

1.19 CX SCHEDULES

.1 Prepare detailed critical path Cx Schedule and submit to Departmental Representative 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-OPT review: 28 days 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: 3 months 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 OPT: 21 days before start of OPT.

.9 OPT: 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 14 days 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 Departmental Representative will monitor progress of Cx against this schedule.

1.20 CX REPORTS

.1 Submit reports of tests, witnessed and certified by Consultant to Departmental Representative who will verify reported results.

.2 Include completed and certified FPT reports in properly formatted Cx Reports.

.3 Before reports are accepted, reported results to be subject to verification by Consultant.

1.21 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.

1.22 TESTS TO BE PERFORMED BY DEPARTMENTAL REPRESENTATIVE/USER

.1 Audio/Video Conferencing Equipment, Wireless Access points, network switches.

1.23 TRAINING PLANS

.1 Refer to Section 01 91 41 - Commissioning (Cx) - Training.

1.24 FINAL SETTINGS

.1 Upon completion of Cx to satisfaction of Departmental Representative, lock control devices in their final positions, indelibly mark settings, and include in Cx Reports.

1.25 PAYMENTS FOR CX

.1 All payment required for Cx to be borne by the contractor.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Commissioning forms to be completed for equipment, system and integrated system.

1.2 INSTALLATION/START-UP CHECK LISTS

.1 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative, supplemental additional data lists will be required for specific project conditions.

.3 Use check lists for equipment installation. Document check list, verifying checks have been made. Indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Consultant. Check lists will be required during Commissioning and will be included in System Operation Manual (SOM) at completion of project.

.5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Product Information (PI) forms compile gathered data on items of equipment produced by equipment manufacturer, including nameplate information, parts list, operating instructions, maintenance guidelines, pertinent technical data, and recommended checks necessary to prepare for start-up and functional testing, and to be used during operation and maintenance of equipment. This documentation is included in the SOM at completion of work.

.2 Prior to Functional Performance Testing (FPT) of systems, complete items on PI forms related to systems and obtain Departmental Representative's approval.

1.4 FUNCTIONAL PERFORMANCE TESTING (FPT) FORMS

.1 PV forms to be used for checks, running dynamic tests, and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.

.2 FPT report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.

.3 Prior to FPT of integrated system, complete FPT forms of related systems and obtain Departmental Representative's approval.

1.5 SAMPLES OF COMMISSIONING FORMS

.1 Consultant will develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with specification data.

- .1 Intrusion alarm system.
- .2 Access control system.
- .3 Sound masking system.
- .4 Intercom system.
- .5 Classroom audio system.
- .6 Clock system.

.2 Revise items on Commissioning forms to suit project requirements.

.3 Samples of Commissioning forms and a complete index of produced to date will be attached to this section.

1.6 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

.1 When additional forms are required, but are not available from Consultant develop appropriate verification forms and submit to Departmental Representative for approval prior to use.

- .1 Additional commissioning forms to be in same format as provided by Consultant.

1.7 COMMISSIONING FORMS

.1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.

.2 Strategy for Use:

- .1 Consultant provides Contractor project-specific Commissioning forms with Specification data included.
- .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
- .3 Confirm operation as per design criteria and intent.
- .4 Identify variances between design and operation and reasons for variances.
- .5 Verify operation in specified normal and emergency modes and under specified load conditions.
- .6 Record analytical and substantiating data.
- .7 Verify reported results.
- .8 Form to bear signatures of recording technician and reviewed and signed off by Consultant.
- .9 Submit immediately after tests are performed.
- .10 Reported results in true measured SI unit values.
- .11 Provide Departmental Representative with originals of completed forms.

.12 Maintain copy on site during start-up, testing, and commissioning period.

.13 Forms to be both hard copy and electronic format with typed written results in System Operation Manual in accordance with Section 01 91 51 - System Operation Manual (SOM).

1.8 LANGUAGE

.1 To suit the language profile of the awarded contract.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Architectural Field Review and Compliance

Static Verification

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
SUBJECT	Common Interior	LOCATION	
ASSEMBLY	Finishes	DRAWING REFERENCE	

COMPONENTS	SPECIFIED	SHOP DRAWINGS	INSTALLED
OTHER ACCESSORIES			

OTHER ACCESSORIES					
Architectural Field Review & Compliance Activity	Performance Criteria	STATUS			COMMENTS
		YES	NO	N/A	
Construction checklists prepared					
Construction checklists completed					
Field review reports completed					
Compliance test reports completed					
Deficiency (Issues log) created					
Issues Log items addressed					
Verify training completed					
Review required maintenance and data, and systems operations manuals					
INTERIM ACCEPTANCE					
Seasonal Compliance test reports completed					
Issues Log Seasonal items addressed					
Outstanding Cx issues addressed or explained					
FINAL ACCEPTANCE					

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

Architectural Field Review and Compliance

Start-Up

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

SHEET INTENTIONALLY LEFT BLANK FOR INDIVIDUAL TO POPULATE AS NEEDED

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

Architectural Field Review and Compliance

Functional Performance Testing

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

SHEET INTENTIONALLY LEFT BLANK FOR INDIVIDUAL TO POPULATE AS NEEDED

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

BUILDING SYSTEM INTEGRATION

Static Verification

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE	ALL RELATED EQUIPMENT AND SYSTEMS	LOCATION	

DESCRIPTION	RELATED SYSTEMS	POWER REQUIREMENTS	OPERATION TESTED & VERIFIED

GENERAL COMMENTS:

POSITION/TITLE	**SIGNATURE**	**DATE**

BUILDING SYSTEM INTEGRATION

Start-Up

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

BUILDING SYSTEM INTEGRATION

Functional Performance Testing

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

DDC FIELD CONTROL PANEL

Static Verification

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

	SPECIFIED	**SHOP DRAWINGS**	**INSTALLED**
MANUFACTURER			
MODEL NO.			
SERIAL NO.			
TYPE			
I/O INTERFACE			
BATTERY BACKUP			

CONTROLLER INFORMATION	**FIELD PANEL 1**	**FIELD PANEL 2**	**FIELD PANEL 3**
MODEL NUMBER			
POINT CAPACITY			
POINTS USED			
SERIAL NUMBER			

STATIC VERIFICATION ACTIVITY	**Y/N**	**COMMENTS**	**Y/N**	**COMMENTS**	**Y/N**	**COMMENTS**
WIRING TERMINATED						
POWER CONNECTED						
EMERGENCY POWER						
WIRING IDENTIFICATION						
PANEL IDENTIFICATION						
PANEL DIRECTORY						
PANEL ACCESSIBLE						

GENERAL COMMENTS:

POSITION/TITLE	**SIGNATURE**	**DATE**

DDC FIELD CONTROL PANEL

Startup

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

STARTUP ACTIVITY	DDC PANEL 1		DDC PANEL 2		DDC PANEL 3	
	Y/N	COMMENTS	Y/N	COMMENTS	Y/N	COMMENTS
VERIFICATION COMPLETE						
POINTS LIST COMPLETE						
NETWORK CONNECTION COMPLETE						
CONTROL PROGRAM INSTALLED						
PANEL COMMUNICATING WITH OWS						
SENSORS CALIBRATED						
PANEL DRESSED						
DIRECTORY INSTALLED						
PANEL IDENTIFICATION INSTALLED						
PANEL CLEANED						

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

DDC FIELD CONTROL PANEL

Functional Performance Testing

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

DOMESTIC COLD WATER SYSTEM

Verification Program

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

VERIFICATION ACTIVITIES	**EQUIPMENT NUMBER**	**STATUS**			**COMMENTS**
		YES	**NO**	**N/A**	
CONTROL INTERFACE VERIFIED					
MUNICIPAL CONNECTION VERIFIED					
BACK FLOW PREVENTERS INSTALLED & CERTIFIED					
CONTRACTOR STARTUP COMPLETE					
DOMESTIC WATER PUMP VERIFIED					
PRESSURE REDUCING VALVES SET AND VERIFIED					
FLOW MEASURING DEVICES VERIFIED					
INITIAL CHEMICAL TREATMENT COMPLETE					
POTABLE WATER TESTING COMPLETE					
BALANCING COMPLETE					
DOMESTIC WATER SYSTEM READY FOR FUNCTIONAL PERFORMANCE TESTING					

GENERAL COMMENTS:

POSITION/TITLE	**SIGNATURE**	**DATE**

DOMESTIC COLD WATER SYSTEM

Start-Up

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

DOMESTIC COLD WATER SYSTEM

Functional Performance Testing

REVISION #: _____

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COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

DOMESTIC HOT WATER SYSTEM

Static Verification

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

VERIFICATION ACTIVITIES	**EQUIPMENT NUMBER**	**STATUS**			**COMMENTS**
		YES	**NO**	**N/A**	
CONTROL INTERFACE VERIFIED					
HOT WATER GENERATORS STARTED BY MANUFACTURER					
HOT WATER GENERATORS VERIFIED					
PRIMARY DOMESTIC HOT WATER PUMP VERIFIED					
RECIRCULATING DOMESTIC HOT WATER PUMP VERIFIED					
CONTROL VALVES VERIFIED					
TEMPERATURE SENSORS VERIFIED					
FLOW MEASURING DEVICES VERIFIED					
HEAT EXCHANGER					
STORAGE TANK(S)					
BALANCING COMPLETE					
DOMESTIC HOT WATER SYSTEM READY FOR FUNCTIONAL PERFORMANCE TESTING					

GENERAL COMMENTS:

POSITION/TITLE	**SIGNATURE**	**DATE**

DOMESTIC HOT WATER SYSTEM

Start-Up

REVISION #: _____

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COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

DOMESTIC HOT WATER SYSTEM

Functional Performance Testing

REVISION #: _____

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COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

SHEET INTENTIONALLY LEFT BLANK FOR INDIVIDUAL TO POPULATE AS NEEDED

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

DRAINAGE SYSTEM

Static Verification

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

EQUIPMENT NO.	FIXTURE LOCATION	SPECIFIED	SHOP DRAWINGS	INSTALLED

DRAINAGE SYSTEM

Static Verification

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

EQUIPMENT NO.	FIXTURE LOCATION	SPECIFIED	SHOP DRAWINGS	INSTALLED

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

DRAINAGE SYSTEM

Start-Up

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

SHEET INTENTIONALLY LEFT BLANK FOR INDIVIDUAL TO POPULATE AS NEEDED

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

DRAINAGE SYSTEM

Functional Performance Testing

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

SHEET INTENTIONALLY LEFT BLANK FOR INDIVIDUAL TO POPULATE AS NEEDED

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

EXHAUST FANS

Static Verification

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

EXHAUST FAN	**SPECIFIED**	**SHOP DRAWINGS**	**INSTALLED**
MANUFACTURER			
TYPE/ SIZE			
MODEL NO.			
MOTOR CONTROL CENTRE NO.			
MOTOR HP			
VOLTAGE / PHASE / FREQUENCY			
STATIC PRESSURE AIR (PA)			
FAN RPM			
AIR VOLUME (L/S)			
VIBRATION ISOLATOR TYPE			

EXHAUST FAN	**STATUS**	**COMMENTS**
INSTALLED AS PER DRAWINGS & SPECIFICATIONS		
INSTALLED AS PER MANUFACTURER'S REQUIREMENTS		
FAN BEARINGS LUBRICATED		
GREASE EXTENSION LEADS REQUIRED		
FAN ROTATION CORRECT		
FAN CASING CLEANED		
BELT GUARDS INSTALLED		
ALIGNMENT REPORT ATTACHED		
INLET & OUTLET GUARDS INSTALLED		
DUCT GEOMETRY CORRECT		
FLEXIBLE CONNECTORS CORRECT		
VIBRATION ISOLATORS CORRECT		
STARTER & DISCONNECT COMPLETE		
DISCONNECT LOCATION CORRECT		
BELT TENSION		
FAN WHEEL CLEARANCE		
FAN INTERLOCKS CORRECT		
VARIABLE SPEED DRIVE/VOLUME CONTROLS		

EXHAUST FANS

Static Verification

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

AIR DISTRIBUTION SYSTEM	**STATUS**	**COMMENTS**
QUALITY OF DUCT CONSTRUCTION		
SUITABILITY OF DUCT FITTINGS		
DUCTWORK INSULATION		
WALL PENETRATIONS SEALED		
ACCESS FOR INSPECTION & SERVICING		
DUCT MOUNTED ACCESS DOORS CLOSED		
FIRE DAMPERS OPEN		

START-UP	**STATUS**	**COMMENTS**
ALL SYSTEM COMPONENTS STARTED AS DETAILED ON EQUIPMENT START-UP SHEETS.		
DUCTWORK PRESSURE TESTED		
NOISE & VIBRATION		
AIR BALANCING COMPLETE		
AIR BALANCE REPORT ATTACHED		

MOTORIZED DAMPER	**SPECIFIED**	**SHOP DRAWINGS**	**INSTALLED**
MANUFACTURER			
TYPE OR MODEL NO.			
SUPPLY DAMPER SIZE			
RETURN DAMPER SIZE			

MOTORIZED DAMPER	**STATUS**		
	NO. 1	**NO. 2**	**NO. 3**
DAMPERS			
DAMPER LOCATION			
AIR LEAKAGE AT SHUTOFF			
NO CRACKS AROUND DAMPER FRAME			
BLADES CLOSE FULLY, SEAL TIGHTLY			
MOTORIZED DAMPER STROKES FULLY OPEN TO FULLY CLOSED			
DAMPER ACCESSIBLE & IDENTIFIED			

EXHAUST FANS

Static Verification

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

MOTORIZED DAMPER	**STATUS**		
	NO. 1	**NO. 2**	**NO. 3**
LINKAGE CONNECTIONS INSTALLED			
FREE MOVEMENT & STROKE			
ACCESS TO DAMPER			
ACTUATOR NOT IN AIR STREAM			
NORMAL POSITIONS AS SPECIFIED			
DAMPER CONTROL SEQUENCES			
MIXING DAMPERS STROKE IN UNISON			
LINKAGE CONNECTIONS INSTALLED			
FREE MOVEMENT & STROKE			
ACCESS TO DAMPER			
ACTUATOR NOT IN AIR STREAM			
NORMAL POSITIONS AS SPECIFIED			
DAMPER CONTROL SEQUENCES			
MIXING DAMPERS STROKE IN UNISON			

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

EXHAUST FANS

Start-Up

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

SHEET INTENTIONALLY LEFT BLANK FOR INDIVIDUAL TO POPULATE AS NEEDED

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

EXHAUST FANS

Functional Performance Testing

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

SHEET INTENTIONALLY LEFT BLANK FOR INDIVIDUAL TO POPULATE AS NEEDED

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

FAN COILS
Static Verification

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

FAN COILS	**SPECIFIED**	**SHOP DRAWINGS**	**INSTALLED**
MANUFACTURER			
MODEL NO.			
SIZE			
SERIAL NO.			

FAN COILS	**STATUS**	**COMMENTS**
MOUNTING CORRECT		
SERVICE SPACE ADEQUATE		
PIPE SUPPORT & LAYOUT CORRECT		
ISOLATING VALVES INSTALLED		
BALANCING VALVES INSTALLED		
AIR VENTS INSTALLED		
DRAIN PAN & PIPING INSTALLED		
FILTERS INSTALLED		
CONTROL VALVE INSTALLED		
THERMOSTAT CORRECT		
SPEED SWITCH INSTALLED		
VIBRATION & NOISE CORRECT		
FRESH AIR DAMPER OPERATIONAL		

GENERAL COMMENTS:

POSITION/TITLE	**SIGNATURE**	**DATE**

FAN COILS

Start-Up

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
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GENERAL COMMENTS:

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FAN COILS

Functional Performance Testing

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

INSULATED MOLDED CASE CIRCUIT BREAKERS

Functional Performance Testing

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE DATA			
MANUFACTURER		SERIAL NO.	

EQUIP. TEMPERATURE	°C	Indicates Temperature Corrected Reading to 20°C

CONTACT RESISTANCE	RESISTANCE TCF:		
	PHASE A	PHASE B	PHASE C
INITIAL (MICRO-OHMS)			
INITIAL (MICRO-OHMS)			
CLEANED (MICRO-OHMS)			

ELECTRICAL OPERATIONS				
CLOSE		OK		N/A
TRIP		OK		N/A
TRIP-FREE		OK		N/A
ANTIPUMP		OK		N/A

MINIMUM COIL PICKUPS	
CLOSE COIL	V
TRIP COIL	V

BOLTED CONNECTION RESISTANCE		MICRO-OHMS		MILLI-OHMS	RESISTANCE TCF:				
FROM		TO			PHASE A	PHASE B	PHASE C	NEUTRAL	GROUND

INSULATION TESTS		MEG-OHMS		MICRO-AMPS	INSULATION TCF:		
	KV	TIME (min)	PHASE A	PHASE B	PHASE C	NEUTRAL	
PHASE-TO-PHASE							
PHASE-TO-GROUND							
LINE-TO-LOAD							

INSULATED MOLDED CASE CIRCUIT BREAKERS

Functional Performance Testing

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ADDRESS:		FILE NUMBER:	15014
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BREAKER NAMEPLATE							
MANUFACTURER		SERIAL NO.					
TYPE		CATALOG NO.					
FRAME SIZE (F)		MOUNTING		B.I.		D.O.	

TRIP UNIT NAMEPLATE							
MANUFACTURER					CT RATIO		
TYPE					RATING PLUG(R)		
THERMAL MEMORY		ON		OFF	SENSOR TAP		
	ZONE INTLK		TARGETS				

SETTINGS AS FOUND					LONG TIME PU						DELAY								
RATING PLUG(R)					SHORT TIME PU						DELAY		I^2T		IN		OUT		N/A
SENSOR TAP					INST. PU			ON		OFF									
GRD. FLT.		3W		4W	GRD. FLT. PU			ON		OFF	DELAY		I^2T		IN		OUT		N/A

SETTINGS AS LEFT					LONG TIME PU						DELAY								
RATING PLUG(R)					SHORT TIME PU						DELAY		I^2T		IN		OUT		N/A
SENSOR TAP					INST. PU			ON		OFF									
GRD. FLT.		3W		4W	GRD. FLT. PU			ON		OFF	DELAY		I^2T		IN		OUT		N/A

	PRIMARY INJECTION		SECONDARY INJECTION	MFG. TIME CURRENT CURVE NO.	

PICKUP TESTS	MFG STANDARD		PHASE A		PHASE B		PHASE C	
	MIN	MAX	FOUND	LEFT	FOUND	LEFT	FOUND	LEFT
INSTANTANEOUS								
LONG TIME								
SHORT TIME								
GROUND FAULT								

TIME DELAY TESTS			PHASE A				PHASE B				PHASE C			
	MFG STANDARD		FOUND		LEFT		FOUND		LEFT		FOUND		LEFT	
	MIN	MAX	AMPS	DELAY	AMPS	DELAY	AMPS	DELAY	AMPS	DELAY	AMPS	DELAY	AMPS	DELAY
INSTANTANEOUS														
LONG TIME														
SHORT TIME														
GROUND FAULT														

INSULATED MOLDED CASE CIRCUIT BREAKERS

Functional Performance Testing

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

PLUMBING FIXTURE

Static Verification

REVISION #: ___________

NAME: ______________________
COMPANY: ______________________
ADDRESS: ______________________
____

CUSTOMER: PWGSC
PROJECT: R.060508.003
FILE NUMBER: 15014
DATE: DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

EQUIPMENT NO.	FIXTURE LOCATION	SPECIFIED	SHOP DRAWINGS	INSTALLED

PLUMBING FIXTURE

Static Verification

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NAME:		CUSTOMER:	PWGSC
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ADDRESS:		FILE NUMBER:	15014
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NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

START-UP	**SPECIFIED**	**COMMENTS**
INSTALLED AS PER DRAWINGS & SPECIFICATIONS		
INSTALLED AS PER MANUFACTURER'S RECOMMENDATIONS		
COLD WATER FEED CLEAN		
COLD WATER FEED PRESSURE		
HOT WATER FEED CLEAN		
HOT WATER FEED PRESSURE		
FIXTURE CLEAN		
PIPE ARRANGEMENT & SUPPORT		
NO LEAKAGE FROM SEALS		
FIXTURE WORKS CORRECTLY		

GENERAL COMMENTS:

POSITION/TITLE	**SIGNATURE**	**DATE**

PLUMBING FIXTURE

Start-Up

REVISION #: _____

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PLUMBING FIXTURE

Functional Performance Testing

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		DATE:	DD / MM / YYYY

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

PUMP

Static Verification

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

PUMP	**SPECIFIED**	**SHOP DRAWINGS**	**INSTALLED**
MANUFACTURER			
MODEL			
SERIAL NO.			
PUMP CAPACITY (USGPM)			
PUMP HEAD (FT)			
PUMP RPM			
PUMP CURVE NO.			

PUMP	**STATUS**	**COMMENTS**
SPECIFICATIONS		
RECOMMENDATIONS		
PUMP IS LEVEL		
MOTOR & PUMP ALIGNED (ALIGNMENT REPORT ATTACHE		
PUMP BASE GROUTED		
PUMP HAS ADEQUATE SERVICE SPACE		
RECOMMENDED		
PRESSURE GAUGES INSTALLED		
OF FLOW CORRECT		
VALVES & STRAINERS INSTALLED		
BEARINGS LUBRICATED		
NAMEPLATE IS VISIBLE		
VIBRATION ISOLATORS CORRECT		
PIPE ARRANGEMENT & SUPPORT		
CUNO FILTER FULL AND VALVES OPEN		
PIPING IDENTIFICATION INSTALLED		
STRAINERS / PARTICLE FILTERS		
CHEMICAL FEEDER		
COUPLING GUARD		
LIFTING HOOKS FOR MOTOR INSTALLED		
NAMEPLATE HEAD (FT)		
OPERATION TYPE (PARALLEL/SINGLE)		
OPERATION & MAINTENANCE		

MOTOR	**SPECIFIED**	**SHOP DRAWINGS**	**INSTALLED**
MANUFACTURER			

PUMP

Static Verification

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

MODEL			
SERIAL NO.			
MOTOR HORSEPOWER			
VOLTAGE / PHASE / FREQUENCY			
AMPERAGE			
HEADER SIZE AND RATE			
EFFICIENCY			
MOTOR RPM			

START-UP	**STATUS**	**COMMENTS**
IMPELLER & MOTOR ROTATION CORRECT		
OPERATION FROM ECMS VERIFIED		
OPERATED FOR 12 HOURS CONTINUOUSLY		
WORN PART & SEALS REPLACED IN PUMPS USED FOR CLEANING		
NO LEAKAGE FROM MECHANICAL SEALS.		
NET POSITIVE SUCTION HEAD CHECKED/CALCULATED		
AIR FLOW FOR MOTOR COOLING		

GENERAL COMMENTS:

POSITION/TITLE	**SIGNATURE**	**DATE**

PUMP
Start-Up

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

PUMP

Functional Performance Testing

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

RADIATION

Static Verification

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

RADIATION	**NO. 1**	**NO. 2**	**NO. 3**	**NO. 4**	**NO. 5**	**NO. 6**
LOCATION						
THERMOSTAT LOCATED CORRECTLY						
SHUT-OFF VALVES INSTALLED						
AIR VENTS INSTALLED						
PIPING CORRECT						
FIN & ENCLOSURE CONDITION						
ACCESS AVAILABLE						
CONTROL VALVE OPERATION						
CONTROL VALVE NORMALLY OPEN/CLOSED						
CIRCUIT BALANCING VALVES						

START-UP	**NO. 1**	**NO. 2**	**NO. 3**	**NO. 4**	**NO. 5**	**NO. 6**
GPM SPECIFIED						
GPM ACTUAL						
PRESSURE DROP						
SPECIFIED CAPACITY						
CALCULATED CAPACITY						

GENERAL COMMENTS:

POSITION/TITLE	**SIGNATURE**	**DATE**

RADIATION

Start-Up

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

RADIATION

Functional Performance Testing

REVISION #: _____

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ADDRESS:		FILE NUMBER:	15014
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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

SPLIT SYSTEM AIR CONDITIONING UNIT

Static Verification

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

SPLIT SYSTEM CONDENSER	**SPECIFIED**	**SHOP DRAWINGS**	**INSTALLED**
MANUFACTURER			
MODEL NO.			
LOCATION			
TYPE			
SERIAL NO.			
MOTOR MCA			
VOLTAGE / PHASE / FREQUENCY			
REFRIGERANT {TYPE} INSTALLED			
LINE SET			

SPLIT SYSTEM CONDENSER	**STATUS**	**COMMENTS**
INSTALLATION & MOUNTING		
PIPING CONNECTIONS		
ACCESS FOR SERVICING		
PIPING INSULATION		
ISOLATING/BALANCING VALVES		
THERMOSTAT INSTALLED		
VIBRATION & NOISE		

GENERAL COMMENTS:

POSITION/TITLE	**SIGNATURE**	**DATE**

SPLIT SYSTEM AIR CONDITIONING UNIT

Start-Up

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

SPLIT SYSTEM AIR CONDITIONING UNIT

Functional Performance Testing

REVISION #: _____

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ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

SUMP PUMP

Static Verification

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

SUMP PUMP	**SPECIFIED**	**SHOP DRAWINGS**	**INSTALLED**
MANUFACTURER			
MODEL NO.			
SERIAL NO.			
TYPE			
SIMPLEX OR DUPLEX			
CAPACITY (USGPM)			
HEAD (FT)			
MOTOR RPM			
MOTOR (HP)			
VOLTAGE / PHASE / FREQUENCY			

SUMP PUMP	**STATUS**	**COMMENTS**
INSTALLED AS PER DRAWINGS & SPECIFICATIONS		
INSTALLED AS PER MANUFACTURER'S RECOMMENDATIONS		
PUMP INSTALLED LEVEL ON FIRM BASE		
PUMP ACCESSIBLE FOR SERVING		
MOTOR AND PUMP ALIGNED		
BEARINGS LUBRICATED		
NAMEPLATE VISIBLE		
PUMP ON/OFF CONTROL FLOAT/MERCURY FLOAT SWITCHES AT CORRECT LEVEL		
HIGH LEVEL ALARM INSTALLED AT CORRECT LEVEL AND VERIFIED		
PIPING AS PER SPECIFICATION		
ISOLATION & CHECK VALVES		
INTAKE SCREEN/FILTER		
PRESSURE GAUGES INSTALLED		
ESSENTIAL POWER		

SUMP PUMP

Static Verification

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ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

START-UP	**STATUS**	**COMMENTS**
CAPACITY (USGPM)		
SUMP CONTAINS WATER BEFORE PUMP STARTED		
IMPELLER AND MOTOR ROTATION CORRECT		
FLOW DIRECTION CORRECT		
PUMP CAN BE REMOVED FROM SUMP FOR SERVICE		
NO LEAKAGE FROM MECHANICAL SEALS		

GENERAL COMMENTS:

POSITION/TITLE	**SIGNATURE**	**DATE**

SUMP PUMP

Start-Up

REVISION #: _____

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GENERAL COMMENTS:

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SUMP PUMP

Functional Performance Testing

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

VAV BOX

Static Verification

REVISION #: _____

NAME:		CUSTOMER:	PWGSC
COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

VARIABLE AIR VOLUME BOX						
MANUFACTURER, MODEL & TYPE	**VAV-1**	**VAV-2**	**VAV-3**	**VAV-4**	**VAV-5**	**VAV-6**
LOCATION						
SIZE						
FLOW (L/S) (DESIGN/ACTUAL)						
INLET DUCT LENGTH (MIN. 4 X DUCT I)						
SILENCER/ACOUSTIC DUCT INSTALLED						
VAV BOX UNDAMAGED						
VAV BOX SUPPORTED CORRECTLY						
IDENTIFICATION TAGS VISIBLE						
CONTROLS ACCESSIBLE						

REHEAT COILS	**VAV-1**	**VAV-2**	**VAV-3**	**VAV-4**	**VAV-5**	**VAV-6**
PIPING CORRECT						
PIPING IDENTIFIED						
PIPING INSULATED						
DRAIN INSTALLED						
AIR VENT INSTALLED						
SHUT OFF VALVE INSTALLED						
ACCESS DOORS INSTALLED						

REHEAT COILS	**VAV-1**	**VAV-2**	**VAV-3**	**VAV-4**	**VAV-5**	**VAV-6**
CONTROL VALVE OPERATION						
CONTROLS VERIFIED						
ENTERING AIR TEMPERATURE AT MAXIMUM AIR FLOW						
EXITING AIR TEMPERATURE AT MAXIMUM AIR FLOW						

GENERAL COMMENTS:

VAV BOX

Static Verification

REVISION #: _____

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COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

POSITION/TITLE	SIGNATURE	DATE

VAV BOX

Start-Up

REVISION #: _____

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COMPANY:		PROJECT:	R.060508.003
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		DATE:	DD / MM / YYYY

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

VAV BOX

Functional Performance Testing

REVISION #: _____

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COMPANY:		PROJECT:	R.060508.003
ADDRESS:		FILE NUMBER:	15014
		DATE:	DD / MM / YYYY

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 This Section specifies roles and responsibilities of Commissioning Training.

.2 Related Requirements;

Provide training for the following Sections:

.1 Section 27 51 16 Public Address and Mass Notification.
.2 Section 27 51 19 Sound Masking System.
.3 Section 27 51 23 Intercommunication and Program Systems.
.4 Section 27 53 13 Clock System.
.5 Section 28 13 23 Access Control System.
.6 Section 28 16 19 Intrusion Alarm System.
.7 Section 28 23 00 Video Surveillance.

1.2 TRAINEES

.1 Trainees: Personnel selected for operating and maintaining this facility. Includes Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.

.2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

.1 Consultant will provide:

.1 Descriptions of systems.
.2 Instruction on design philosophy, design criteria, and design intent.

.2 Contractor and certified factory-trained manufacturers' personnel to provide instruction on the following:

.1 Start-up, operation, and shut-down of equipment, components, and systems.
.2 Control features, reasons for, results of, implications on associated systems of, and adjustment of set points of control and safety devices.
.3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.3 Contractor and equipment manufacturer to provide instruction on:

.1 Start-up, operation, maintenance and shut-down of equipment with certified installation, started up and carried out FPT tests.

1.4 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:

.1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.

.2 Effective on-going inspection, measurements of system performance.

.3 Proper preventive maintenance, diagnosis, and trouble-shooting.

.4 Ability to update documentation.

.5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

.1 Instructors to be responsible for content and quality.

.2 Training materials to include:

.1 "As-Built" Contract Documents.

.2 Operating Manual.

.3 Maintenance Manual.

.4 Management Manual.

.5 TAB and PV Reports.

.3 Project Manager, Commissioning Manager, and Property Manager will review training manuals.

.4 Training materials to be in a format that permits future training procedures to same degree of detail.

.5 Supplement training materials:

.1 Transparencies for overhead projectors.

.2 Multimedia presentations.

.3 Manufacturer's training videos.

.4 Equipment models.

1.6 SCHEDULING

.1 Include in Commissioning Schedule time for training.

.2 Deliver training during regular working hours, training sessions to be 3 hours in length.

.3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

.1 Be responsible for:

.1 Implementation of training activities,

.2 Coordination among instructors,

.3 Quality of training, training materials,

.2 Departmental Representative will evaluate training and materials.

.3 Upon completion of training, provide written report, signed by Instructors, witnessed by Departmental Representative.

1.8 TRAINING CONTENT

.1 Training to include demonstrations by Instructors using the installed equipment and systems.

.2 Content includes:

.1 Review of facility and occupancy profile.

.2 Functional requirements.

.3 System philosophy, limitations of systems and emergency procedures.

.4 Review of system layout, equipment, components and controls.

.5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.

.7 Maintenance and servicing.

.8 Trouble-shooting diagnosis.

.9 Inter-action among systems during integrated operation.

.10 Review of M&D documentation.

.3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

1.9 VIDEO-BASED TRAINING

.1 Manufacturer's videotapes to be used as training tool with Departmental Representative's review and written approval 3 months prior to commencement of scheduled training.

.2 On-Site training videos:

.1 Videotape training sessions for use during future training.

.2 To be performed after systems are fully commissioned.

.3 Organize into several short modules to permit incorporation of changes.

.3 Production methods to be professional and high quality.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Acronyms:

.1 Cx - Commissioning.

.2 FPT - Functional Performance Testing.

.3 HVAC - Heating, Ventilation and Air Conditioning.

.4 M&D – Maintenance and Data Manual.

.5 OPT – Optimization.

.6 PI - Product Information.

.7 SOM - System Operation Manual.

.8 WHMIS - Workplace Hazardous Materials Information System.

1.2 GENERAL REQUIREMENTS

.1 Standard letter size paper 216 mm x 279 mm.

.2 Methodology used to facilitate updating.

.3 Drawings, diagrams, and schematics to be professionally developed.

.4 Electronic copy of data to be in a format accepted and approved by Departmental Representative.

1.3 APPROVALS

.1 Prior to commencement, co-ordinate requirements for preparation, submission, and approval with Departmental Representative.

1.4 GENERAL INFORMATION

.1 Provide Departmental Representative the following for insertion into appropriate Part and Section of SOM:

.1 Complete list of names, addresses, telephone and fax numbers of contractor, sub-contractors that participated in delivery of project - as indicated in Section 1.2 of SOM.

.2 Summary of architectural, structural, fire protection, mechanical and electrical systems installed and commissioned - as indicated in Section 1.4 of SOM.

.1 Including sequence of operation as finalized after commissioning is complete as indicated in Section 2.0 of SOM.

.3 Description of building operation under conditions of heightened security and emergencies as indicated in Section 2.0 of SOM.

.4 System, equipment and components Maintenance Management System (MMS) identification - Section 2.1 of SOM.

.5 Information on operation and maintenance of architectural systems and equipment installed and commissioned - Section 2.0 of SOM.

.6 Information on operation and maintenance of fire protection and life safety systems and equipment installed and commissioned - Section 2.0 of SOM.

.7 Information on operation and maintenance of mechanical systems and equipment installed and commissioned - Section 2.0 of SOM.

.8 Operating and maintenance manual - Section 3.2 of SOM.

.9 Final commissioning plan as actually implemented.

.10 Completed commissioning checklists.

.11 Commissioning test procedures employed.

.12 Completed Product Information (PI) and Performance Verification (PV) report forms, approved and accepted by Departmental Representative.

.13 Commissioning reports.

1.5 CONTENTS OF OPERATING AND MAINTENANCE MANUAL

.1 For detailed requirements refer to Section 01 78 00 - Closeout Submittals.

.2 Departmental Representative to review and approve format and organization within 12 weeks of award of contract.

.3 Include original manufactures brochures and written information on products and equipment installed on this project.

.4 Record and organize for easy access and retrieval of information contained in SOM.

.5 Include completed PI report forms, data and information from other sources as required.

.6 Inventory directory relating to information on installed systems, equipment and components.

.7 Approved project shop-drawings, product and maintenance data.

.8 Manufacturer's data and recommendations relating: manufacturing process, installation, commissioning, start-up, M&D, shutdown and training materials.

.9 Inventory and location of spare parts, special tools and maintenance materials.

.10 Warranty information.

.11 Inspection certificates with expiration dates, which require on-going re-certification inspections.

.12 Maintenance program supporting information including:

.1 Recommended maintenance procedures and schedule.

.2 Information to removal and replacement of equipment including, required equipment, points of lift and means of entry and egress.

1.6 LIFE SAFETY COMPLIANCE (LSC) MANUAL

.1 Samples of LSC Manual will be available from Departmental Representative.

.2 Content of Manual:

.1 All possible Emergency situations modes including: presence of fire and smoke, power failure, loose of water or pressure, chemical spills and refrigerant release.

.2 Failure of elevators and escalators.

.3 HVAC emergencies and fuel supply failures.

.4 Intrusion and security breach.

.5 Emergency provisions for natural disasters, bomb threats and other disruptive situations.

.6 Dedicated emergency generators for high security projects, medical facilities and computer systems.

.7 Emergency control procedures for fire, power and major equipment failure.

.8 Emergency contacts and numbers.

.9 Manual to be readily available and comprehensible to non- technical readers.

1.7 SUPPORTING DOCUMENTATION FOR INSERTION INTO SUPPORTING APPENDICES

.1 Provide Departmental Representative supporting documentation relating to installed equipment and system, including:

.1 General:

.1 Finalized commissioning plan.

.2 WHMIS information manual.

.3 Approved "as-built" drawings and specifications.

.4 Procedures used during commissioning.

.5 Cross-reference to specification sections.

.2 Architectural and structural:

.1 Inspection certificates, construction permits.

.2 Roof anchor log books.

.3 PV reports.

.3 Fire prevention, suppression and protection:

.1 Test reports.

.2 Smoke test reports.

.3 PV reports.

.4 Mechanical:

.1 Installation permits, inspection certificates.

.2 Piping pressure test certificates.

.3 Ducting leakage test reports.

.4 TAB and PV reports.

.5 Charts of valves and steam traps.

.6 Copies of posted instructions.

.5 Electrical:

.1 Installation permits, inspection certificates.

.2 TAB and PV reports.

.3 Electrical work log book.

.4 Charts and schedules.

.5 Locations of cables and components.

.6 Copies of posted instructions.

.7 Copper and fibre optic cable test report.

.8 Product cut-sheets, installation and maintenance manual, software.

.2 Assist Departmental Representative with preparation of SOM.

1.8 LANGUAGE

.1 English Language to be in separate binders.

1.9 IDENTIFICATION OF FACILITY

.1 When submitting information to Departmental Representative for incorporation into SOM, use following system for identification of documentation:

.1 Canada School of Public Service (CSPS) Fit-up, Stanley Knowles Bldg., Winnipeg, Manitoba Project No. R.060508.003

1.10 USE OF CURRENT TECHNOLOGY

.1 Use current technology for production of documentation. Emphasis is ease of accessibility at all times, maintainenance of up-to-date state, and compatibility with user's requirements.

.2 Obtain Departmental Representative's approval before starting Work.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

.2 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.2 DEFINITIONS

.1 Hazardous Materials: Dangerous substances, dangerous goods, hazardous commodities and hazardous products, include but not limited to poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or materials that endanger human health or environment if handled improperly.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting one week prior to beginning work of this Section, with Contractor's Representative and Departmental Representative, in accordance with Section 01 31 19 - Project Meetings to:

.1 Verify project requirements.

.2 Verify existing site conditions adjacent to demolition work.

.3 Co-ordination with other construction sub-trades.

.2 Hold project meetings as directed by Departmental Representative.

.3 Ensure key personnel attend.

.4 Departmental Representative will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.

.2 Scheduling:

.1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion.

.1 In event of unforeseen delay notify Departmental Representative in writing.

1.4 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures and Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Shop Drawings:

.1 Submit for review and approval demolition drawings, diagrams, or details showing sequence of demolition work and supporting structures and underpinning.

.2 Submit demolition drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: Ensure Work is performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial and Municipal regulations.

1.6 EXISTING CONDITIONS

.1 If material resembling spray or trowel applied asbestos or other substance listed as hazardous be encountered in course of demolition, stop work, take preventative measures, and notify Departmental Representative immediately. Proceed only after receipt of written instructions from Departmental Representative.

.2 Structures to be demolished are based on their condition, at time of examination prior to tendering.

.3 Remove, protect, and store salvaged items as directed by Departmental Representative. Salvage items as identified by Departmental Representative.

Part 2 Products

Not used.

Part 3 Execution

3.1 PREPARATION

.1 Protection of in-place conditions:

.1 Support affected structures and, if safety of structure being demolished appears to be endangered, take preventative measures, stop Work, and immediately notify Departmental Representative.

.2 Prevent debris from blocking elevators and mechanical and electrical systems that must remain in operation.

3.2 DEMOLITION

.1 Perform demolition work in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

.2 Remove contaminated or dangerous materials as 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 Prior to start of Work remove contaminated or hazardous materials as directed by Departmental Representative from site and dispose of at designated disposal facilities in safe manner and in accordance with TDGA and other applicable requirements. Refer to Existing Conditions in PART 1 of this Section.

.4 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.

.5 At end of each day's work, leave Work in safe and stable condition.

.6 Demolish to minimize dusting. Keep materials wetted as directed by Departmental Representative.

.7 Contain fibrous materials to minimize release of airborne fibres while being transported within facility.

.8 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.

.9 Use natural lighting to perform Work where possible.

.1 Shut off lighting except as required for security purposes at end of each day.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM A36/A36M-08, Standard Specification for Carbon Structural Steel.

.2 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A325-07a, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

.4 ASTM A325M-08, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength Metric.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-85.10-99, Protective Coatings for Metals.

.3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA).

.1 Handbook of the Canadian Institute of Steel Construction.

.2 CISC/CPMA Standard 2-75, Quick-Drying Primer for use on Structural Steel.

.4 Canadian Standards Association (CSA)

.1 CSA G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA S16-01(R2007), Limit States Design of Steel Structures.

.3 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel.

.4 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.

.5 CSA W59-03, Welded Steel Construction (Metal Arc Welding).

.5 Master Painters Institute

.1 MPI-INT 5.1-08, Structural Steel and Metal Fabrications.

.2 MPI-EXT 5.1-08, Structural Steel and Metal Fabrications.

.6 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International

.1 NACE No. 3/SSPC SP-6-06, Commercial Blast Cleaning.

1.2 SUBMITTALS

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

.2 Shop Drawings:

.1 Provide drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada, covering the design of all connections.

.3 Erection drawings:

.1 Submit erection drawings indicating details and information necessary for assembly and erection purposes including:

.1 Description of methods.

.2 Sequence of erection.

.3 Type of equipment used in erection.

.4 Temporary bracings.

.4 Fabrication drawings:

.1 Submit fabrication drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in Manitoba, Canada.

.5 Source Quality Control Submittals:

.1 Submit copies of mill test reports prior to fabrication of structural steel, upon request.

.1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.

.2 Provide mill test reports certified by metallurgists qualified to practice in Manitoba, Canada.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials in manufacturer's original, undamaged containers with identification labels intact.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Design details and connections in accordance with requirements of CAN/CSA-S16 to resist forces, moments, shears and allow for movements indicated.

.2 Shear connections:

.1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.

.2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.

.3 All bolted connections to use a minimum of A325 high strength bolts. Minimum connection shall consist of 2 bolts.

.4 The structural steel supplier shall provide and be responsible for all holes in steel sections required by other trades. The steel section shall be strengthened where required to guarantee the original strength of the member. Any cutting or modifications on the job site shall be done only as directed by the Departmental Representative.

2.2 MATERIALS

.1 Structural steel: To CSA-G40.20/G40.21 Grade as indicated.

.2 Anchor bolts: To CSA-G40.20/G40.21, Grade 300W.

.3 Bolts, nuts and washers: To ASTM A325.

.4 Welding materials: To CSA W59 and certified by Canadian Welding Bureau.

.5 Shop paint primer: To CISC/CPMA2-75 solvent reducible alkyd, grey.

2.3 FABRICATION

.1 Fabricate structural steel in accordance with CAN/CSA-S16and in accordance with reviewed shop drawings.

.2 Fabricator is to notify the Departmental Representative of any proposed member substitutions and changed connection details prior to fabrication and erection.

.3 Continuously seal members by continuous welds where indicated. Grind smooth.

2.4 SHOP PAINTING

.1 Clean, prepare surfaces and shop prime structural steel in accordance with CAN/CSA-S16.

.2 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter. Prepare surface according to NACE No.3/SSPC-SP-7.

.3 Apply one coat of primer in shop to steel surfaces except:

.1 Surfaces and edges to be field welded.

.4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5°C.

.5 Maintain dry condition and 5°C minimum temperature until paint is thoroughly dry.

.6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: Comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 GENERAL

.1 Structural steel work: In accordance with CAN/CSA-S16.

.2 Welding: In accordance with CSA W59.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures.

3.3 CONNECTION TO EXISTING WORK

.1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Departmental Representative for direction before commencing fabrication.

3.4 MARKING

.1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

.2 Match marking: Shop mark bearing assemblies and splices for fit and match.

3.5 ERECTION

.1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 and in accordance with reviewed erection drawings.

.2 Field cutting or altering structural members: to approval of Departmental Representative.

.3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

.4 Continuously seal members by continuous welds where indicated. Grind smooth.

3.6 FIELD QUALITY CONTROL

.1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Departmental Representative at their discretion.

.2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Departmental Representative.

.3 Submit test reports to Departmental Representative within 1 week of completion of inspection.

3.7 FIELD PAINTING

.1 Paint in accordance with Section 09 91 00 - Painting.

.1 Touch up damaged surfaces and surfaces without shop coat with primer to NACE No.3/SSPC-SP-7 except as specified otherwise. Apply in accordance: MPI Architectural Painting Specification Manual.

3.8 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.2 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 51.34-M86 - Vapour Barrier, Polyethylene Sheet for Use in Building Construction and amendment.

.2 Canadian Standards Association (CSA)

.1 CSA B111-1974 (R2003) - Wire Nails, Spikes and Staples.

.2 CAN/CSA G164-M92 (R2003) – Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA O112.9-10 (R2014) - Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).

.4 CSA O141-05 (R2014) - Softwood Lumber.

.5 CSA O151-09 (R2014) – Canadian Softwood Plywood.

.3 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber, 2007.

1.2 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 wood products and accessories. Include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

.1 As required, submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

1.3 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood, particleboard, OSB, and wood based composite panels in accordance with CSA and ANSI standards.

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 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 wood from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 FRAMING STRUCTURAL AND PANEL MATERIALS

.1 Lumber: Softwood S-P-F species, select grade, S4S; pressure preservative treated for exterior applications; moisture content 19% (S-dry) or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber – Grade 2 minimum.

.2 Furring, blocking, nailing strips, grounds, and rough bucks:

.1 S2S or S4S material.

.2 Board sizes: "Standard" or better grade.

.3 Dimension sizes: "Standard" light framing or better grade.

.4 Install concealed wood blocking for support of wall mounted cabinets, A/V equipment, lockers, toilet partitions, handrail brackets, chair rails, caretaking room walls, railings, and other items as required.

.3 Plywood:

.1 Canadian softwood plywood (CSP): To CSA O151, standard construction.

.2 Pressure preservative treated for exterior applications.

2.2 ACCESSORIES

.1 Polyethylene film: To CAN/CGSB 51.34, Type 1, 0.15 mm thick.

.2 Sealants: In accordance with Section 07 92 00 - Joint Sealants.

.3 General purpose adhesive: To CSA O112.9.

.4 Nails, spikes, and staples: To CSA B111.

.5 Fastener Finishes:

.1 Galvanizing: To CAN/CSA G164, use galvanized fasteners for exterior work, interior highly humid areas, and lumber treated with pressure-preservative and fire-retardant.

Part 3 Execution

3.1 EXAMINATION

.1 Verify conditions of substrates are acceptable for product installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate.
- .2 Inform Departmental Representative of unacceptable conditions.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Install members true to line, levels and elevations, square and plumb.

.2 Construct continuous members from pieces of longest practical length.

.3 Install furring and blocking to space-out and support casework, cabinets, wall and ceiling finishes, facings, and other work as required.

.4 Install rough bucks, nailers, and linings to rough openings as required to provide backing for frames and other work.

.5 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

.6 Frame, anchor, fasten, tie, and brace members to provide necessary strength and rigidity.

.7 Countersink bolts where necessary to provide clearance for other work.

3.3 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.2 Progress Cleaning: Leave Work area clean at end of each day.

.3 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment.

.4 Waste Management: Remove 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 rough carpentry installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI/BHMA A156.9-2010, Cabinet Hardware.

.2 ANSI A208.1-09, Particleboard.

.3 ANSI A208.2-09, Medium Density Fiberboard (MDF) for Interior Applications.

.2 Architectural Woodwork Manufacturers Association of Canada (AWMAC)

.1 Architectural Woodwork Standards, 2nd edition (2014).

.3 ASTM International

.1 ASTM B221-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 71.20-M88, Adhesive, Contact, Brushable.

.5 Canadian Standards Association (CSA)

.1 CSA B111-1974 (R2003) - Wire Nails, Spikes and Staples.

.2 CSA O151-09 (R2014), Canadian Softwood Plywood.

.6 National Electrical Manufacturers Association (NEMA)

.1 ANSI/NEMA LD3-2005 - High-Pressure Decorative Laminates (HPDL).

.7 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber, 2007.

1.2 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 architectural woodwork. Include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

.1 If required, submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

.2 Indicate details of construction, profiles, jointing, fastening and other related details.

.1 Scales: Profiles full size; details half of full size.

.3 Indicate materials, thicknesses, finishes, and hardware.

.4 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage, and location of exposed fastenings.

.4 Samples:

.1 Submit duplicate 150 x 150 mm samples of laminated plastic for colour selection.

.2 Submit duplicate 150 mm long samples of PVC edgebanding for colour selection and approval by Consultant.

.5 Certifications: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.3 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood, particleboard, OSB, and wood based composite panels to CSA and NPA standards.

1.4 PRE-INSTALLATION MEETING

.1 Before framing is completed, arrange meeting, including Contractor, woodwork manufacturer, woodwork installer, and framing sub-contractor.

.1 Review locations of backing required for casework installation as shown on casework shop drawings.

.2 Review method of attachment for backing to wall system as shown on architectural drawings.

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 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.1 Protect millwork against dampness and damage during and after delivery.

.2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.

.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 architectural woodwork from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Softwood lumber: Unless specified otherwise, S4S, moisture content 15% or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.3 AWMAC custom grade, moisture content as specified.

.2 Hardwood lumber: Moisture content in accordance with AWMAC standards.

.3 Machine stress-rated lumber is acceptable for all purposes.

.4 Hardwood plywood: To AWMAC standards, natural birch, grade A veneer face for transparent finish, thicknesses as shown on drawings.

.1 Plywood resin to contain no added urea-formaldehyde.

.5 Interior mat-formed wood particleboard: To ANSI/NPA A208.1.

.1 Particleboard resin to contain no added urea-formaldehyde.

.6 Hardboard:

.1 To CAN/CGSB 11.3.

.2 Hardboard resin to contain no added urea-formaldehyde.

.7 MDF (medium density fibreboard): To ANSI A208.2, Grade 130 or better.

.1 Modulus of rupture: Minimum 21.6 N/mm^2 (3130 psi).

.2 MDF resin to contain no added urea-formaldehyde.

.8 Moisture resistant MDF: To ANSI A208.2, 6 mm.

.9 Canadian softwood plywood (CSP): To CSA O151, standard construction.

.1 Plywood resin to contain no added urea-formaldehyde.

.10 Laminated plastic for horizontal surfaces: To NEMA LD3, Horizontal Grade Standard (HGS), 1.2 ± 0.12 mm thick; suede or matte finish.

.11 Laminated plastic for vertical surfaces: To NEMA LD3, Vertical Grade Standard (VGS), 0.7 mm ± 0.10 mm thick, microdot, wood grain, suede, or matte finish.

.12 Laminated plastic liner sheet: Grade CLS, 0.5 ± 0.10 mm thick, white colour.

.13 Laminated plastic backing sheet: Grade BKL, minimum 0.5 mm thickness.

.14 Thermofused Melamine: To NEMA LD3, melamine, polyester, or foil resin impregnated paper thermally fused under pressure to an approved core.

.1 High wear resistant thermofused melamine: Equal or exceed 400 cycles (Minimum standard for HPL abrasion test).

.15 Edgebanding: Extruded impact resistant PVC, 3 mm thick, colour to match plastic laminate.

.16 Aluminum extrusions: To ASTM B221, profiles as indicated on drawings.

.17 Nails and staples: To CSA B111.

.18 Wood screws: Stainless steel, type and size to suit application.

.19 Splines: Metal.

.20 Sealant: In accordance with Section 07 92 00 - Joint Sealants.

.21 Wood adhesive: Type II, polyvinyl acetate (PVA).

.22 Laminated plastic adhesive: Contact adhesive to CAN/CGSB 71.20.

2.2 HARDWARE

.1 General:

- .1 All hardware to be to BHMA A156.9.
- .2 Finish: Brushed nickel or stainless steel, unless otherwise specified.

.2 Hinges: European style hinges.

.3 Pulls: Metal, with brushed nickel finish, contemporary closed end bar pull.

- .1 Mounting screws: 128 mm center-to-center.
- .2 Overall dimension: 170 mm long; 40 mm projection from mounting surface.
- .3 Confirm proposed product with Consultant.

.4 Catches: Type 1 – magnetic catch.

.5 Adjustable shelf standards and supports: Vertical slotted shelf standard, type B04102.

.6 Drawer slides: Full extension side mounted drawer slides with ball bearings, zinc finish.

2.3 MANUFACTURED UNITS

.1 Casework:

- .1 Grade: AWMAC Custom Grade.
- .2 Construction type: Frameless.
- .3 Cabinet and door interface: Flush overlay.
- .4 Core:
  - .1 Top, bottom, gables, doors, body, shelves, and valances: Particleboard, 19 mm thick.
  - .2 Tops and bottoms ≥ 812 mm and without valances: Particleboard, 25 mm thick.
  - .3 Shelves and adjustable shelves ≥ 812 mm width: Particleboard 25 mm thick.
  - .4 Backs: Particleboard, 13 mm thick.
- .5 Surfaces:
  - .1 Exposed surfaces: HPDL.
  - .2 Exposed interior surfaces: HPDL matching exposed surfaces.
  - .3 Semi-exposed surfaces: Cabinet liner vertical grade laminate, white.
- .6 Edgeband: 3 mm PVC.
  - .1 Colour: As selected by Consultant.
- .7 Ladder base: Canadian softwood plywood, 19 mm thick.
  - .1 Kitchenette: Softwood plywood, 19 mm thick, with 6 mm moisture resistant MDF mounted to front face.

.2 Drawers:

- .1 Grade: AWMAC Custom grade:
- .2 Fronts: Particle board core, 19 mm thick, with HPDL.
- .3 Sides and Backs:
  - .1 Particle board, 16 mm, with white melamine surfaces.

.4 Bottoms:

.1 Tempered hardboard, 13 mm thick, with white melamine surfaces.

.3 Laminated plastic countertops:

.1 Core material: Particleboard.

.2 Surface: HPDL.

.3 Front edges: 3 mm PVC.

2.4 FABRICATION

.1 Set nails and countersink screws apply plain wood filler to indentations, sand smooth and leave ready to receive finish.

.2 Shop install cabinet hardware for doors, shelves, and drawers. Recess shelf standards unless noted otherwise.

.3 Shelving to cabinetwork to be adjustable unless otherwise noted.

.4 Provide cut-outs for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.

.5 Shop assemble work for delivery to site in sizes easily handled and to ensure passage through building openings.

.6 Obtain governing dimensions before fabricating items that are to accommodate or abut appliances, equipment, and other materials.

.7 Ensure adjacent parts of continuous laminate work match in colour and pattern.

.8 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3000 mm. Keep joints 600 mm from sink cut-outs.

.9 Apply laminate backing sheet to reverse side of core of plastic laminate work.

.10 Apply laminated plastic liner sheet where indicated.

Part 3 Execution

3.1 EXAMINATION

.1 Verify conditions of substrates are acceptable for architectural woodwork installation in accordance with manufacturer's instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Perform architectural woodwork to AWMAC Woodwork Standards.

.2 Install millwork at locations shown on drawings.

.1 Position accurately, level, plumb, and straight.

.3 Fasten and anchor millwork securely.

.1 Supply and install heavy duty fixture attachments for wall mounted cabinets.

.4 Use draw bolts in countertop joints.

.5 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting, or penetrating objects.

.6 At junction of plastic laminate counter and adjacent wall finish, apply small bead of silicone sealant in accordance with Section 07 92 00 - Joint Sealants.

.7 Fit hardware accurately and securely in accordance with manufacturer's written instructions.

.8 Chair rail:

.1 Fabricate from white birch, Select or better grade, plain sawn.

.2 Attach cleat to wall mechanically.

.3 Attach chair rail to cleat with Type II wood adhesive. Clamp installed rail to cleat until adhesive sets and cures. Wipe away excess 'squeeze-out' adhesive immediately after clamping.

.4 Fabricate rails in one piece and length when practical.

.5 Fit joints to produce hair-line crack.

3.3 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.2 Progress Cleaning: Leave Work area clean at end of each day.

.3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.

.1 Clean millwork, cabinet work, outside surfaces, insides of cupboards and drawers.

.2 Remove excess glue from surfaces.

.4 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

3.4 PROTECTION

.1 Protect millwork from damage until final inspection.

.2 Protect installed products and components from damage during construction.

.3 Repair damage to adjacent materials caused by architectural woodwork installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C423-09a, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.2 ASTM E90-04, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.3 ASTM E413-04, Classification for Rating Sound Insulation.

.2 Canadian Standards Association (CSA)

.1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S102-07, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC S114-05, Test for Determination of Non-Combustibility in Building Materials.

.3 CAN/ULC S702-09, Standard for Mineral Fibre Thermal Insulation for Buildings.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.2 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 data sheets.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOCs for insulation products and adhesives.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.4 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

.5 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.3 QUALITY ASSURANCE

.1 Convene pre-installation meeting one week prior to beginning work of this Section in accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Chart.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordinate with other building sub-trades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials in manufacturer's original containers clearly labeled with manufacturer's name, product identification, safety information, and expiration date.

.2 Store material in a safe manner and where the temperatures are within range specified by manufacturer.

.3 Remove empty containers from site on a daily basis.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 PROJECT CONDITIONS

.1 Maintain environmental conditions of temperature, humidity, and ventilation within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

.2 Ventilate area to receive insulation to maintain safe working conditions.

.3 Protect workers as recommended by standards and manufacturer's recommendations.

.4 Protect adjacent surfaces, equipment, and site areas from damage of overspray.

Part 2 Products

2.1 BATT INSULATION

.1 Acoustic batt insulation: To CAN/ULC S702, Type 1; non-combustible to CAN/ULC S114, lightweight, semi-rigid stone wool batt insulation.

.1 Surface burning characteristics to CAN/ULC S102:

.1 Flame spread: 0.

.2 Smoke developed: 0.

.2 Airborne sound transmission loss: To ASTM E90.

.3 Rating sound insulation: To ASTM E413.

.4 Sound absorption coefficients: To ASTM C423:

Thickness (mm)	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	NRC
25	0.14	0.25	0.65	0.90	1.01	1.01	0.70
38	0.18	0.44	0.94	1.04	1.02	1.03	0.85
50	0.28	0.60	1.09	1.09	1.05	1.07	0.95
76	0.52	0.96	1.18	1.07	1.05	1.05	1.05
102	0.86	1.11	1.20	1.07	1.08	1.07	1.10

2.2 ACCESSORIES

.1 Staples: CSA B111, 12 mm minimum leg.

.2 Tape: As recommended by manufacturer.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 GENERAL

.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.

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures.

.5 Cut and trim insulation neatly to fit spaces.

.6 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

3.3 EXAMINATION

.1 Examine substrates and immediately inform Departmental Representative in writing of defects.

.2 Verify substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

.3 Verify acoustic and firestop sealants required at stud framing junctions with adjacent building components or at mechanical and electrical conduit and duct penetrations are installed.

.4 Confirm mechanical, electrical, and telecommunications service lines in walls and ceilings to be insulated have been inspected.

3.4 BATT INSULATION INSTALLATION

.1 Install acoustic insulation where indicated to maintain sound attenuation of separation in building elements and spaces.

.2 Place acoustic blankets between studs ensuring friction fit, free of sags, folds, voids, or open joints that may let sound pass through.

.3 Fit insulation closely around electrical boxes, pipes, ducts, frames, and other objects in or passing through insulation.

.4 Do not compress insulation excessively to fit voids.

3.5 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 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 S101-07 - Standard Methods of Fire Endurance Tests of Building Construction and Materials

.2 CAN/ULC S102-07 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.3 CAN/ULC S115-05 – Standard Method of Fire Tests of Firestop Systems.

1.2 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 non-combustible construction or have "0" annular space in buildings of combustible construction.

.1 Words "tightly fitted" to ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.3 SYSTEM DESCRIPTION

.1 Provide fire and smoke stop systems consisting of a material or combination of materials installed to maintain the integrity of the Fire Resistance Rating of the fire separation by maintaining an effective barrier against the spread of flame, smoke, heat, and hot gases through penetrations, blank openings, construction joints, or at perimeter fire containment in or adjacent to the Fire Separation in accordance with the requirements of the National Building Code.

.2 Non-rated fire separations require firestop to stop passage of smoke and gases.

1.4 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 Sheet.

.3 Shop Drawings:

.1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings, and method of installation.

.2 Construction details should accurately reflect actual job conditions.

.4 Samples:

.1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.

.5 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 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.

.4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: Company specializing in fire stopping installations, approved by manufacturer, and having 5 years of documented experience.

.2 Pre-Installation Meetings: Convene pre-installation meeting one week prior to beginning work of this Section, with Departmental Representative to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building sub-trades.

.4 Review manufacturer's installation instructions and warranty requirements.

.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.

1.6 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, and 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 Remove waste materials 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.

.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.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 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 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 Departmental Representative.

.2 Install floor fire stopping before interior partition erections.

.3 Mechanical pipe insulation: Certified fire stop system component.

.1 Ensure pipe insulation installation precedes fire stopping.

3.5 FIELD QUALITY CONTROL

.1 Inspections: Notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

.2 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.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, rubbish, tools and equipment.

.3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C509-06 (2011) - Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.

.2 ASTM C834-05 – Latex Sealants.

.3 ASTM C919-12 - Standard Practice for Use of Sealants in Acoustical Applications.

.4 ASTM C920-05 – Standard Specification for Elastomeric Joint Sealants.

.5 ASTM E814-13a - Standard Test Method for Fire Tests of Penetration Firestop Systems.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 19.13-M87 - Sealing Compound, One-component, Elastomeric, Chemical Curing.

.2 CAN/CGSB 19.17-M90 – One-Component, Acrylic Emulsion Sealing Compound.

.3 CAN/CGSB 19.21-M87 – Sealing and Bedding Compound, Acoustical.

.4 CAN/CGSB 19.24-M90 - Multi-component, Chemical Curing Sealing Compound.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 National Institute of Building Sciences (NIBS)

.1 NIBS Guideline 3-2012 – Building Enclosure Commissioning Process BECx.

1.2 DESIGN REQUIREMENTS

.1 Sealants acceptable for use on this project must be listed on CGSB Qualified Products List as issued by CGSB Qualification Board for Joint Sealants.

1.3 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 joint sealants. Include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Manufacturer's product literature to describe:

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Samples:

.1 Submit 2 samples of each type of material and colour.

.2 Cured samples of exposed sealants for each colour where required to match adjacent material.

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 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, well-ventilated area.

.2 Store and protect joint sealants from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.5 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.

.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.

1.6 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.

.2 Ventilate area of work as directed by Departmental Representative.

Part 2 Products

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours or contains toxic chemicals.

.2 When low odour or non-toxic caulks are not possible, confine usage to areas that are contained behind air barriers, or are applied as long as possible before occupancy to maximize off-gas time.

.3 Where sealants are qualified with primers, use only those primers.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Polyurethane Sealant: To CAN/CGSB 19.24, Type 2, Class B; and ASTM C920, Type M, Grade NS, Use NT, M, A and O; non-sag, multi component, chemical curing.

.1 Typical uses: Perimeter windows.

.2 Elastomeric Polyurethane Sealant: To CAN/CGSB 19.13, Type 2; and ASTM C920, Type S, Grade NS, Use NT, M, A and O; non-sag, single component, moisture curing hybrid polyurethane.

.1 Typical uses: Perimeter caulking of windows and doors.

.3 Latex Sealant: To CAN/CGSB 19.17; and ASTM C834; single component, acrylic latex or siliconized acrylic latex.

.1 Typical uses: General purpose, acoustic sealing, back bedding glazing compound, window frame perimeters.

.4 Acoustic Sealant: To CAN/CGSB 19.21 and ASTM C919, acoustic grade, single component, non-hardening, non-skinning.

.1 Typical uses: Acoustic sealing of gypsum wall board partitions, sealing of interior polyethylene air/vapour barrier.

.5 Acoustic and Smoke Sealant: To CAN/CGSB 19.21 and ASTM C919, acoustic grade, single component, non-hardening, non-skinning.

.1 Typical use: Acoustic and smoke sealing of gypsum wall board partitions.

.6 Fire-Resistive Sealant: To ASTM E814, one part fire-stopping sealant.

.1 Typical uses: Penetrations in fire-rated floor and wall assemblies.

.2 Refer to Section 07 84 00 – Fire Stopping.

.7 Silicone, one part: To CAN/CGSB 19.13; and ASTM C920, Type S, Grade NS; mildew resistant, single component, colour white unless otherwise specified.

.1 Typical uses: Around washroom fixtures, lavatories, and other wet areas.

2.3 ACCESSORIES

.1 Confirm with sealant manufacturer for compatibility for all items.

.2 Preformed compressible and non-compressible back-up materials:

.1 Polyethylene, urethane, neoprene, or vinyl foam:

.1 Extruded foam backer rod.

.2 Size: oversize 30 to 50%.

.3 Neoprene or butyl rubber:

.1 Round solid rod, Shore A hardness 70.

.4 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/m^3 density, or neoprene foam backer, size as recommended by manufacturer.

.5 Bond breaker tape:

.1 Polyethylene bond breaker tape that will not bond to sealant.

.6 Elastomeric Joint Filler:

.1 To ASTM C509, preformed, pre-compressed self-expanding foam material, impregnated with water-based, non-drying, polymer modified 100% acrylic dispersion. Pressure sensitive tape on one side, water based.

.7 Primer: Non-staining type, to suit application.

2.4 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 Verify conditions of substrate are acceptable for joint sealant installation in accordance with manufacturer's written instructions.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 GENERAL

.1 Install joint sealers to NIBX Guideline 3: Annex M.2 Example Construction Checklist for Building Envelope System Joint Sealants.

.2 Install sealants at intersections between dissimilar materials, and expansion and control joints.

.3 Install joint sealers at interior vertical and horizontal joints.

3.3 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 that 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.

3.4 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.

3.5 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.

3.6 MIXING

.1 Mix materials in accordance with sealant manufacturer's instructions.

3.7 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.

3.8 FIELD QUALITY CONTROL

.1 To NIBS Guideline 3: Annex M.1 Construction and Industry Checklist M.1-5 for Joint Sealers.

.2 Perform adhesion tests.

3.9 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: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

3.10 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by joint sealant installation.

END OF SECTION

Section 08 01 00
Door Schedule

DOOR						FRAME			FIRE RATING	HARDWARE SET	HARDWARE NOTES
NO.	NOMINAL SIZE	STC	MATERIAL	FINISH	GLASS	MATERIAL	FINISH	SIDE LIGHT			
D101	EX, TO BE RECONFIGURED	-	ALUM	CL ANOD	YES	ALUM	CL ANOD	YES		1	CA,, POWER OPERATOR, INTEGRATED PUSH BUTTON IN MULLION, SMOKE SEALS
D102A	915 x 2134	-	HM	PT	NO	PS	PT	-		2	PANIC, SMOKE SEPARATION SEALS, CLOSER, NO HARDWARE REQ'D ON OUTSIDE
D103	SITE CONFIRM	-	WD (TOP HUNG TWO-PANEL SLIDING)	PT	NO	ALUM	CL ANOD	NO		3	SLIDING DOOR
D104A	915 x 2134	-	HM	PT	NO	PS	PT	-		4	LOCKABLE, NO STOP, NO CLOSER
D104B	915 x 2134	-	HM	PT	NO	PS	PT	-		4	LOCKABLE, NO STOP, NO CLOSER
D105	SITE CONFIRM	-	WD (TOP HUNG THREE-PANEL SLIDING)	PT	NO	ALUM	CL ANOD	NO		3	SLIDING DOOR
D106	915 x 2134	-	WD SLAB	CLEAR	NO	PS	PT	YES		5	NO LOCK REQ'D, FLOOR STOP
D107A	915 x 2134	45	WD SLAB	CLEAR	NO	PS	PT	YES		6	FLOOR STOP, ACOUSTIC SEALS, CLOSER/HOLDER. NO LOCK REQUIRED
D107B	915 x 2134	45	WD SLAB	CLEAR	NO	PS	PT	YES		6	FLOOR STOP, ACOUSTIC SEALS, CLOSER/HOLDER. NO LOCK REQUIRED
D107C	915 x 2134	45	WD SLAB	CLEAR	NO	PS	PT	YES		7	FLOOR STOP, ACOUSTIC SEALS, CLOSER/HOLDER. NO LOCK REQUIRED
D109	915 x 2134	45	WD SLAB	CLEAR	NO	PS	PT	YES		5	CLOSER, FLOOR STOP. NO LOCK REQUIRED
D110	915 x 2134	-	WD SLAB	CLEAR	NO	PS	PT	NO		9	CLOSER, FLOOR STOP. NO LOCK REQUIRED
D112	915 x 2134	-	WD SLAB	CLEAR	NO	PS	PT	YES		5	NO LOCK REQ'D, FLOOR STOP
D113	915 x 2134	45	WD SLAB	CLEAR	NO	PS	PT	NO		10	NO LOCK REQ'D, WALL STOP, ACOUSTIC SEALS
D114	915 x 2134	45	WD SLAB	CLEAR	NO	PS	PT	YES		11	NO LOCK REQ'D, FLOOR STOP, ACOUSTIC SEALS
D01	EX, FROM DS06	-	EX							8	TO BE LOCKABLE (NO DEADBOLT REQ'D)
DS20	EX, FROM DS18B	-	EX							8	TO BE LOCKABLE (NO DEADBOLT REQ'D)

LEGEND

ALUM	Aluminum	G	Glass
ADO	Automatic Door Operator	HM	Hollow metal, welded
CA	Card Access	PT	Paint
CL ANOD	Clear anodizing	PS	Pressed Steel
CLEAR	Clear stain	SC	Solid Core
EX	Existing	WD	Wood

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM A653/A653M-13, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.3 Canadian Standards Association (CSA)

.1 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door Manufacturers' Association (CSDMA)

.1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frame Products, 2006.

.2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Door and Frame Products, 2009.

.5 National Fire Protection Association (NFPA)

.1 NFPA 80-2007, Standard for Fire Doors and Other Opening Protectives.

.2 NFPA 252-2012, Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN4-S104-M80, Standard Method for Fire Tests of Door Assemblies.

.2 CAN4-S105-M85, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

1.2 DESIGN REQUIREMENTS

.1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 or NFPA 252 for ratings specified or indicated.

.2 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

.3 Installed Door and Frame Assembly: Conform to NFPA 80 for fire rated class as scheduled.

1.3 SUBMITTALS

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

.2 Product Data: Indicate door and frame configurations and finishes, location of cut-outs for hardware reinforcement.

.3 Shop drawings:

.1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, arrangement of hardware, fire rating, and finishes.

.2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings fire rating, and finishes.

.3 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.

.2 Show glazing stops.

.5 Manufacturer's Installation Instructions: Indicate special installation instructions.

.6 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

.7 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Remove doors and frames from wrappings or coverings upon receipt on site and inspect for damage.

.3 Store in vertical position, spaced with blocking to permit air circulation between components.

.4 Store materials on planks or dunnage, out of water, and covered to protect from damage.

.5 Clean and touch up scratches or disfigurement caused by shipping or handling with zinc-rich primer.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Remove waste materials in accordance with Section 01 74 21 – Construction and Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: To ASTM A653/A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

2.2 DOOR CORE MATERIALS

.1 Honeycomb construction:

.1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m³ minimum, sanded to required thickness.

.2 Temperature rise rated (TRR): Core composition to limit temperature rise on unexposed side of door to 250°C for time period indicated in drawings. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104 or NFPA 252.

2.3 ADHESIVES

.1 Heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

2.4 PRIMER

.1 Zinc-rich touch-up primer to CAN/CGSB 1.181.

2.5 PAINT

.1 Field paint steel doors and frames in accordance with Section 09 91 00 – Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

2.6 ACCESSORIES

.1 Door hardware: Specified in Section 08 71 00.

.2 Door silencers: Single stud rubber/neoprene type.

.3 Fabricate glazing stops as formed galvanized steel channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk tamper-proof sheet metal screws.

.4 Metallic paste filler: To manufacturer's standard.

.5 Fire labels: Metal riveted.

.6 Sealant: Refer to Section 07 92 00 – Joint Sealing.

.7 Glazing Stops: Formed galvanized steel channel, minimum 16 mm high, accurately fitted, butted at corners and fastened to frame sections with counter-sunk, tamper proof sheet metal screws.

.8 Glazing: Refer to Section 08 80 50 – Glazing.

2.7 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Interior frames: 1.6 mm welded type construction.

.4 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.5 Prepare frame for door silencers, 3 for single door.

.6 Manufacturer's nameplates on frames and screens are not permitted, except as required for fire rating data.

.7 Conceal fastenings except where exposed fastenings are indicated.

.8 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

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 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

.4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 FRAMES

.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 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.10 DOOR FABRICATION GENERAL

.1 Doors: Swing type, flush, with provision for glass openings as indicated.

.2 Interior doors: Honeycomb construction.

.3 Fabricate doors with longitudinal edges welded.

.1 Seams: Grind welded joints to a flat plane, and sand flush.

.4 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware as required.

.5 Reinforce doors where required, for surface mounted hardware. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.6 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.7 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN4-S104 or NFPA 252 and list by nationally recognized agency.

.8 Manufacturer's nameplates on doors are not permitted except as required for fire rating data.

2.11 DOORS: HONEYCOMB CORE CONSTRUCTION

.1 Form face sheets for interior doors from 1.3 mm sheet steel with honeycomb or temperature rise rated core laminated under pressure to face sheets.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 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.

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 and thresholds: 13 mm.

.3 Adjust operable parts for correct function.

3.5 GLAZING

.1 Install glazing for doors and frames in accordance with Section 08 80 50 - Glazing.

3.6 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC).

.1 Architectural Woodwork Standards, 2nd edition (2014).

.2 ASTM International

.1 ASTM E413-04 – Classification for Rating Sound Insulation.

.3 Canadian Standards Association (CSA)

.1 CAN/CSA O132.2 Series-90 (R1998) - Wood Flush Doors.

.4 National Fire Protection Association (NFPA)

.1 NFPA (Fire) 80-2007 - Standard for Fire Doors and Other Opening Protectives.

.2 NFPA (Fire) 252-2012 - Fire Tests of Door Assemblies.

.5 Underwriters' Laboratories of Canada (ULC)

.1 CAN4-S104-M80 - Standard Method for Fire Tests of Door Assemblies.

.2 CAN4-S105-M85 - Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

.6 Wood Door Manufacturers Association (WDMA)

.1 ANSI/WDMA I.S. 1A-13 – Interior Architectural Wood Flush Doors.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.3 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 sheets.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOCs:

.1 For caulking materials during application and curing.

.2 For door materials and adhesives.

.3 Shop Drawings:

.1 Indicate door types and cut-outs for lights, sizes, and core construction.

.4 Samples:

.1 Submit one 200 x 200 mm corner sample of each type of door.

.5 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.6 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

.7 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Wood fire rated doors: Labelled and listed by an organization accredited by Standards Council of Canada.

1.5 DELIVERY, STORAGE, AND HANDLING

.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.

.4 Store doors away from direct sunlight.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials.

.2 Dispose of packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

.3 Divert unused adhesive material from landfill to official hazardous material collections site approved by Departmental Representative.

Part 2 Products

2.1 WOOD FLUSH DOORS

.1 Solid core: To CAN/CSA O132.2.

.1 Construction:

.1 Stile and rail frame bonded to specified core.

.2 Thickness: 44 mm.

.3 Conform to AWMAC Woodwork Standards, custom grade.

.2 Stiles: Structural composite lumber, width 30 mm.

.3 Rails: Structural composite lumber, width 84 mm.

.4 Faces of wood veneered doors intended for transparent finish: AA – premium, rotary cut birch.

.5 Core:

.1 Non-rated doors: Sound dampening core to ASTM E413, rated to STC 46, no added urea formaldehyde.

.2 Fire rated doors: Manufacturer's standard solid core, to AWMAC Section 9, no added urea formaldehyde, and to meet scheduled fire ratings.

.6 Adhesive: Type I PVA crosslink, no added urea formaldehyde.

2.2 FIRE RATED WOOD DOORS

.1 Tested in accordance with CAN4-S104 or NFPA 252 to achieve rating as scheduled.

2.3 ACCESSORIES

.1 Accessories: Refer to Door Schedule and Section 08 71 00 - Door Hardware.

2.4 FINISHES

.1 Clear stain as specified in Section 09 91 00.

2.5 FABRICATION

.1 Fabricate doors in accordance with AWMAC Quality Standards and ULC requirements.

.2 Doors: Meet the requirements of ANSI/WDMA I.S. 1A Heavy Duty performance level.

.3 Stiles and rails fully bonded to core and assembled unit to be abrasive planed prior to lamination of faces. Size stiles to fit intended door hardware.

.4 Doors assembled using Type 1 adhesive, with no urea-formaldehyde resins.

.5 Fire-rated doors: Construction standard of manufacturer and conforming to requirements of all applicable labelling agencies.

.6 Provide blocking as required for surface mounted hardware to prevent the need for through-bolting.

.7 Factory drill pilot holes for hinges.

.8 Bevel lock and hinge stile to AWMAC Woodwork Standards, 3° bevel.

.9 Affix permanent metal nameplates to door on hinge edge, indicating manufacturer's name and fire rating.

Part 3 Execution

3.1 INSTALLATION

.1 Unwrap and protect doors in accordance with CAN/CSA O132.2 Series, Appendix A.

.2 Install doors and hardware in accordance with manufacturer's printed instructions and CAN/CSA O132.2 Series, Appendix A.

.3 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.4 Install labelled fire rated doors to NFPA 80.

.5 Allow fitting clearance of 3 mm.

.6 Install stops.

.7 Trim non-rated door widths as required by cutting equally on both edges. Reseal and refinish all cut or planed surfaces immediately to match factory finish.

.8 Trim door height by cutting bottom edges maximum 19 mm.

.9 Trim fire door heights at bottom edge only in accordance with fire rating requirements.

.10 Do not trim fire rated door widths.

.11 Pilot holes to be factory drilled.

.12 Coordinate installation of doors with installation of frames and hardware.

.13 Adjust doors for smooth and balanced door movement and operation.

3.2 ADJUSTMENT

.1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

3.3 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer and 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.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 National Fire Protection Association (NFPA)

.1 NFPA 80-2007, Fire Doors and Other Opening Protectives.

.2 Underwriters Laboratory of Canada (ULC)

.1 CAN/ULC S104-10, Fire Tests of Door Assemblies.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Coordinate placement of access panels with mechanical, electrical, and plumbing trades.

.2 Confirm placement of access panels with Consultant.

1.3 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 access door components. Include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

.1 Submit catalogue details for each type of door illustrating profiles, dimensions and methods of assembly. Indicate location and details of installation.

.4 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

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 incorporation into manual.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 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 access doors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 ACCESS PANELS

.1 Materials:

.1 Galvanized cold-rolled sheet steel.

.2 Components:

.1 Frame: Steel sheet, minimum 1.5 mm thick, with flange for installation to gypsum board substrate and rounded safety corners.

.1 Weld exposed joints in flange and grind smooth.

.2 Door: Steel sheet, minimum 1.9 mm thick, reinforced to maintain flat surface.

.3 Hinge: Continuous steel with pin hinge or concealed springed hinge, with 175° swing.

.4 Lock: Flush, screwdriver operated cam lock.

.5 Finish: Powder coat prime paint.

.6 Rated access panels: For fire rated wall assemblies, provide access panels complying NFPA 80 or CAN/ULC S104, with insulated sandwich-type construction.

.3 Fabrication:

.1 Fabricate components straight, square, flat, with slightly rounded exposed edges.

.2 Ensure products are without burrs, snags, and sharp edges.

.3 Exposed welds continuous and ground smooth.

.4 Provide anchors or make provisions in frame for anchorage to adjacent construction. Provide size, number, and location of anchors on all sides to secure access panel in opening.

.4 Sizes: As follows, unless indicated:

.1 For body entry: 600 x 600 mm minimum.

.2 For hand entry: 300 x 300 mm minimum.

Part 3 Execution

3.1 EXAMINATION

.1 Verify conditions of substrates are acceptable for access panel installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Consultant of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Follow manufacturer's instructions for installation of access panels.

.2 Locate access doors within view of equipment and ensure equipment is accessible for operating, inspecting, adjusting, servicing without using special tools.

.3 Install panels level, plumb, and straight.

3.3 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: Remove 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 access door installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI A117.1-2009, Standard for Accessible and Usable Buildings and Facilities.

.2 Builders Hardware Manufacturers Association (BHMA)

.1 BHMA A156.1-2013, Butts and Hinges.

.2 BHMA A156.2-2011, Bored and Preassembled Locks and Latches.

.3 BHMA A156.3-2014, Exit Devices.

.4 BHMA A156.4-2013, Door Controls - Closers.

.5 BHMA A156.5-2010, Cylinder and Input Devices for Locks.

.6 BHMA A156.6-2010, Architectural Door Trim.

.7 BHMA A156.13-2012, Mortise Locks and Latches Series 1000.

.8 BHMA A156.16-2013, Auxiliary Hardware.

.9 BHMA A156.19-2013, Power Assist and Low Energy Power - Operated Doors.

.10 BHMA A156.22-2012, Door Gasketing and Edge Seal Systems.

.3 Canadian Standards Association (CSA)

.1 CSA B651-12 – Accessible Design for the Built Environment.

.4 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)

.1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

.5 National Fire Protection Association (NFPA)

.1 NFPA (Fire) 80-2007 - Standard for Fire Doors and Other Opening Protectives.

.2 NFPA (Fire) 252-2012 - Fire Tests of Door Assemblies.

1.2 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 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.

.3 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 Manufacturer's Instructions: Submit manufacturer's installation instructions.

.6 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

.7 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

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 door hardware for incorporation into manual.

1.4 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 Door hardware to comply to CSA B651 for accessibility 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 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 indoors in dry location and in accordance with manufacturer's recommendations in clean, well-ventilated area.

.2 Store and protect door hardware from nicks, scratches, and blemishes.

.3 Protect prefinished surfaces with wrapping or strippable coating.

.4 Replace defective or damaged materials with new.

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 BHMA A156.13, series 1000 mortise lock, Grade 1.

.1 Case: Wrought steel, zinc dichromate plated, 3 mm thick.

.2 Cylinder: Brass.

.2 Lever handles: Special design flat face with handicap return 50 mm round nose.

.3 Normal strikes: Box type, lip projection not beyond jamb.

.2 Hinges: To BHMA A156.1, five-knuckle, standard weight, 0.134 gauge steel.

.3 Cylinders:

.1 To BHMA A156.5, solid brass, 6 pin, to suit mortise lock. Finish: Satin chromium plated.

.4 Exit devices: Narrow stile aluminum door application, to BHMA A156.3, Grade 1.

.5 Door Closers: To BHMA A156.4, Grade 1, and ANSI A117.1, rack and pinion operation, cast aluminum alloy housing, surface mounted, adjustable backcheck intensity.

.6 Door Operators:

.1 Power assist and low energy power operated doors: To BHMA A156.19 and ANSI A117.1, rack and pinion design contained within cast aluminum housing, 170° swing.

.1 Door switch: SPDT, UL listed, 15 amp at 120 VAC, to fit 44 mm (1-3/4 inch) frame, stainless steel plate.

.7 Door bottom: Aluminum case with movable drop bar seal. Seal actuated by plunger contacting jamb. Aluminum with sponge neoprene insert.

.8 Overhead stop: Surface mounted, single acting, slide track design, with shock end cap.

.9 Door Stops: To BHMA A156.16, solid cast brass, heavy duty casting with solid pin, complete with rubber bumper.

.10 Wall stops: Brass, bronze, and stainless steel with rubber convex bumper, 63 mm diameter, 19 mm projection, concealed mounting.

.11 Sliding door hardware:

.1 Bottom channel: Extruded aluminum, mill finish.

.2 Roller guide: Steel plate with brass roller.

.12 Architectural door trim: To BHMA A156.6,.

.1 Door protection plates: Kick plate type 1.27 mm thick stainless steel, No. 4 finish.

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 Refer to Door Hardware Schedule.

.2 Coordinate with Departmental Representative for Keying Strategy.

.3 Provide keys in duplicate for every lock.

.4 Provide four master keys for each master key group.

.5 Stamp keying code numbers on keys and cylinders.

Part 3 Execution

3.1 INSTALLATION

.1 Comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Supply 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) and CSA B651.

.5 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.6 Use only manufacturer's supplied fasteners.

.1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.7 Remove construction cores when directed by Departmental Representative.

.1 Install permanent cores and ensure locks operate correctly.

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: 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: Remove 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 door hardware installation.

3.5 HARDWARE SCHEDULE

Set: 1.0

1 Cylinder	41 101	US26D	SA
1 Automatic Operator	5730	689	NO
2 Door Switch	503		NO
1 Card Reader	By Others		00
1 Balance of Hardware is Existing			00

Notes: Remove existing closer on active leaf. Install auto operator and new keyed cylinder.

All aluminum framing and door to be re-configured as per plan.

Set: 2.0

3 Hinge	TA2714 NRP 4-1/2" x 4"	US26D	MK
1 Mortise Exit Device	8400 Exit Only	628	AD
1 Surface Closer	J8501	689	NO
1 Drop Plate	8146	689	NO
1 Door Stop	441H	US26D	RO
1 Weatherstrip and Sweep	By Door Supplier		00

Set: 3.0

1	Sliding Door Hdwe	HBP200A Series		PE
4	Roller	106R/94		PE
1	Guide Channel	2802BT		PE
4	Flush Pull	872	US26D	RO

Set: 4.0

3	Hinge	TA2714 NRP 4-1/2" x 4"	US26D	MK
1	Storeroom Lock	7904 OBJ	US26D	SA
1	Surface Overhead Stop	55-X36	652	RF

Set: 5.0

3	Hinge	TA2714 4-1/2" x 4"	US26D	MK
1	Passage Set	7915 OBJ	US26D	SA
1	Door Stop	441H	US26D	RO

Set: 6.0

3	Hinge	TA2714 4-1/2" x 4"	US26D	MK
1	Passage Set	7915 OBJ	US26D	SA
1	Door Closer	351 PSH	EN	SA
1	Kick Plate	K1050 10"	US32D	RO
2	Gasketing	290AS		PE
1	Gasketing	2891AS		PE
1	Gasketing	S88BL		PE
1	Door Bottom	4131CRL		PE

Notes: Install 2891AS gasket to head of frame. Mount closer to gasketing.

Set: 7.0

3	Hinge	TA2714 4-1/2" x 4"	US26D	MK
1	Passage Set	7915 OBJ	US26D	SA
1	Door Closer	351 H	EN	SA
1	Kick Plate	K1050 10"	US32D	RO
1	Door Stop	441H	US26D	RO
3	Gasketing	290AS		PE
1	Gasketing	S88BL		PE
1	Door Bottom	4131CRL		PE

Set: 8.0

1	New Sargent cylinder to suit existing lock	00
1	Re-Use Existing	00

Set: 9.0

3	Hinge	TA2714 4-1/2" x 4"	US26D	MK
1	Passage Set	7915 OBJ	US26D	SA
1	Surface Overhead Stop	10-X36	652	RF

Set: 10.0

3	Hinge	TA2714 4-1/2" x 4"	US26D	MK
1	Passage Set	7915 OBJ	US26D	SA
1	Wall Stop	406	US32D	RO
3	Gasketing	290AS		PE
1	Gasketing	S88BL		PE
1	Door Bottom	4131CRL		PE

Set: 11.0

3	Hinge	TA2714 4-1/2" x 4"	US26D	MK
1	Passage Set	7915 OBJ	US26D	SA
1	Door Stop	441H	US26D	RO
3	Gasketing	290AS		PE
1	Gasketing	S88BL		PE
1	Door Bottom	4131CRL		PE

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C542-05 (2011), Standard Specification for Lock-Strip Gaskets.

.2 ASTM D2240-05 (2010), Standard Test Method for Rubber Property - Durometer Hardness.

.3 ASTM E84-14, Standard Test Method for Surface Burning Characteristics of Building Materials.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 12.1-M90, Tempered or Laminated Safety Glass.

.2 CAN/CGSB 12.3-M91, Flat, Clear Float Glass.

.3 CAN/CGSB 12.8-97, Insulating Glass Units.

.3 Glass Association of North American (GANA)

.1 GANA Glazing Manual – current edition.

.2 GANA Laminated Glazing Reference Manual - 2009.

1.2 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 glass, sealants, and glazing accessories. Include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

.1 As required, submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

.4 Samples:

.1 Submit duplicate 200 x 200 mm size samples of each type of glass to be installed.

.5 Certificates: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.6 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

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 glazing for incorporation into manual.

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 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 glazing and frames from nicks, scratches, and blemishes.

.3 Protect prefinished aluminum surfaces with strippable coating.

.4 Replace defective or damaged materials with new.

1.6 AMBIENT CONDITIONS

.1 Install glazing when ambient temperature is 10°C minimum. Maintain ventilated environment for 24 hours after application.

.2 Maintain minimum ambient temperature before, during, and 24 hours after installation of glazing compounds.

Part 2 Products

2.1 MATERIALS

.1 Flat Glass:

.1 Float glass: To CAN/CGSB 12.3, glazing quality, 6 mm thick.

.2 Safety glass: To CAN/CGSB 12.1, transparent, 6 mm thick.

.1 Type 2 - tempered.

.2 Class B-float.

.3 Category 11.

.4 Edge treatment.

.2 Insulated Glass Units: CAN/CGSB 12.8, double pane, outer and inner pane of clear tempered glass; interpane space filled with air; total unit thickness of 25 mm (1 inch).

.3 Sealant: In accordance with Section 07 92 00 - Joint Sealants.

2.2 ACCESSORIES

.1 Setting blocks: Neoprene, 80-90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area.

.2 Spacer shims: Neoprene, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.

.3 Glazing tape: Preformed butyl compound with integral resilient tube spacer, 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; widths as required for application, black colour.

.4 Lock-strip gaskets: To ASTM C542.

Part 3 Execution

3.1 EXAMINATION

.1 Verify conditions of substrates are acceptable for glazing installation in accordance with manufacturer's written instructions.

.1 Verify openings for glazing are correctly sized and within tolerance.

.2 Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

.3 Visually inspect substrate.

.4 Inform Departmental Representative of unacceptable conditions.

.5 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

.1 Perform work in accordance with GANA Glazing Manual for glazing installation methods.

.2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line. Butt-joint tape edges, seal joints with butyl sealant.

.3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.

.4 Set glass unit on setting blocks; apply pressure against fixed stop for full contact.

.5 Place glazing tape on free perimeter of glazing in same manner described.

.6 Install removable stop without displacement of tape. Apply pressure on tape for full continuous contact.

.7 Knife trim protruding tape.

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.

.1 Remove traces of primer, caulking.

.2 Remove glazing materials from finish surfaces.

.3 Remove labels.

.4 Clean glass using approved non-abrasive cleaner in accordance with manufacturer's instructions.

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

.2 Waste Management: Remove 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 After installation, mark each light with an "X" using removable plastic tape or paste.

.3 Repair damage to adjacent materials caused by glazing installation.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

.2 Product data: Manufacturer's current technical literature on each product proposed.

- .1 Manufacturer's data sheets.
- .2 Preparation instructions and recommendations.
- .3 Storage and handling requirements and recommendations.
- .4 Installation methods.

.3 Samples:

- .1 Duplicate samples of film proposed for installation on the project.

.4 Closeout Submittals: Section 01 78 00 - Closeout Submittals.

- .1 Provide operation and maintenance data for window film for incorporation into manual.
- .2 Follow manufacturer's written instructions for care and maintenance of glazing film.
- .3 Use only cleaning solution recommended by manufacturer for regularly scheduled cleaning of glazing film.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle materials in accordance with section 01 61 00 - Common Product Requirements.

.2 Provide and maintain dry, off-ground weatherproof storage.

.3 Waste Management and Disposal: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Decorative film products, applied to interior glass surfaces.

.2 Signage Window Film:

- .1 Removable release liner.
- .2 Pressure sensitive adhesive.
- .3 Pattern: As selected by Departmental Representative.
- .4 Glazing Film Accessories:
  - .1 General: Provide products complying with requirements of glazing film manufacturer for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
  - .2 Cleaners, Primers, and Sealers: Types recommended by glazing film manufacturer.

Part 3 Execution

3.1 PREPARATION

.1 Clean glass before beginning installation using neutral cleaning solution.

.2 Ensure no deleterious material adheres to glass by scraping surface of glass using industrial razors.

.3 Ensure dust, grease, and chemical residue are removed from surface of glass before installation of film.

.4 Examine glass under natural daylight and identify cracks, blisters, bubbles, discolouration, edge defects, or other anomalies that may cause film to delaminate or cause vision transparency or distortion problems. Report findings to Departmental Representative.

3.2 INSTALLATION

.1 Install security film to glass windows ensuring no blisters, bubbles, scratches or distortions.

.2 Cut film edges straight and square.

.3 Apply and attach film to glass in accordance with manufacturer's written instructions.

.4 Fit tight to glass perimeter with razor cut edge.

.5 Splicing:

- .1 Splice film only when glass is greater in width than film.
- .2 Splice film only after approval from Departmental Representative.
- .3 Use butt factory edges only.
- .4 Ensure maximum overlap of 3 mm.

3.3 INSTALLER'S INSPECTION

.1 Remove and replace film that continues to show blisters, bubbles, tears, scratches, edge defects or vision distortion in film when viewed under natural daylight from 2 metres minimum, after 30 day period.

3.4 FINAL CLEANING

.1 Wash interior and exterior of each window and film, using cleaning solution recommended by film manufacturer.

END OF SECTION

Canada School of Public Service (CSPS) - Project R.060508.003
CSPS Fit-Up
Stanley Knowles Building, Winnipeg, Manitoba

NO.	ROOM NAME	FLOOR	BASE	CEILING		WALL								NOTES
						NORTH		EAST		SOUTH		WEST		
		Material	Mat.	Material	Fin.	Material	Fin.	Material	Fin.	Material	Fin.	Material	Fin.	
100A	Public Corridor A	CPT	RUB	EX	-	GWB	PT	-	-	GWB	PT	GWB	PT	
100B	Public Corridor B	CPT	RUB	EX	-	GWB	PT	GWB	PT	GWB	PT	GWB/EX GL	PT/-	
101	Reception	RVT	RUB	GWB	PT	GWB	PT	GWB	PT	GWB	PT	-	-	
102	Corridor	CPT	RUB	GWB	PT	GWB	PT	GWB	PT	-	-	GWB	PT	
103	Classroom Storage	CPT	RUB	ACT-1	-	GWB	PT	GWB	PT	GWB	PT	-	-	
104	Telecom Room	CPT	RUB	EX	-	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
105	Classroom Storage	CPT	RUB	ACT-1	-	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
106	Undesignated	CPT	RUB	ACT-2	-	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
107A	Classroom	CPT	RUB	ACT-1	-	GWB/FPP	PT/-	GWB	PT	GWB	PT	GWB	PT	
107B	Classroom	CPT	RUB	ACT-1	-	GWB/FPP	PT/-	GWB	PT	GWB/FPP	PT/-	GWB	PT	
107C	Classroom	CPT	RUB	ACT-1	-	GWB	PT	GWB	PT	GWB/FPP	PT/-	GWB	PT	
108A	Open Area	RVT	RUB	ACT-1	-	-	-	GWB	PT	GWB	PT	GWB	PT	
108B	Kitchenette	RVT	RUB	ACT-1	-	-	-	GWB	PT	GWB	PT	GWB	PT	
109	Meeting Room	CPT	RUB	ACT-1/GWB	-/PT	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
110	Multipurpose Room	CPT	RUB	GWB	PT	GL	-	GWB	PT	GWB	PT	GWB	PT	
111	Workstations	CPT	RUB	ACT-1	-	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
111A	Shared Equipment	CPT	RUB	ACT-1	-	-	-	-	-	-	-	GWB	PT	
112	Office	CPT	RUB	ACT-2	-	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
113	Quiet Room	CPT	RUB	ACT-2	-	GWB	PT	GWB	PT	GWB	PT	GWB	PT	
114	Webex Room	CPT	RUB	ACT-2	-	GWB	PT	GWB	PT	GWB	PT	GWB	PT	

LEGEND

ACT	Acoustic Ceiling Tile	GT	Glazed Tile
CPT	Carpet Tile	GWB	Gypsum Wall Board
EX	Existing	PT	Paint
EX GL	Existing Glazing	RUB	Rubber Base
FPP	Folding Panel Partition	SV	Sheet Vinyl
GL	Glazed Wall	RVT	Resilient Vinyl Tile

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C475/C475M-12e1, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.2 ASTM C557-03(2009)e1, Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.

.3 ASTM C665-12, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.4 ASTM C840-13, Standard Specification for Application and Finishing of Gypsum Board.

.5 ASTM C1002-07, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.6 ASTM C1047-14a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.7 ASTM C1178/C1178M-08, Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.

.8 ASTM C1396/C1396M-06a, Standard Specification for Gypsum Wallboard.

.9 ASTM D3273-12, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

.10 ASTM D6329-98 (2008), Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers.

.11 ASTM E84-14 - Standard Test Method for Surface Burning Characteristics of Building Materials.

.12 ASTM E96/E96M-05, Standard Test Methods for Water Vapor Transmission of Materials.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 51.34-M86 (R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.2 CAN/CGSB 71.25-M88, Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.

.3 Gypsum Association (GA)

.1 GA-214-15, Recommended Levels of Finish for Gypsum Board, Glass Mat, and Fiber-Reinforced Gypsum Panels.

.4 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC S702-09, Mineral Fibre Thermal Insulation for Buildings.

1.2 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 gypsum board assemblies. 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 Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store gypsum board assemblies materials level off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.

.3 Protect from weather, elements and damage from construction operations.

.4 Handle gypsum boards to prevent damage to edges, ends, or surfaces.

.5 Replace defective or damaged materials with new.

1.4 AMBIENT CONDITIONS

.1 Maintain temperature 10°C minimum, 21°C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost-free surfaces.

.3 Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

Part 2 Products

2.1 MATERIALS

.1 Standard board: To ASTM C1396/C1396M, paper faced, regular, thickness as shown on Drawings, Type X where indicated, 1200 mm wide x maximum practical length, ends square cut, edges bevelled.

2.2 ACOUSTIC INSULATION

.1 Non-rated walls: To CAN/ULC S702 or ASTM C665; preformed glass fibre, friction fit batts, unfaced; or preformed mineral fibre processed from rock or slag.

.2 Rated walls: To CAN/ULC S702, preformed mineral fibre processed from rock or slag, friction fit batts, unfaced.

2.3 PLENUM ACOUSTIC BARRIER

.1 Plenum barrier: Purpose made, bonded acoustical cotton, mineral wool fibre, or fibreglass, adhered to foil backing; 25 mm minimum thickness.

.1 Burning characteristics to ASTM E84: Class A – non-flammable.

.1 Flame spread: ≤ 5.

.2 Smoke developed: ≤ 35.

2.4 ACCESSORIES

.1 Furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.

.2 Steel drill screws: To ASTM C1002, Type S.

.3 Stud adhesive: To CAN/CGSB 71.25 or ASTM C557.

.4 Casing beads, corner beads, control joints and edge trim: To ASTM C1047, metal, zinc-coated by electrolytic process, 0.5 mm base thickness, perforated flanges, one piece length per location.

.5 Sealants: In accordance with Section 07 92 00 - Joint Sealants.

.1 Acoustic sealant: In accordance with Section 07 92 00 - Joint Sealants.

.6 Polyethylene: To CAN/CGSB 51.34, Type 2, minimum thickness 0.15 mm.

.7 Joint compound: To ASTM C475, asbestos-free.

Part 3 Execution

3.1 EXAMINATION

.1 Verify conditions of substrates are acceptable for installation of gypsum board assemblies in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 ERECTION

.1 Apply and finish gypsum board to ASTM C840 except where specified otherwise.

.2 Install work level to tolerance of 1:1200.

.3 Frame perimeter of openings for access panels, with furring channels.

.4 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.

.5 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.6 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

.7 Install wall furring for gypsum board wall finishes to ASTM C840, except where specified otherwise.

.8 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.9 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

.10 Erect drywall resilient furring transversely across studs, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 25 mm drywall screw.

.11 Install 150 mm continuous strip of 12.7 mm gypsum board along base of partitions where resilient furring installed.

3.3 APPLICATION

.1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, and electrical and mechanical work have been approved.

.2 Apply gypsum board to metal furring or framing using screw fasteners. Maximum spacing of screws 300 mm on centre.

.3 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.

.4 Apply water-resistant gypsum board where ceramic wall tiles are to be applied. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core, and to fastener heads. Do not apply joint treatment on areas to receive tile finish.

.5 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, and access panels, in partitions where perimeter sealed with acoustic sealant.

.6 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

.7 Install gypsum board with face side out.

.8 Do not install damaged or damp boards.

.9 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 INSTALLATION

.1 Install gypsum board in accordance with GA-214.

.2 Erect accessories straight, plumb or level, rigid, and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges.

.3 Provide continuous polyethylene dust barrier behind and across control joints.

.4 Splice corners and intersections together and secure to each member with 3 screws.

.5 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape, and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.6 Install plenum barrier to manufacturer's recommendations.

.7 Gypsum Board Finish: Finish gypsum board walls and ceilings to following levels in accordance with AWCI Levels of Gypsum Board Finish:

.1 Level 1: At plenum areas above ceiling, and other concealed areas.

.1 Embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.

.2 Level 5: All exposed areas.

.1 Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.

.8 Finish corner beads, control joints, and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.9 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.10 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.11 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.12 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.

.13 Remove ridges by light sanding or wiping with damp cloth.

3.5 CEILING INSTALLATION

.1 Install to ASTM C754 or GA-216.

.2 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840 except where specified otherwise.

.3 Install ceiling framing independent of walls, columns, and above ceiling work.

.4 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.5 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.6 Install work level, to tolerance of 1:1200.

.7 Coordinate location of hangers with other work.

.8 Reinforce openings in ceiling suspension system that interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 600 mm past each end of openings.

.9 Laterally brace entire suspension system.

.10 Locate control joints at approximate 15 m spacing on ceilings.

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.

.2 Waste Management: Remove waste materials 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 gypsum board assembly installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM A653/A653M-08, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM C645-14, Standard Specification for Non-structural Steel Framing Members.

.3 ASTM C754-15, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.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.

1.2 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 Samples:

.1 Submit duplicate 300 mm long samples of non-structural metal framing.

.4 Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.

.5 Certificates: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.3 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 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 metal framing from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Non-load bearing channel stud framing: To ASTM C645, and ASTM A653/A653M with minimum Z180 (G60) zinc coating, non-load bearing rolled steel, channel shaped, for screw attachment of gypsum board.

.1 Knock-out service holes at 460 mm centres.

.2 Depth: As scheduled on Drawings.

.3 Thickness: To meet performance requirements with minimum thickness 0.53 mm (25 gauge), or as indicated on Drawings.

.2 Floor and ceiling tracks: To ASTM C645, same material and thickness as studs, in widths to suit stud sizes, 32 mm flange height.

.3 Acoustical sealant: In accordance with Section 07 92 00 - Joint Sealants.

.4 Touch-up primer for galvanized surfaces: To CAN/CGSB 1.181.

Part 3 Execution

3.1 EXAMINATION

.1 Verify conditions of substrate are acceptable for non-structural metal framing application in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 ERECTION

.1 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.

.2 Place studs vertically at 400 mm on centre 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.

.3 Refer to Drawings for indication of partitions extending stud framing through the ceiling to the structure above or to particular heights. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners. Refer also to Details.

.1 Attach studs to bottom track using screws. Do not attach studs to ceiling track to allow for deflection of structural members when in contact.

.2 Use one of the following methods as best suited for application:

.1 50 mm or longer leg ceiling tracks.

.2 Use double track slip joint.

.3 Use two-piece telescoping top tracks where required.

.4 Erect metal studding to tolerance of 1:1000.

.5 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.6 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.7 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified.

.1 Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.

.8 Install heavy gauge single jamb studs at openings.

.9 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.

.10 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.11 Provide 40 mm stud or furring channel (heavy gauge, when necessary) secured between studs for attachment of wall supported elements, fastening fixtures attached to steel stud partitions, or install galvanized or stainless steel back plate reinforcement sheets, minimum 0.912 mm thick by minimum 100 mm wide, elsewhere where necessary and where indicated.

.12 Install steel studs of furring channel between studs for attaching electrical and other boxes.

.13 Install 19 mm deep horizontal furring channels at 600 mm o.c. on vertical studs per exterior wall types.

.14 Extend partitions to exterior wall and ceiling, as detailed, to maintain fireproofing and smoke stop, as indicated.

.15 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.

.1 Use 50 mm leg ceiling tracks.

.16 Install continuous insulating strips to isolate studs from uninsulated surfaces.

.17 Install two continuous beads of acoustical sealant or insulating strip 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: Remove 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 non-structural metal framing application.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI A108/A118/A136.1-2014, Specifications for the Installation of Ceramic Tile.

.2 ANSI A137.2:2013, American National Standard Specifications for Glass Tile.

.2 ASTM International

.1 ASTM C979/C979M-10, Standard Specification for Pigments for Integrally Colored Concrete.

.3 Terrazzo Tile and Marble Association of Canada (TTMAC)

.1 2012-2014 Specifications Guide 09 30 00 - Tile Installation Manual.

1.2 SUBMITTALS

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

.2 Product data:

.1 Include manufacturer's information on:

.1 Tile, marked to show each type, size, and shape required.

.2 Cement mortar and grout.

.3 Samples:

.1 Base tile: Submit duplicate sample tiles of each selected colour, texture, size, and pattern of tile.

.2 Grout: Submit manufacturer’s colour sample strips; if not possible submit manufacturer’s colour range on card or sheet.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

1.4 AMBIENT CONDITIONS

.1 Maintain air temperature and structural base temperature at tile installation area above 12°C for 48 hours before, during, and 48 hours after, installation.

.2 Do not install tiles at temperatures less than 12°C or above 38°C.

1.5 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide minimum 2% of each type and colour of tile required for project for maintenance use. Store where directed.

.3 Maintenance material is to be from same production run as installed material.

Part 2 Products

2.1 WALL TILE

.1 Glass tile: To ANSI A137.2.

.1 Dimensions: Nominal 100 x 400 mm.

.2 Face: Striated pattern.

.3 Colour: Grey.

2.2 BOND COAT

.1 Glass tile mortar:

.1 Thin set interior installation: Polymer modified mortar, non-sag, bright white, meeting shear bond strength requirements of ANSI A118.4.

2.3 GROUT

.1 Latex Cement Grout: To ANSI A118.6, fast curing, high early strength, polymer-modified, stain resistant, unsanded mix for use with glass tile.

.2 Colouring Pigments:

.1 Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.

.2 Colouring pigments to be added to grout by manufacturer.

.3 Job coloured grouts are not acceptable.

2.4 ACCESSORIES

.1 Edge profile: Anodized aluminum, L-shaped profile, 3.2 mm wide top section and vertical wall section, integrated perforated anchoring leg, and integrated grout joint spacer.

.1 Finish: Brushed satin chrome.

.2 Sealant: In accordance with Section 07 92 00 - Joint Sealants.

2.5 MIXES

.1 Mortar: Mix to manufacturer's instructions.

.2 Adjust water volumes to suit water content of sand.

2.6 CLEANING COMPOUNDS

.1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and levelling compounds and elastomeric waterproofing membrane and coat.

.2 Materials containing acid or caustic material are not acceptable.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 EXAMINATION

.1 Verify conditions of substrates are acceptable for installation of tile in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate.
- .2 Inform Departmental Representative of unacceptable conditions.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

3.3 WORKMANSHIP

.1 Perform tile work in accordance with TTMAC Tile Installation Manual, except where specified otherwise.

- .1 Install in accordance with TTMAC detail 305W-2012-2014/Thin Set Method – Walls.

.2 Apply tile to clean and sound surfaces.

.3 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.

.4 Maximum surface tolerance 1:800.

.5 Knock down trowel ridges and back butter glass tile to ensure ridges are not visible through installed tile.

.6 Make joints between tile uniform and approximately 1.5 mm wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.

.7 Remove excess mortar from tile joint areas so at least 2/3 of the tile depth remains for grouting.

.8 Lay out tiles so perimeter tiles are minimum one-half size.

.9 Sound tiles after setting and replace hollow-sounding units to obtain full bond.

.10 Make internal angles square.

.11 Allow minimum 24 hours after installation of tiles before grouting.

.12 Clean installed tile surfaces after installation and grouting cured.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM A641/A641M-09a (2014) – Standard Specification for Zinc-Coated/Galvanized Carbon Steel Wire.

.2 ASTM A653/A653M-08 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM C635/C635M-13a - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

.4 ASTM C636/C636M-13 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

.5 ASTM E84-14 - Standard Test Method for Surface Burning Characteristics of Building Materials.

.6 ASTM E1264-08e1 - Standard Classification for Acoustical Ceiling Products.

.7 ASTM E1414/E1414M-11ae1 - Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.

.8 ASTM E1477-98a (2013) - 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 92.1-M89 - Sound Absorptive Prefabricated Acoustical Units.

.3 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC S102-07 - Surface Burning Characteristics of Building Materials and Assemblies.

1.2 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 sheets.

.3 Samples: Submit duplicate samples to Departmental Representative for approval prior to ordering of material.

.1 Acoustical panels: 100 x 100 mm sample of each type selected.

.2 Grid materials: 300 mm length of each type selected.

.4 Extra Stock Materials:

.1 Provide extra materials of acoustic units in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide 2% of total acoustic unit area of extra full panels, to Departmental Representative, with manufacturer’s packaging and labelling.

.5 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

.6 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.3 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 minimum 5 m^2 of acoustical panel ceiling including one inside corner.

.3 Construct mock-up where directed by Departmental Representative.

.4 Allow for review of mock-up by Departmental Representative before proceeding with ceiling work.

.5 Reviewed mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of the finished work.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver acoustical ceiling units to project site in unopened manufacturer's packaging. Store in enclosed space and protect from damage.

.2 Acclimatize acoustical ceiling units at installation site as recommended by manufacturer.

.3 Store extra materials required for maintenance, where directed by Departmental Representative.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Remove waste materials in accordance with Section 01 74 21 – Construction and Demolition Waste Management and Disposal.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Permit wet work to dry before beginning to install.

.2 Maintain uniform minimum temperature of 15°C and humidity of 20% before and during installation.

.3 Store materials in work area 48 hours prior to installation.

.4 Provide extras of each exposed suspension component, amounting to 2% of amount installed.

.5 Ensure extra materials are from same production run as installed materials.

.6 Clearly identify each type of acoustic unit, including colour and texture.

.7 Deliver to Departmental Representative upon completion of the work of this section.

Part 2 Products

2.1 ACOUSTIC UNIT MATERIALS

.1 Acoustic Ceiling Tiles: To CAN/CGSB 92.1 and ASTM E1264.

- .1 Location: Refer to Room Finish Schedule.
- .2 Thickness: Minimum 22 mm (7/8 inch).
- .3 Composition: Wet formed mineral fibre.
- .4 Surface colour: White.
- .5 Surface finish: Non-directional fine fissured; latex paint.
- .6 Fire rating: Class A.
- .7 Fire performance: To CAN/ULC S102 and ASTM E84.
  - .1 Flame spread: 25 or less.
  - .2 Smoke developed: 50 or less.
- .8 Noise Reduction Coefficient (NRC): Minimum 0.75.
- .9 Ceiling Attenuation Class (CAC) rating to ASTM E1414/E1414M: Minimum 35.
- .10 Light Reflectance to ASTM E1477: 0.86.

.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.

2.2 GRID MATERIALS

.1 All Grid Materials: To ASTM A653/A653M, commercial quality cold rolled steel with hot dipped galvanized coating. Main beams and cross tees to be double web construction with exposed flange design. Exposed surfaces chemically cleaned, capped with baked polyester paint.

.2 Non-fire Rated Grid: Intermediate duty; exposed T; components die cut and interlocking.

.3 Fire Rated Grid: Intermediate duty, listed by ULC/UL for use in fire-rated assembly, exposed T; components die cut and interlocking.

.4 Exposed Grid Surface Width: 14.3 mm (9/16 inch) face dimension, with bolt slot and 6 mm (1/4 inch) reveal.

.5 Grid Finish Colour: White.

2.3 ACCESSORIES

.1 Adhesives and mounting accessories as recommended by manufacturer.

.2 Attachment devices: Size for five times design load indicated in ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated.

.3 Wire for hangers and ties: To ASTM A641/A641M, Class 1 zinc coating, soft annealed, with yield stress load at least 3 times design load, but not less than 12 gauge.

.4 Touch-Up Paint: Type and colour to match acoustic and grid units.

Part 3 Execution

3.1 EXAMINATION

.1 Do not install acoustical panels and tiles until work above ceiling has been inspected by Departmental Representative.

.2 Do not proceed with installation until wet work such as concrete and painting has been completed and thoroughly dried.

3.2 PREPARATION

.1 Lay out system to balanced grid design or as indicated on reflected ceiling plans, with edge units at least 50% of acoustic unit size.

.2 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components. Verify layout of hangers will not interfere with other work.

3.3 INSTALLATION – SUSPENSION SYSTEM

.1 Install after major above-ceiling work is complete.

.2 Install suspension system to ASTM C636/C636M, and as supplemented in this section.

.3 Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

.4 Install system capable of supporting imposed loads to deflection of 1/360 maximum.

.5 Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers and related carrying channels to span extra distance.

.6 Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 150 mm of each corner; or support components independently.

.7 Do not eccentrically load system, nor produce rotation of runners.

.8 Perimeter Moulding:

.1 Install edge moulding at intersection of ceiling and vertical surfaces.

.2 Use longest practical lengths.

.3 Mitre corners.

.4 Provide at junctions with other interruptions.

3.4 INSTALLATION - ACOUSTIC UNITS

.1 Install acoustic units to manufacturer's instructions.

.2 Install units after above ceiling work is complete.

.3 Fit acoustic units in place, without damaged edges or other defects detrimental to appearance and function.

.4 Install acoustic units level, in uniform plane, and without twist, warp, and dents.

.5 Scribe and cut acoustic units to fit adjacent work. Butt joints tight, and terminate edges with moulding.

.6 In fire rated ceiling systems, secure lay-in panels with hold-down clips and protect over light fixtures, diffusers, air return grilles and other appurtenances according to Certification Organizations' design requirements.

.7 Double cut and field paint exposed edges of tegular units.

.8 Where round obstructions occur, provide preformed closures to match perimeter moulding.

3.5 ERECTION TOLERANCES

.1 Maximum Variation from Flat and Level Surface: 3 mm in 3000 mm.

.2 Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2°.

.3 Install acoustical units as shown on reflected ceiling plan.

3.6 ADJUSTING AND CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.2 Progress Cleaning: Leave Work area clean at end of each day.

.3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools and equipment.

.4 Replace damaged and broken panels.

.5 Clean exposed surfaces of acoustical ceilings, including trim, edge mouldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace ceiling products that cannot be successfully cleaned or repaired.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM D2047-11, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.

.2 ASTM E1155-14/E1155M, Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers.

.3 ASTM F150-06 (2013), Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring.

.4 ASTM F970-07 (2011), Standard Test Method for Static Load Limit.

.5 ASTM F1700-13a, Standard Specification for Solid Vinyl Floor Tile.

.6 ASTM F1861-08 (2012)e1 – Standard Specification for Resilient Wall Base.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.2 SUBMITTALS

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

.2 Product data: Manufacturer's printed product literature, specifications, and data sheets.

.3 Samples:

.1 Submit duplicate tile samples in full size.

.2 Submit 300 mm long samples of base and transition strips.

.4 Closeout Submittals:

.1 Provide maintenance data for resilient flooring for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 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: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.4 AMBIENT CONDITIONS

.1 Maintain air temperature and structural base temperature at flooring installation area above 20°C for 48 hours before, during, and 48 hours after installation.

1.5 MAINTENANCE

.1 Extra Materials:

.1 Provide extra materials of resilient flooring and adhesives in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide 10 m^2 of each colour, pattern, and type of flooring material required for project for maintenance use.

.3 Extra materials to be from same production run as installed materials.

.4 Identify each box or roll of flooring and each container of adhesive.

.5 Deliver to Departmental Representative, upon completion of the work of this section.

.6 Store where directed by Departmental Representative.

Part 2 Products

2.1 MATERIALS

.1 Vinyl resilient flooring: To ASTM F1700, Class III printed vinyl plank.

.1 Backing: Commercial grade.

.2 Wear layer thickness: Minimum 0.5 mm.

.3 Total thickness: Minimum 2.5 mm.

.4 Static load limit to ASTM F970: Minimum 52 kg/cm^3 (750 psi).

.5 Slip resistance to ASTM D2047: Accessibility compliant.

.6 Finish: Quartz enhanced polyurethane.

.7 Pattern: Striated.

.8 Colour: Grey and white, as selected by Departmental Representative.

.2 Static dissipative vinyl tile: To ASTM F150, and ASTM F1700 or ASTM F1066 Class 2, vinyl composition tile.

.1 Wear layer thickness: Minimum 3.2 mm.

.2 Total thickness: Minimum 3.2 mm.

.3 Slip resistance to ASTM D2047: Accessibility compliant.

.4 Accessories:

.1 Copper grounding strips, as recommended by tile manufacturer.

.2 Adhesive: Conductive, as recommended by tile manufacturer.

.5 Colour and pattern: As selected by Departmental Representative.

.3 Resilient base: To ASTM F1861, continuous, top set, complete with premoulded end stops and external corners.

.1 Type: Rubber.

.2 Style:

.1 Straight for carpeted areas.

.2 Coved for sheet vinyl areas.

.3 Thickness: 3 mm.

.4 Height: 100 mm.

.5 Lengths: Cut lengths minimum 2400 mm.

.6 Colour: As selected by Departmental Representative.

.4 Transition strips: Finishing and edge-protection profiles; purpose made aluminum extrusions, satin finish.

.5 Primers and adhesives: Types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.

.6 Sub-floor filler and leveller: Self-levelling cementitious compound capable of bonding to properly prepared substrate surfaces.

.1 Compressive strength: Minimum 36.5 MPa (5300 psi) at 28 days.

.2 Capable of being walked on without damage after 3 hours.

.3 Capable of being coated after 24 hours at 21°C.

.7 Edging to floor penetrations: Aluminum, type recommended by flooring manufacturer.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 EXAMINATION

.1 Verify conditions of substrates are acceptable for product installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

.2 Ensure concrete floors are clean and dry, using test methods recommended by flooring manufacturer.

.3 Perform pH tests on concrete floor regardless of age of concrete. Document and retain test results.

.4 Confirm flatness of substrate by measurements taken in accordance with ASTM E1155/E1155M.

.1 Composite flatness (F_F): Minimum 36.

.2 Composite levelness (F_L): Minimum 20.

3.3 PREPARATION

.1 Remove existing resilient flooring.

.2 Remove or treat old adhesives to prevent residual, old flooring adhesives from bleeding through to new flooring and/or interfering with the bonding of new adhesives.

.3 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

.4 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.5 Prime concrete substrate 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 to 72 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 month following building occupation.

.2 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.3 For static dissipative resilient flooring, install copper grounding strips under flooring, to flooring manufacturer’s installation directions.

.4 Lay flooring with border widths minimum 1/3 width of full material.

.5 As installation progresses, and after installation, roll flooring with 45 kg minimum roller to ensure full adhesion.

.6 Cut flooring around fixed objects.

.7 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.

.8 Install aluminum 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 pre-moulded end pieces at flush door frames.

.7 Cope internal corners. Use pre-moulded corner units for right angle external corners. Use formed straight base material for external corners of other angles.

.8 Use toeless type base where floor finish will be carpet, coved type elsewhere.

.9 Install toeless type base before installation of carpet on floors.

3.6 CLEANING

.1 Perform cleaning in accordance with Section 01 74 11 - Cleaning.

.2 Remove excess adhesive from floor, base, and wall surfaces without damage.

.3 Clean floor and base surface to manufacturer's printed instructions.

3.7 PROTECTION

.1 Protect new floors from time of final set of adhesive until final inspection.

.2 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Carpet and Rug Institute (CRI)

.1 CRI Carpet Installation Standard 2011.

.2 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting 1 week prior to beginning work of this Section, with Departmental Representative 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-trades.

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturers' printed product literature and data sheets for each carpet tile, adhesive, and subfloor patching compound. Include product characteristics, performance criteria, physical size, finish, and product limitations.

.2 Submit 2 copies of WHMIS MSDS for each product to be used.

.3 Shop Drawings:

.1 Information on shop drawings to indicate:

.1 Nap: Direction, open edges, special patterns.

.2 Cut-outs: Show locations where cut-outs are required.

.3 Edgings: Show location of edge mouldings and edge bindings.

.4 Samples:

.1 Submit duplicate samples of carpet tile specified, in selected colour and pattern.

.5 Certificates: 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: Manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: Submit maintenance data for installed products for incorporation into manual.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra stock materials in accordance with Section 01 78 00 – Closeout Submittals, deliver to Departmental Representative extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels.

.1 Provide minimum extra 3% of carpet tile installed.

.2 Provide maintenance material from same dye lot and run as installed material.

.3 Delivery, storage, and protection: Comply with Departmental Representative's requirements for delivery and storage of extra materials.

1.6 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 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 materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

.3 Store and protect carpet tile and adhesive in original containers or wrapping with manufacturer's seals and labels intact.

.4 Store and protect carpet tile and accessories in location as directed by Departmental Representative.

.5 Store carpet and adhesive at minimum temperature of 18°C and relative humidity of maximum 65% for minimum of 48 hours before installation.

.6 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness.

.7 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.8 Replace defective or damaged materials with new.

1.7 SITE CONDITIONS

.1 Ambient Conditions:

.1 Moisture: Ensure substrate is within moisture limits and alkalinity limits recommended by manufacturer. Prepare testing and provide report to Departmental Representative.

.2 Temperature: Maintain ambient temperature of not less than 18°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, and work above ceilings is complete.

Part 2 Products

2.1 CARPET TILES

.1 Size: 610 x 610 mm.

.2 Installation pattern: Ashlar.

.3 Pile Surface Appearance: Multi-level pattern loop.

.4 Pile fibre: Nylon 6.

.5 Dye method: 100% solution dyed.

.6 Colour and pattern: As selected by Departmental Representative.

.1 Multi-tonal greys and greens with orange accents, striped directional pattern.

.7 Backing: Polyolefin composite.

.8 Pile weight: 542 g/m^2.

.9 Machine gauge: 47.2 rows/10 cm.

.10 Density: Average 11.66 kilotex/cm^2.

.11 Stitch count: 35.43 stitches/10 cm.

.12 Pile height: 2.3 mm.

.13 Total thickness: 5.8 mm.

.14 Stain resistance: Minimum 8.0 to AATCC 175.

.15 Fibre shape: Maximum modification ratio 2.5 for soil release capability for high traffic area carpet.

.16 Appearance retention rating: Minimum 3.0 at 12,000 cycles to Hexapod test to ASTM D5252 or 22,000 cycles to Vetterman test to ASTM D5417.

.17 Dimensional Stability: maximum + 0.12% to CAN/CGSB 4.2 No. 76/ISO 2551.

.18 Static control: Maximum 3.5 kV to AATCC 134.

.19 Air quality: To CCI/CRI Green Label Plus requirements.

.20 Anti-microbial resistance: Permanent treatment to prevent growth of bacteria and fungi.

2.2 ACCESSORIES

.1 Pressure sensitive adhesive tabs: Recommended by carpet tile manufacturer for direct tape down installation of carpet tiles.

.2 Carpet edge/reducer strip: Extruded aluminum, anodized satin finish, profile height appropriate to ensure smooth transition to adjoining floor surface.

.3 Sub-floor filler and leveller: Self-levelling cementitious compound capable of bonding to properly prepared substrate surfaces.

.1 Compressive strength: Minimum 36.5 MPa (5300 psi) at 28 days.

.2 Capable of being walked on without damage after 3 hours.

.3 Capable of being coated after 24 hours at 21°C.

Part 3 Execution

3.1 EXAMINATION

.1 Examine conditions, substrates and work to receive work of this Section.

.2 Verify conditions of substrates are acceptable for carpet tile installation in accordance with manufacturer's written instructions.

.1 Inform Departmental Representative of unacceptable conditions.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Subfloor Preparation:

.1 Inspect concrete and determine special care required to make it a suitable for carpet.

.2 Fill and level cracks 3 mm wide or protrusions over 0.8 mm with appropriate and compatible patching compound.

.3 Comply with manufacturer's written recommendations for maximum patch thickness.

.4 Prime large patch areas with compatible primer.

.5 Ensure concrete substrates are cured, clean, and dry.

.6 Ensure concrete substrates are free of paint, dirt, grease, oil, curing or parting agents, and other contaminants, including sealers, which could interfere with bonding of adhesive.

.7 Where powdery or porous concrete surface is encountered, apply primer compatible with adhesive to provide a suitable surface for glue-down installation.

.2 Surface Preparation: Prepare surface in accordance with manufacturer's written recommendations and co-ordinate with Section 01 70 00 - Examination and Preparation.

.1 Prepare floor surfaces in accordance with CRI Carpet Installation Standard.

3.3 INSTALLATION

.1 Install carpet tiles in accordance with manufacturer's written instructions, and CRI 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 Snugly join carpet tiles in completed installation.

.1 Do not trap yarn between carpet tiles.

.4 Apply pressure-sensitive adhesive tabs according to manufacturer's recommendations.

.5 Ensure finished installation presents smooth wearing surface free from conspicuous seams, burring, and other faults.

.6 Use material from same dye lot.

.1 Ensure colour, pattern, and texture match within visual areas.

.2 Maintain constant pile direction.

.7 Fit around architectural, mechanical, electrical and telephone outlets, furniture fitments, around perimeter of rooms into recesses, and around projections.

.8 Extend carpet tiles into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

.9 Install carpet tiles smooth and free from bubbles, puckers, and other defects.

.10 Protect exposed carpet tile edges at transition to other flooring materials with suitable transition strips.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.2 Progress Cleaning: Leave Work area clean at end of each day.

.3 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.

.4 Waste Management: Remove waste materials for 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 Install carpet protection to satisfaction of Departmental Representative.

.3 Repair damage to adjacent materials caused by tile carpeting installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specification Manual, 2014.

.3 National Fire Code of Canada – 2010.

.4 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.2 QUALITY ASSURANCE

.1 Pre-Installation Meeting:

.1 Convene pre-installation meeting one week prior to beginning work of this Section in accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Chart.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Coordination with other building sub-trades.

.4 Review installation instructions and warranty requirements.

1.3 SCHEDULING

.1 Submit work schedule for various stages of painting to Departmental Representative for review. Submit schedule minimum 48 hours in advance of proposed operations.

.2 Obtain written authorization from Departmental Representative for changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants.

1.4 SUBMITTALS

.1 Submit 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 Samples:

.1 Submit duplicate 200 x 200 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:

.1 1.6 mm sheet steel for finishes over metal surfaces.

.2 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.

.2 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.3 Test reports: Submit certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.4 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturer's Instructions:

.1 Submit manufacturer's application instructions.

.6 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.

1.5 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 - 4 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 Departmental Representative requirements for delivery and storage of extra materials.

1.6 DELIVERY, STORAGE AND HANDLING

.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°C to 30°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 Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Place materials defined as hazardous or toxic in designated containers.

.3 Handle and dispose of hazardous materials in accordance with TDGA, Regional and Municipal, regulations.

.4 Ensure emptied containers are sealed and stored safely.

.5 Dispose of unused paint materials at official hazardous material collections site as approved by Departmental Representative.

.6 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.

.7 Material that cannot be reused is to be treated as hazardous waste and disposed of in an appropriate manner.

.8 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.9 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 Ensure empty paint cans are dry prior to disposal or recycling (where available).

.10 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

1.7 SITE CONDITIONS

.1 Heating, Ventilation, and Lighting:

.1 Ventilate enclosed spaces.

.2 Provide heating facilities to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Provide continuous ventilation for seven days after completion of application of paint.

.4 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.

.5 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.

.6 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 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°C.

.2 Substrate temperature is above 32°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 Relative humidity is under 85% or when the dew point is more than 3 degrees Celsius variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees Celsius below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.

.5 Rain or snow is forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining, or snowing at site.

.6 Ensure 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 15% for wood.

.2 12% for plaster and gypsum board.

.3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "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.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 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 Departmental Representative 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 the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Provide paint materials for paint systems from single manufacturer for each system used.

.3 Use materials that are lead and mercury free, and that have low VOC content, where possible.

.4 Use paint materials with good flowing and brushing properties, and that dry or cure free of blemishes, streaks, sags, or air entrapment. Refer to Field Quality Control/Standard of Acceptance requirements.

.5 Where required, paints and coatings to meet ‘flame spread’ and ‘smoke developed’ ratings designated by local Code requirements and authorities having jurisdiction.

.6 Conform to latest MPI requirements for interior painting work including preparation and priming.

.7 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) are to be in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

.8 Linseed oil, shellac, and turpentine: Highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, and compatible with other coating materials as required.

.9 Provide paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA Method 24) content levels.

.10 Use MPI listed materials having minimum E2 rating where indoor air quality (odour) requirements exist.

.11 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:

.1 Water-based.

.2 Non-flammable.

.3 Manufactured without compounds that contribute to ozone depletion in the upper atmosphere.

.4 Manufactured without compounds that contribute to smog in the lower atmosphere.

.5 Do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.

.12 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

.13 Flash point: 61.0°C or greater for water-borne surface coatings and recycled water-borne surface coatings.

.14 Ensure manufacture and process of both water-borne surface coatings and recycled 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.

2.2 COLOURS

.1 Colour schedule will be based upon selection of three base colours and five accent colours. No more than eight colours will be selected for entire project and no more than three colours will be selected in each area.

.2 Refer to Section 09 00 10 – Room Finish and Materials Schedules.

.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 approval from Departmental Representative 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 2 - Velvet-Like Finish	Max.10	10 to 35
Gloss Level 3 - Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 - Satin-Like Finish	20 to 35	min. 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 Galvanized metal: Door frames, railings, fire extinguisher cabinet, miscellaneous steel.

.1 INT 5.3N – G5 – Institutional low odour/low VOC.

.2 Dressed lumber: Doors, chair railing:

.1 INT 6.3Q – Waterborne varnish, G4 finish.

.3 Gypsum wallboard and textured finishes:

.1 INT 9.2B - High performance architectural latex.

.1 Walls: G4 finish.

.2 Ceilings: G1 finish.

2.6 INTERIOR REPAINTING

.1 Steel – High Heat: Radiators.

.1 RIN 5.2A – G5 – Heat resistant enamel, maximum 205°C.

.2 Galvanized Metal: High contact/high traffic areas (doors, frames).

.1 RIN 5.3K – G5 – institutional low odour/low VOC.

.3 Gypsum wallboard and textured finishes:

.1 RIN 9.2B – High performance architectural latex.

.1 Walls: G4 finish.

.2 Ceilings: G1 finish.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 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 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 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.

.3 Maximum moisture content as follows:

.1 Gypsum board: 12%.

.2 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 Departmental Representative.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect building occupants and general public in and about the building.

.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. Signs to approval of Departmental Representative.

.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, or wiping with dry, clean cloths.

.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 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 pre-treatment as soon as possible after cleaning and before deterioration occurs.

.5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap, and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.6 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.

.7 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 vacuum cleaning.

.8 Touch up of shop primers with primer as specified.

.9 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

3.5 APPLICATION

.1 Method of application to be as approved by Departmental Representative. Apply paint by brush, roller, or sprayer. 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 that 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.

.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 closets and alcoves as specified for adjoining rooms.

.10 Finish top, bottom, edges and cut-outs of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.2 Do not paint over nameplates.

.3 Keep sprinkler heads free of paint.

3.7 SITE TOLERANCES

.1 Walls: No defects visible from a distance of 1000 mm at 90° to surface.

.2 Ceilings: No defects visible from floor at 45° 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 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 Departmental Representative. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing, and handling of paint to clean condition as approved by Departmental Representative.

END OF SECTION

Part 1 General

1.1 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 marker boards. Include product characteristics, performance criteria, physical size, finish, and limitations.

1.2 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Surface burning characteristics of materials: Listed and labelled by an organization accredited by Standards Council of Canada.

1.3 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 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 from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Marker Board Surface Materials (WB)

.1 Writing Surface Face Sheet: Dry erase surface.

.2 Core: Lightweight polystyrene foam.

.3 Board thickness: 4.7 mm (3/16 inch).

.4 Colour: White, low gloss.

.1 Mount whiteboards on aluminum angle hangers with concealed fasteners.

.5 Mounting channel: Extruded aluminum, 6063-T5 alloy, ‘h’ shaped profile, anodized satin finish. Attach with stainless steel screws. Provide channel of width to give firm retention of marker board when installed.

.6 Location: As indicated on the Drawings.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that conditions of substrate are acceptable for installation in accordance with manufacturer's written instructions. Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Confirm location and height with Departmental Representative prior to installation unless indicated on Drawings.

.2 Secure units level and plumb.

.3 Use heavy duty fasteners to provide secure attachment.

.4 Marker Boards:

.1 Butt panels tight with concealed spline to hairline joint.

.5 Mechanical Attachment:

.1 To concrete or solid masonry use lag screw and expansion bolts or screws and lead plugs as appropriate for loads and stresses involved.

.2 To hollow masonry use toggle bolts or equivalent.

.3 To steel studs or metal furring use metal screws. Secure framing members in stud walls.

3.3 CLEANING

.1 Clean 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.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM A276/A276M-15, Standard Specification for Stainless Steel Bars and Shapes.

.2 ASTM A314-15, Standard Specification for Stainless Steel Billets and Bars for Forging.

.3 ASTM A582/A582M-12e1, Standard Specification for Free-Machining Stainless Steel Bars.

.4 ASTM B221-14/B221M-13, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

.5 ASTM B247/B247M-09, Standard Specification for Aluminum and Aluminum Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings.

.6 ASTM E90-04, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.7 ASTM E336-05, Standard Test Method for Measurement of Airborne Sound Insulation in Buildings.

.2 Underwriters Laboratories' of Canada (ULC)

.1 CAN/ULC S102-07, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 DESIGN REQUIREMENTS

.1 Provide doors that, when fully extended and latched, completely close off opening in which installed.

.2 Design system to withstand door operation under normal traffic without damage, racking, sagging, or deflection.

.3 Design and fabricate glazed partitions with minimum STC of 40 tested to ASTM E90.

1.3 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 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

.1 Indicate installation requirements including dimensions, head and jamb conditions, track layout, stacking arrangement, switching, hardware, finish and colour, operating mechanism, and location.

.4 Samples:

.1 Submit duplicate 200 x 200 mm samples of partition finish for each colour selected.

.5 Quality assurance/control submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Submit test data indicating compliance with design requirements regarding sound transmission and fire hazard classification.

.2 Submit acoustical test data to ASTM E90 and ensure construction details and weight are provided.

.3 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Manufacturer's Instructions: submit manufacturer's installation instructions. Indicate special handling criteria, installation sequence, and cleaning procedures.

.5 Manufacturer's Field Reports: Manufacturer's field reports specified.

.6 Closeout Submittals:

.1 Provide operation and maintenance data for folding panel partitions for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 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 Upon completion of Work, after cleaning is carried out.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Glazed partition system: Factory fabricated assembly consisting of frameless glass panels fastened with top and bottom rails.

2.2 COMPONENTS

.1 Overhead suspension system:

.1 Track: Tempered anodized aluminum channel housing designed to support partitions; track joints reinforced with stainless steel junction plates.

.2 Trolley:

.1 Bearings: High carbon chromium stainless steel body to ASTM A276 or ASTM A314.

.2 Rollers: Austenitic stainless steel to ASTM A582, type 303.

.3 Body: To ASTM B247, forged aluminum.

.2 Glass panel rails: Sufficient to structurally support glazing and doors under specified loads.

.1 Extruded aluminum to ASTM B221, 6063-T6 alloy, with end caps, slide block, end brackets, keyed cylinder thumb turn lock.

.2 Setting blocks: Aluminum and neoprene, size as recommended by manufacturer.

.3 Gaskets: EPDM as recommended by manufacturer.

.3 Hardware:

.1 Equip partition with manufacturer's standard hardware. Hardware finish selected from manufacturer's standard finishes.

.4 Sound seals:

.1 Provide sound seals at floor, ceiling, jambs, and abutting edges.

.2 Use manufacturer's standard astragal inserts for jamb and panel joint seal.

2.3 ACCESSORIES

.1 Provide manufacturer's standard stack jamb closure panel.

.2 Provide pass door with keyed latch.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Secure and level track to structural steel supports.

.2 Install folding glazed panel partitions in accordance with manufacturer's printed instructions.

.3 Touch up damaged finishes, repair damage to partitions to match original finish.

.4 Clean partition system and protect from damage.

.5 Adjust and leave partitions in smooth operating condition.

3.3 FIELD QUALITY CONTROL

.1 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.

3.4 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.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM E90-04 - Airborne-Sound Transmission Loss of Building Partitions and Elements.

.2 ASTM E413-04 - Classification for Rating Sound Insulation.

.3 ASTM E557-00(2006) - Standard Guide for the Installation of Operable Partitions.

.4 CAN/CSA-C22.2 No. 100-04 - Motors and Generators.

.5 CAN/ULC S102-07 - Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.6 NEMA LD3-2005 - High - Pressure Decorative Laminates.

.7 NEMA MG 1-2006 - Motors and Generators.

1.2 PERFORMANCE REQUIREMENTS

.1 Sound Transmission Coefficient (STC): 53-57 when measured in accordance with ASTM E90, for completely functioning operable wall.

.2 Install partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

.3 Operation: Vertical raised opening; continuous hinged panels.

.4 Design operable partition wall to have design life of at least 10,000 complete closed-to-open-to-closed cycles.

1.3 SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data on partition operation, hardware and accessories, electric operating components, track switching components, colours and finishes available.

.3 Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, adjacent construction and finish trim, and stacking sizes.

.4 Samples:

.1 Submit two (2) samples of each surface finish, 200 x 200 mm size, illustrating quality, colours selected, and texture.

.5 Installation Data: Manufacturer's special installation requirements including special procedures, perimeter conditions requiring special attention, and installation sequence.

1.4 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Operation and Maintenance Data:

.1 Include recommended cleaning methods, cleaning materials, and stain removal methods.

.2 Describe cleaning materials detrimental to surfaces and hardware finish.

Part 2 Products

2.1 PARTITIONS

.1 Automatic vertically retractable acoustic wall.

.1 Closed position: Hard, rigid, flat, plumb; two vertical planes of panels separated by acoustical air space.

.2 Open position: Accordion stacking operation, self storing within ceiling.

2.2 COMPONENTS

.1 Panel Construction:

.1 Panel Substrate Facing: Steel sheet, architecturally flat with no bowing, oil canning, warping, or waviness.

.2 Core: Acoustic construction utilizing manufacturer's standard fabrication methods.

.3 Panel to Panel Seals: Continuous flexible seal fitted to panel edge construction.

.2 Folding mechanism:

.1 Primarily constructed of structural grade aluminum.

.2 Hangers: Steel, welded or bolted to supporting structure.

.3 Ropes: Wire cable for each set of folding mechanisms, 6 x 31 galvanized steel aircraft cable, wrapped on yoyo drums with 2 safety wraps and multiple layers of cable.

.3 Carriers: Ball bearing, steel wheels on trolley carrier, sized to carry imposed loads, with capability for vertical adjustment.

.4 Acoustic Seals: Flexible acoustic seals at jambs, ceilings, floor, and above track to structure acoustic seal.

.5 Pocket Enclosures: Door, frame, and trim to match adjacent walls.

.6 Sensor edge: Installed to full length of bottom edge of wall, pressure sensing strip; designed to cut power to motor drive and to activate electromagnetic brake if activated.

.7 Acoustic Sealant: Specified in Section 07 92 00.

2.3 ELECTRICAL CHARACTERISTICS AND COMPONENTS

.1 Motor: Sized to deliver sufficient torque to safely raise and lower the operable wall.

.2 Control box: NEMA 1.

.3 Brake: Electromagnetic type, activates firmly when power to system is lost; minimum retarding torque rating equal to 200% of motor drive full load torque.

2.4 PANEL FINISHES

.1 Wood Veneer Finish: Birch species, AA grade face veneer, contact adhesive laminated to panel substrate.

.2 Whiteboard finish: HPDL laminate for use as marking surface, white colour.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify attachment substrate and site conditions.

.3 Verify that field measurements are as indicated on shop drawings.

.4 Verify track supports are laterally braced and will permit track to be level within 6 mm of required position and parallel to the floor surface.

.5 Verify floor flatness of 3 mm per 300 mm, non-cumulative.

3.2 PREPARATION

.1 Verify that required utilities are available, of the correct characteristics, in proper location, and ready for use.

3.3 INSTALLATION

.1 Install partitions to manufacturer instructions.

.2 Install electric operator, wiring, and controls. Locate control station(s) as indicated.

.3 Fit and align partition assembly level and plumb.

.4 Lubricate moving components.

.5 Apply acoustic sealant to achieve required acoustic performance.

3.4 ADJUSTING

.1 Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.

.2 Visually inspect partition in fully extended position for light leaks to identify a potential acoustical leak.

.3 Adjust to achieve light tight seal.

3.5 CLEANING

.1 Section 01 74 11: Cleaning installed work.

.2 Clean finish surfaces and partition accessories.

3.6 CLOSEOUT ACTIVITIES

.1 Demonstration: Demonstrate operation of partition, identify potential operational problems.

END OF SECTION

Part 1 General

1.1 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 wall and corner guards and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Installation Drawings: Indicate large scale details, materials, finishes, dimensions, anchorage and assembly.

.4 Samples: Submit duplicate 300 mm long samples of profiles for wall and corner guards.

1.2 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 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 corner guards from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Corner guards: Minimum 1.5 mm thick, 51 mm leg size, type 304 stainless steel satin finish, radiused profile, adhesive attached.

.2 End wall protectors: 1.5 mm thick, type 304 stainless steel, satin finish, radiused profile, mechanically attached.

2.2 ACCESSORIES

.1 Adhesive: Water resistant type as recommended by manufacturer for substrate.

.2 Fasteners: Self-tapping stainless steel.

Part 3 Execution

3.1 EXAMINATION

.1 Verify conditions of substrate are acceptable for wall and corner guard installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 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 units on solid backing and erect with materials and components straight, tight, and in alignment.

.2 Surface mount corner guards to substrate with adhesive.

.3 Attach end wall protectors to substrate with stainless steel screws.

.4 Install to heights as shown in Drawings.

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 after installation to remove construction and accumulated environmental dirt.

.3 Clean surfaces after installation using manufacturer's written recommended cleaning procedures.

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

.5 Waste Management: Remove 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 wall and corner guard installation.

END OF SECTION

Part 1 General

1.1 PERFORMANCE REQUIREMENTS

.1 Installed roller shade systems to be free from sagging, rippling, curling, cupping, twisting, and telescoping.

.2 Window coverings required to be consistent with existing building standards. Confirm product details and selections with Departmental Representative before beginning fabrication.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature and data sheets for roller shades. Include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

.1 Indicate dimensions in relation to window jambs, operator details, top rail, conditions between adjacent blinds, corner conditions, head anchorage details, hardware and accessories details.

.4 Samples:

.1 Submit duplicate samples of manufacturer's standard colours and textures for confirmation by Departmental Representative.

.1 Submit fascia samples, minimum 150 mm long.

.2 Submit samples of shade and blackout fabrics, minimum size 150 x 150 mm.

1.3 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 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, in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect roller shades from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS AND FABRICATION

.1 Heavy-duty manual chain-operated horizontal roller shade systems.

- .1 Roller tube: Extruded aluminum with internal ribs, alloy 6063-T5 or 6063-T6, diameter sufficient to bear weight of shade fabric without deflection.
  - .1 Idler end cap: Spring loaded for ease of roller removal.
- .2 Brackets: Nickel plated cold rolled steel, for single or double roller tube installations as required.
  - .1 Mounting: Ceiling or wall, confirm on site with Departmental Representative.
- .3 Bottom bar: External mount, round.
- .4 Fascia: Extruded aluminum, finish as selected by Departmental Representative from manufacturer's standard range.
- .5 Operating chain: #10 nickel plated steel or stainless steel bead chain.
- .6 Sizes: As determined by field measurement.
- .7 Standard of acceptance:
  - .1 Light Harvesting Shading Solutions Inc.
  - .2 Urban Edge Shading.
  - .3 Contempra Textrol 2000.
  - .4 Alternate products of equal performance characteristics may be proposed for review and consideration.

.2 Fabrics:

- .1 Blackout fabric: Polyester with foam coating, openness factor 0%. Colour as selected by Departmental Representative from manufacturer's standard range.
  - .1 Standard of acceptance:
    - .1 Mermet Avila.
    - .2 Alternate products of equal performance characteristics may be proposed for review and consideration.
- .2 Sunshade fabric: PVC coated fibreglass, openness factor 1%. Colour as selected by Departmental Representative from manufacturer's standard range.
  - .1 Standard of acceptance:
    - .1 Mermet E Screen.
    - .2 Alternate products of equal performance characteristics may be proposed for review and consideration.

Part 3 Execution

3.1 EXAMINATION

.1 Verify conditions of substrates and surfaces to receive roller shades are acceptable for product installation in accordance with manufacturer's instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Install roller shades in accordance with manufacturer's instructions.

.2 Install roller shades level and true.

.3 Use non-corrosive metal fasteners for installation, concealed in final assembly.

3.3 ADJUSTING

.1 Adjust shade components for correct function and operation in accordance with manufacturer's written instructions.

.2 Adjust to provide for quiet operation without binding.

.3 Adjust shade and shade cloth to hang flat without waves, folds, or distortion.

.4 Lubricate moving parts to operate smoothly and fit accurately.

3.4 TOLERANCES

.1 Maximum variation of gap at window opening perimeter: 6 mm per 2.4 m of shade height.

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 Clean exposed surfaces and edges/ends, including metal and shadecloth, using non-abrasive materials and methods recommended by manufacturer. Remove and replace work that cannot be satisfactorily cleaned.

.4 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by roller shade installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 21 13 13 – Wet Pipe Sprinkler Systems.

1.2 SUBMITTALS

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

.2 Shop drawings; submit drawings stamped and signed by professional Engineer registered or licensed in Province of Manitoba, Canada.

.3 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.4 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify current model production.
- .5 Certification of compliance to applicable codes.

.5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.6 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual approved by, and final copies deposited with Departmental Representative before final inspection.
- .3 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.6 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.

.2 Make changes as required and re-submit as directed by Departmental Representative.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.8 Site records:

.1 Maintain neat record of changes on a set of prints during construction.

.2 Submit to Departmental Representative minimum five (5) working days before Substantial Completion.

.3 Contractor shall certify and check the accuracy of each drawing.

.4 Record additional changes and submit final record drawings at Total Performance.

.9 As-Built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for Sprinkler System, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Departmental Representative for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for Sprinkler System using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 Spare sprinklers and tools in accordance with NFPA 13.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Waste Management and Disposal:

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

Part 2 Products

2.1 MATERIALS

.1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

.2 Do verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

Part 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23 - Interior Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

.1 Testing to be witness by Authority Having Jurisdiction.

.2 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.

3.4 DEMONSTRATION

.1 Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Departmental Representative will record these demonstrations on video tape for future reference.

3.5 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 National Fire Prevention Association (NFPA)

.1 NFPA 13, Standard for the Installation of Sprinkler Systems, latest edition.

.2 NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide 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 and signed by professional engineer registered or licensed in the Province where work is taking place.

.2 Indicate:

.1 Materials.

.2 Finishes.

.3 Method of anchorage

.4 Number of anchors.

.5 Supports.

.6 Reinforcement.

.7 Assembly details.

.8 Accessories.

.4 Samples:

.1 Submit samples of following:

.1 Each type of sprinkler head.

.2 Signs.

.5 Test reports:

.1 Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.6 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.7 Manufacturers' Instructions:

.1 Provide manufacturer's installation instructions.

.8 Field Quality Control Submittals:

.1 Manufacturer's Field Reports: manufacturer's field reports specified.

1.3 CLOSEOUT SUBMITTALS

.1 Provide operation, maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals in accordance with ANSI/NFPA 20.

.2 Manufacturer's Catalog Data, including specific model, type, and size for: Pipe and fittings.

.1 Valves, including gate, check, and globe.

.2 Sprinkler heads.

.3 Pipe hangers and supports.

.4 Mechanical couplings.

.3 Drawings:

.1 Sprinkler heads and piping system layout.

.1 Prepare 760 mm by 1050 mm detail working drawings of system layout in accordance with NFPA 13, "Working Drawings".

.2 Show data essential for proper installation of each system.

.3 Show details, plan view, elevations, and sections of systems supply and piping.

.4 Show piping schematic of systems supply, devices, valves, pipe, and fittings.

.4 Design Data:

.1 Calculations of sprinkler system design.

.2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months.

.5 Field Test Reports: Preliminary tests on piping system.

.6 Records:

.1 As-built drawings of each system.

.1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.

.2 Submit 760 mm by 1050 mm drawings on reproducible Mylar film with title block similar to full size contract drawings.

.7 Operation and Maintenance Manuals:

.1 Provide hydraulic calculations including summary sheet, and Contractors Material and Test Certificate for aboveground piping and other documentation for incorporation into manual in accordance with NFPA 13.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company or person specializing in wet sprinkler systems with documented experience.

.2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide spare sprinklers and tools in accordance with NFPA 13.

1.6 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:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Storage and Protection:

.1 Store materials indoors in dry location.

.2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 A professional Engineer licensed to practice in Manitoba is required to perform and seal the design.

.2 Design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13 latest edition, by pipe schedules for light hazard occupancy or hydraulic calculations for uniform distribution of water over design area.

.3 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.

.4 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings. Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.

.5 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.

.6 Location of Sprinkler Heads:

.1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 for light hazard occupancy 20.9m² per head].

.2 Uniformly space sprinklers on branch.

.7 Water Distribution:

.1 Make distribution uniform throughout the area in which sprinkler heads will open.

.2 Discharge from individual heads in hydraulically most remote area to be 100 % of specified density.

.8 Density of Application of Water:

.1 Size pipe to provide specified density when system is discharging specified total maximum required flow.

.2 Application to horizontal surfaces below sprinklers shall be 0.38 lpm per m².

.9 Sprinkler Discharge Area:

.1 Area: hydraulically most remote 279 m² area as defined in NFPA 13.

.10 Outside Hose Allowances:

.1 Include allowance in hydraulic calculations of 378 lpm for outside hose streams.

.11 Friction Losses:

.1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.

.12 Water Supply:

.1 Base hydraulic calculations on existing water supply reading on existing sprinkler system pressure gauges.

2.2 ABOVE GROUND PIPING SYSTEMS

.1 Provide fittings for changes in direction of piping and for connections.

.1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.

.2 Perform welding in shop; field welding will not be permitted.

.3 Conceal piping in areas with suspended ceiling and paint piping in areas exposed. Coordinate paint color with Architects and Departmental Representative.

2.3 PIPE, FITTINGS AND VALVES

.1 Pipe:

.1 Ferrous: to NFPA 13.

.2 Copper tube: to NFPA 13.

.2 Fittings and joints to NFPA 13:

.1 Ferrous: screwed, welded, flanged or roll grooved.

.1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.

.2 Copper tube: screwed, soldered, brazed, grooved.

.3 Provide welded, threaded, grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.

.4 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will [not] be permitted.

.5 Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.

.6 Fittings: ULC approved for use in wet pipe sprinkler systems.

.7 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.

.8 Side outlet tees using rubber gasketed fittings are not permitted.

.9 Sprinkler pipe and fittings: metal.

.3 Valves:

.1 ULC listed for fire protection service.

.2 Gate valves: open by counter-clockwise rotation.

.3 Check valves: flanged clear opening swing or spring actuated check type with flanged inspection and access cover plate for sizes 10 cm and larger.

.4 Provide gate valve in piping protecting elevator hoist ways, machine rooms, and machinery spaces.

.4 Pipe hangers:

.1 ULC listed for fire protection services in accordance with NFPA.

2.4 SPRINKLER HEADS

.1 General: to NFPA 13 and ULC listed for fire services.

.2 Sprinkler Head Type:

.1 Type A: upright bronze.

.2 Type B: pendent chrome link and lever type.

.3 Type C: pendent chrome glass bulb type.

.4 Type D: recessed pendent polished chrome glass bulb type with ring and cup.

.5 Type E: concealed polished chrome link and lever type.

.6 Type F: side wall polished chrome link and lever type.

.3 Provide nominal [1.2] cm orifice sprinkler heads.

.1 Release element of each head to be of intermediate temperature rating or higher as suitable for specific application.

.2 Provide polished stainless steel ceiling plates or chromium-plated finish on copper alloy ceiling plates, and chromium-plated pendent sprinklers below suspended ceilings.

.3 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance with NFPA 13.

.4 Provide sprinkler heads as indicated.

.5 Deflector: not more than 75 mm below suspended ceilings.

.6 Ceiling plates: not more than 25 mm deep.

.7 Ceiling cups: not permitted.

2.5 PRESSURE GAUGES

.1 ULC listed and to Section 23 05 19.01 - Thermometers and Pressure Gauges - Piping Systems.

2.6 PIPE SLEEVES

.1 Provide pipe sleeves where piping passes through walls, floors.

.2 Secure sleeves in position and location during construction.

.3 Provide sleeves of sufficient length to pass through entire thickness of walls, floors.

.4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.

.1 Firmly pack space with mineral wool insulation.

.2 Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to firm but pliable mass, provide mechanically adjustable segmented elastomeric seal.

.3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material.

.5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:

.1 Provide hot-dip galvanized steel, ductile-iron, cast-iron sleeves.

.2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.

.6 Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs:

.1 Provide 0.61 mm thick galvanized steel sheet.

2.7 ESCUTCHEON PLATES

.1 Provide one piece type metal plates for piping passing through walls, floors, and ceilings in exposed spaces.

.2 Provide polished stainless steel plates, chromium-plated finish on copper alloy plates in finished spaces.

.3 Provide paint finish on metal plates in unfinished spaces.

2.8 INSPECTOR'S TEST CONNECTION

.1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3 m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.

.2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.

.3 Provide discharge orifice of same size as corresponding sprinkler orifice.

2.9 SIGNS

.1 Attach properly lettered and approved metal signs to each valve and alarm device to NFPA 13.

.2 Permanently fix hydraulic design data nameplates to riser of each system.

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 datasheet.

3.2 INSTALLATION

.1 Install, inspect and test to acceptance in accordance with NFPA 13 and NFPA 25.

3.3 PIPE INSTALLATION

.1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.

.2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.

.3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.

.4 Inspect piping before placing into position.

3.4 DISINFECTION

.1 Disinfect new piping.

.2 Fill piping systems with solution containing minimum of 50 parts per million of chlorine and allow solution to stand for minimum of 24 hours.

.3 Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 part per million or residual chlorine content of domestic water supply.

.4 Obtain at least two consecutive satisfactory bacteriological samples from piping, analyzed by certified laboratory, and submit results prior to piping being placed into service.

3.5 FIELD PAINTING

.1 Clean, pre-treat, prime, and paint new systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.

.2 Apply coatings to clean, dry surfaces, using clean brushes.

.3 Clean surfaces to remove dust, dirt, rust, and loose mill scale.

.4 Immediately after cleaning, provide metal surfaces with 1 coat of pre-treatment primer applied to minimum dry film thickness of 0.3 ml, and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 ml.

.5 Shield sprinkler heads with protective covering while painting is in progress.

.6 Upon completion of painting, remove protective covering from sprinkler heads.

.7 Remove sprinkler heads which have been painted and replace with new sprinkler heads.

.8 Provide primed surfaces with following:

.1 Piping in Finished Areas:

.1 Provide primed surfaces with 2 coats of paint to match adjacent surfaces.

.2 Provide valves and operating accessories with 1 coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil.

.3 Provide piping with 50 mm wide red enamel bands or self-adhering red plastic bands spaced at maximum of 6 m intervals throughout piping systems.

.2 Piping in Unfinished Areas:

.1 Provide primed surfaces with one coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil in spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material.

.2 Provide piping with 50 mm wide red enamel bands or self-adhering red plastic bands] spaced at maximum of 6 m intervals.

3.6 FIELD QUALITY CONTROL

.1 Site Test, Inspection:

.1 Perform test to determine compliance with specified requirements in presence of Departmental Representative.

.2 Test, inspect, and approve piping before covering or concealing.

.3 Preliminary Tests:

.1 Hydrostatically test each system at 200 psig for a 2 hour period with no leakage or reduction in pressure.

.2 Flush piping with potable water in accordance with NFPA 13.

.3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.

.4 Test alarms and other devices.

.5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.

.4 Formal Tests and Inspections:

.1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.

.2 Submit written request for formal inspection at least 15 days prior to inspection date.

.3 Repeat required tests as directed.

.4 Correct defects and make additional tests until systems comply with contract requirements. Furnish equipment, instruments, connecting devices, and personnel for tests.

.5 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.

.2 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 - ACTION AND INFORMATIONAL 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 Site Tests:

.1 Testing to be witnessed by authority having jurisdiction.

.2 Develop, with Departmental Representative, detailed instructions for O & M of this installation.

.4 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:

.1 Materials and resources.

.2 Storage and collection of recyclables.

.3 Construction waste management.

.4 Resource reuse.

.5 Recycled content.

.6 Local/regional materials.

.7 Low-emitting materials.

3.7 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

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

END OF SECTION

Part 1 General

1.1 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.2 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 One mechanical seal for each size and type of pump utilizing a mechanical seal.

.2 One casing joint gasket for each size pump.

.3 One glass for each gauge glass.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Waste Management and Disposal:

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

Part 2 Products

2.1 MATERIALS

.1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

.2 Do verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

Part 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23 - Interior Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section [01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

.1 Testing to be witness by Authority Having Jurisdiction.

.2 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.

3.4 DEMONSTRATION

.1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Departmental Representative will record these demonstrations on video tape for future reference.

3.5 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Material and installation of pipe work in general.

1.2 REFERENCES

.1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B24, Cast Copper Alloy Pipe Flanges and Flanged Fittings.

.2 ANSI/ASME B39, Malleable Iron Threaded Pipe Unions.

.3 ANSI/ASME B42, Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300.

.2 American Society for Testing and Materials (ASTM)

.3 American Society of Mechanical Engineers (ASME)

.1 ASME B31.9 – Building Services Piping.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.

Part 2 Products

2.1 GENERAL

.1 Installations shall include all devices, attachments, equipment, components and piping necessary to form a complete working system to code requirements.

2.2 VALVES

.1 Refer to the specific pipe specification sections for valve types.

.2 All valves of one type (e.g. gate valves) must be of one manufacturer. Ensure that working pressure, size and manufacturer's name are cast or stamped into the body of each valve.

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.3 Use O. S. & Y. design on all valves 100 mm and larger unless specifically noted otherwise.

.4 Provide hand wheels on valves 75mm and larger accessible for operation.

2.3 STRAINERS

.1 Provide Y-type strainers where, indicated on the drawings and where specified herein, in piping system, full size of the connected piping ahead of each pump, control valve, meter, etc. Install bucket or basket strainers only where indicated on the drawings.

.2 All strainers shall have the same end connections and working pressure as the attached piping is specified.

.3 Use monel screens with a reinforced edge. Perforations shall be 0.8 mm for water and 3.2 mm ahead of pumps.

.4 Provide 20 mm blow-off lines with ball valves, piped directly to drain on all strainers over 50 mm.

2.4 DIELECTRIC PIPE FITTINGS /UNIONS

.1 Dielectric fittings factory certified to withstand a minimum of 600 volts on a dry line with no flashover. Unions rated at 1.7 MPa conforming to ANSI B16.39. Flanged fittings rated at 1.2 MPa conforming to ANSI B16.24 (bronze) and B16.42 (iron).

2.5 PIPE SLEEVES AND SEALS

.1 Where piping penetrates below grade walls or floors:

.1 Seal: modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening complete with 316 stainless steel fasteners. Seal elements shall be sized and selected per manufacturer's recommendations and be suitable for the required fire-resistance rating and anticipated environmental conditions.

.2 Sleeve: custom-sized molded HDPE sleeves matched to the mechanical seal dimensions complete with reinforcing ribs, end caps, and integrally formed hollow water stop having a minimum outside diameter 100 mm larger than the diameter of the sleeve itself and allowing 13 mm movement between wall forms to resist pour forces.

.2 Elsewhere: Schedule 40 black steel pipe sleeve.

.3 All sleeves and floor penetrations to be water-tight.

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Part 3 Execution

3.1 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Provide valves and either unions, flanges or grooved joint couplings to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping is subject to movement.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, and components.

3.3 DRAINS

.1 Arrange pipe and fittings to ensure complete drainage.

.2 Install drain valve at low points in piping systems, at equipment and at sectional/floor isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.

.4 Provide air vents as required to assist in draining the piping.

.5 Drain valves: Ball valves unless otherwise approved, NPS 3/4 minimum. Provide hose end male thread, cap and chain where not piped to drain.

3.4 DIELECTRIC COUPLINGS

.1 General: Compatible with system, to suit pressure rating of system.

.2 Locations: Where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: Isolating flanges.

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.5 Rated to 150C.

3.5 PIPEWORK INSTALLATION

.1 Install exposed piping, equipment, rectangular cleanouts and similar items approximately as shown, parallel or perpendicular to building lines and as close to the structure as possible.

.2 Conceal all piping except where otherwise approved. Install concealed piping to minimize furring space, maximize headroom, and conserve space.

.3 Exposed piping must be carefully installed to be pleasing to the eye and meet the Architect's requirements.

.4 Install all pipe mounted control devices, such as control valves and wells.

.5 Assemble piping using fittings manufactured to ANSI standards.

.6 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main. Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.7 Use only eccentric reducing fittings at pipe size changes, installed with the piping in line at the top to ensure positive drainage and venting.

.8 Use only long radius welding or soldered fittings in expansion loops, not screwed fittings.

.9 American National Taper pipe thread must be used for all thread connections. Remove burrs and chips and ream or file the pipe ends out to size of bore.

.10 Leave not more than 2 threads exposed on threaded joints when made up.

.11 Screwed fittings jointed with Teflon tape.

.12 Do not use:

.1 close nipples.

.2 threaded protectors as couplings.

.3 direct welded or screwed connections to valves, equipment or other apparatus.

.13 Protect openings against entry of foreign material.

.14 Ream pipes, remove scale and other foreign material before assembly.

.15 Slope piping for positive drainage and venting.

.16 Arrange piping to permit flushing.

.17 Group piping, wherever possible.

.18 Provide anchors and sway braces to Departmental Representative approval.

.19 Provide for thermal expansion.

.20 Provide for movement due to seismic events as required by the NBC.

3.6 EXPANSION OF PIPING

.1 Install all piping systems with due regard and provision for expansion avoiding strain or damage to the building and equipment. Where pipe runs past building expansion joints, provide expansion compensation.

.2 Only major expansion configurations and fittings have been detailed on the drawings. Provide all required additional compensators, loops and swing connections as specified herein, and in accordance with good trade practice.

.3 Use swing connections with a minimum of 3 elbows (i.e. four fittings including the tee) where required. These swing connections are not always shown on the piping drawings for reasons of clarity; they must however, be installed. Where close tolerances do not permit the installation of a complete swing connection, consult the Departmental Representative prior to the closing of tender.

.4 Install expansion loops cold spring 50 percent of the calculated expansion.

.5 Schedule for Expansion Loops:

.1 Maximum Distance between Anchors:

.1 Domestic Hot Water; copper 30 m, steel 45 m.

.2 Loop Size Required:

Pipe Size NPS	Loop Size (m)
3/4	1.22
1	1.27
1-1/4	1.32
1-1/2	1.37
2	1.42

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2-1/2	1.53
3	1.68
4	1.98

.6 If the length between anchors is 50% of the maximum listed above, then the loop can be reduced to 67% of that listed.

.7 Loops shall be located midway between guides.

3.7 PIPE GUIDES

.1 Provide alignment guides where required for proper operation of the system.

3.8 PIPE ANCHORS

.1 Provide substantial pipe anchors. Anchors shall be suitably attached to the structure and the pipe to prevent movement.

3.9 PIPE SLEEVES AND SEALS

.1 General: Install where pipes pass through masonry structures, concrete structures, beams, fire rated assemblies, and elsewhere as indicated. Be responsible for maintaining the integrity of the building envelope when making penetrations. Enlist the services of qualified trade(s) to make openings in, and/or repairs to, building envelope.

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.2 Sleeve Sizes:

.1 Walls and beams: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.2 Floors: 20 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.3 Sleeve Installation:

.1 Concrete walls, masonry walls, beams, and concrete floors on grade: Terminate flush with finished surface.

.2 Other floors:

.1 Terminate 50 mm above finished floor.

.2 Adjust as necessary to accommodate the requirements of through-penetration fire-stopping systems.

.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.4 Sealing:

.1 Foundation walls and below grade floors: Fire retardant, waterproof, modular mechanical seal.

.2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.

.3 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.

.4 Ensure no contact between copper pipe or tube and sleeve.

3.10 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: One piece type with set screws. Chrome or nickel plated brass or stainless steel.

.3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.11 PREPARATION FOR FIRESTOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Firestopping.

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.2 Uninsulated unheated pipes not subject to movement: No special preparation.

.3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.

.4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.12 FLUSHING OUT OF PIPING SYSTEMS

.1 In accordance as specified in relevant sections of Division 22.

.2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning supplemented as specified in relevant sections of Division 22.

.3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.13 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Departmental Representative and Departmental Representative 48-hours minimum prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections of Division 22 where specified, otherwise test to requirements of ASME B31.9.

.3 Test all piping, with the exception of atmospheric vents and sanitary piping, hydraulically to 1½ times the operating pressure but not less than 860 kPag.

.4 Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

.1 Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

.2 Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

.3 Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 30 kPa (10 ft WC). From 15 minutes before inspection starts to completion of inspection, water

level must not drop. Inspect joints for leaks. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

.4 Prepare reports for tests and required corrective action.

.5 Prove piping with less than 14 kPa pressure drop and no visible leakages for a period of 24 hours with a hydraulic test.

.6 Test all sanitary piping in accordance with the applicable Plumbing code.

.7 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or test media.

.8 Conduct tests in presence of Departmental Representative or designate approved by the Departmental Representative.

.9 Pay costs for testing, repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

.10 Insulate or conceal work only after approval and certification of tests by Departmental Representative. Test underground piping prior to backfilling.

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 This section includes a list of manufacturers whose products are approved for installation in the work, provided the product chosen meets with the required design characteristics as particularly noted in the specifications and equipment schedules, and matches the design features of the item where a particular trade name and model is given, and suits the installation. Conform to space limitations on products, which are approved as equal in design characteristics. If the model or size selection is doubtful, contact the Departmental Representative to ensure acceptability.

.2 Related Sections:

.1 Everything in this Project Manual is a requirement for this Division. The following references constitute assistance to the Contractors. Refer to the Table of Contents for additional guidance.

.1 Sections beginning with 22 05.

1.2 APROVED MANUFACTURER APPROVAL

.1 The Drawings and Specifications are based upon manufacturers whose products are specified for installation in the work.

.2 Any other manufacturers requesting "approved equal" status must request approval from the Department Representative by letter stating specifically the items on which he wishes to quote and enclosing all necessary engineering data. Submit electronic copies of all requests. Include the appropriate specification and/or drawing references. Requests should be made at least 14 days prior to closing of tenders, and an addendum may then be issued by the Departmental Representative, prior to closing of tenders, listing any further Acceptable Manufacturers. Late requests may not be approved. Provide additional information requested by the Departmental Representative to facilitate evaluation.

.3 All fire suppression equipment shall be supplied from a manufacturer that has had an established local (Provincial) representative for a minimum of two (2) years, unless otherwise specified.

.4 The Departmental Representative may also take other factors into account.

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1.3 CHANGES DUE TO USE OF DIFFERENT MANUFACTURERS

.1 Where the Contractor proposes to use an item of equipment other than that detailed on the Drawings which requires any redesign of the structure, partitions, foundations, piping, wiring or of any other part of the mechanical, electrical or architectural layout, all such redesign and all new Drawings and details required shall, with the approval of the Departmental Representative, be prepared by the Contractor at his own expense.

.2 Where deviations are approved requiring a different quantity or arrangement of ductwork, piping, wiring, conduit and equipment from that indicated on the Drawings, this Division is responsible to furnish and install all such ductwork piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system, without additional compensation.

Part 2 Products

2.1 HEATING, VENTILATION & AIR CONDITIONING ACCEPTABLE MANUFACTURERS LIST

Equipment		Acceptable Manufacturers
.1	Access doors	Acudor PS-5030, Mifab CAD-FL-PL
.2	Alignment guides	Flexonics, Fulton, Yarway
.3	Automatic flow control valves	Griswold, Bell & Gossett
.4	Ball valves	Crane, Apollo, Bell & Gossett
.5	Butterfly valves	Nibco, Keystone, Bray, Watts
.6	Cast Iron Soil Pipe	Associated, Bibby
.7	Check valves	Nibco, Crane, Newco, Bell & Gossett, Watts
.8	Domestic hot water heaters	Rudd, Rheem, A.O. Smith, AERCO, Precision
.9	Expansion joints	Flexonics, Fulton, Northflex
.10	Gate valves	Nibco, Newco, Watts, Crane
.11	Globe Valves	Nibco, Newco, Watts, Crane
.12	Hangers and Supports	Adsco, Crane, Anvil, Myatt
.13	Sewage/Sump Pumps	Bell & Gossett, Aurora, Barnes, Giant, Zoeller
.14	Shock Absorbers	Zurn, Mifab, Ancon
.15	Thermostatic mixing valve	Powers, Watts, Zurn, Kohler

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.16	Plumbing Fixtures (Water closet, Lavatory, Kitchen Sink, and etc.	American Standard, Kohler, Contrac, Franke
.17	Plumbing Brass	Delta, Chicago Faucets, Kohler, American standard

Part 3 Execution

.1 Not used.

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Material and installation of insulation of plumbing pipes and equipment.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1, Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings

.2 American Society for Testing and Materials (ASTM)

.1 ASTM B209, Specification for Aluminum and Aluminum Alloy Sheet and Plate

.2 ASTM C335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.6 ASTM C921, Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.7 ASTM C547 Standard Specification for Mineral Fiber Pipe Insulation

.8 ASTM C1136 Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

.9 ASTM C533 Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

.10 C1427 Specification for Extruded Preformed Flexible Cellular Polyolefin Thermal Insulation in Sheet and Tubular Form

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts

.4 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

.5 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.3 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings

1.3 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" – plumbing piping in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.2 TIAC:

.1 CPF: Code Piping Finish.

1.4 QUALIFICATIONS

.1 Installer to be specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather, construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

1.6 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Provide sample board with all types of insulation and proper labelling.

1.7 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Provide and apply insulation in accordance with TIAC National Insulation Standards Specification 1501, Piping, and as herein specified:

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 oC mean temperature when tested in accordance with ASTM C335.

.3 Type P-1: Rigid moulded mineral fibre with factory applied vapour retarder jacket (ASJ).

.1 Mineral fibre: to ASTM C547.

.2 Jacket: to ASTM C1136.

.3 Maximum "k" factor: to ASTM C547.

.4 Type P-2: Rigid moulded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C547.

.2 Maximum "k" factor: to ASTM C547.

.5 Type P-3: Flexible Cellular Polyolefin.

.1 Insulation: ASTM C1427.

.2 Maximum "k" factor: ASTM C1427.

.6 Type P-4: Calcium Silicate.

.1 High temperature abuse resistant.

.2 ASTM C 411 to 649 C (1200 F).

.7 Type P-5: Cellular Glass.

.1 Insulation to ASTM C552

2.3 INSULATION SECUREMENT

.1 Tape: Self-adhesive, fibreglass reinforced foil-white kraft paper lamination, 50 mm wide minimum.

.2 Contact adhesive: low VOC, air-drying adhesive.

.3 Canvas adhesive: Washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

2.4 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.5 INDOOR VAPOUR RETARDER FINISH

.1 Water based, fire retardant type, compatible with insulation.

2.6 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type and sheet with pre-formed shapes.

.2 Colour and finish: white, gloss.

.3 Service temperature range: -18oC to 66oC.

.4 Moisture vapour transmission: 0.02 perm.

.5 Thickness: 0.50 mm.

.6 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

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Part 3 Execution

3.1 PRE- INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION – GENERAL

.1 Install in accordance with TIAC National Standards, following manufacturer's instructions and this specification. In case of conflict between TIAC National Standard's, manufacturer's instructions and this specification, this specification shall govern, unless otherwise directed by the Departmental Representative.

.2 Use two layers with staggered joints when required nominal insulation thickness exceeds 75 mm.

.3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.4 Supports, Hangers:

.1 Apply high compressive strength insulation, as indicated below, at oversized saddles where insulation shoes have not been provided.

.1 Hot piping: Calcium silicate or Perlite.

.2 Cold piping: cellular glass or high density foam.

.3 Wood blocks or plastic inserts are acceptable only where approved by the Departmental Representative.

.5 Insulate valves, valve bonnets, strainers, flanges and fittings unless otherwise specified to same requirements as associated piping.

.6 Carry insulation through floors and walls on services above 121°C (250°F) or below room temperature.

.7 Ensure adequate ventilation is provided upon initial heating of insulation, where manufacturer indicates that fumes and odors may be released.

3.3 INSTALLATION OF TYPE P-1 AND P-2 INSULATIONS (FIBREGLASS):

.1 Without integral jacket: mechanically fasten at 300mm centres.

.2 With integral jacket: staple flap on 75mm centres.

.3 Insulation with self-sealing lap seal integral to jacket requires no additional fastening.

.4 Seal butt joints with self-sealing butt strips, minimum 50mm wide.

3.4 INSTALLATION OF TYPE P-3 INSULATION (ELASTOMERIC)

.1 Follow manufacturer's instructions.

3.5 SPECIFIC APPLICATIONS

.1 Thickness:

.1 As listed in following table.

.2 Runouts:

.1 Runouts up to 50mm to individual terminal units, not exceeding 3.7m in length, may have insulation thickness reduced to 13mm.

.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

.3 Jackets:

.1 Indoors:

.1 PVC.

3.6 INSULATION SCHEDULE

Service		Sizes	Type	Thick	Fittings
Dom Cold Water Pipe		13-25mm	P-1	13mm	YES
Dom Cold Water Pipe		32mm-up	P-1	25mm	YES
Dom Hot Water Pipe		13-51mm	P-2	25mm	YES
Dom Hot Water Pipe		64mm-up	P-2	38mm	YES
Dom Recirc Water Pipe		13-51mm	P-2	25mm	YES
Dom Recirc Water Pipe		64mm-up	P-2	38mm	YES
Plg Vents in Attics		ALL	P-1	25mm	YES
Piping Within 1.8m of Roof or O/S Wall Penetrations		ALL	P-1	25mm	YES

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Material and installation of domestic water piping and valves.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).

.1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.

.2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 ASTM B88M, Standard Specification for Seamless Copper Water Tube (Metric).

.3 ASTM F492, Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings.

.4 ASTM B32, Standard Specification for Solder Metal.

.3 American Water Works Association (AWWA).

.1 AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International).

.1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.

.2 CSA B137.9 Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.

.5 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

.6 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67, Butterfly Valves.

.2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.7 National Research Council (NRC)/Institute for Research in Construction.

.1 NRCC 38728, National Plumbing Code of Canada (NPC).

.8 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act, c. 34 (TDGA).

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building, all sizes:

.1 Above ground: copper tube, hard drawn temper, type L: to ASTM B88M.

.2 Buried or embedded:

.1 Copper tube, soft annealed, type K: to ASTM B88M, in long lengths with no buried joints.

.2 Cross-linked polyethylene piping to Series 160 of CSA B137.9.

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.

.2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI/ASME B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 NPS 2 and larger: roll grooved to CSA B242.

2.3 JOINTS

.1 Flanged: ASME B16.21, nonmetallic, flat, asbestos-free, full-face type for Class 150 and 300 cast copper alloy flanges. 1/8-inch maximum thickness, except where thickness or specific material is indicated.

.2 Teflon tape: for threaded joints.

.3 Solder: Alloy Sn95 (95% tin, 5% silver) to ASTM B32.

.4 NPS 2 and over:

.1 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.

.5 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

2.4 GATE VALVES

.1 NPS 2-1/2 and over, in mechanical rooms, flanged:

.1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim.

.2 NPS 2-1/2 and over, other than mechanical rooms, flanged:

.1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet.

2.5 GLOBE VALVES

.1 NPS2 and under, soldered:

.1 To MSS-SP-80, Class 150, 1 MPa, bronze body, renewable PTFE disc, screwed over bonnet, bronze seat.

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, screwed over bonnet, renewable composition disc, bronze seat.

.3 Provide lockshield handles where valve is used for balancing, such as in recirculation system.

2.6 SWING CHECK VALVES

.1 NPS 3 and under, soldered:

.1 To MSS-SP-80, Class 150, 1 MPa, bronze body, brass swing disc for sizes 19mm and under, bronze swing disc for sizes 25mm and greater, screw in cap.

.2 NPS 3 and under, screwed:

.1 To MSS-SP-80, Class 150, 1 MPa, bronze body, brass swing disc for sizes 19mm and under, bronze swing disc for sizes 25mm and greater, screw in cap.

2.7 BALL VALVES

.1 NPS 3 and under, screwed:

.1 To MSS-SP-110, Class 150, bronze body, chrome plated brass ball, brass stem, PTFE adjustable packing, PTFE seat, steel lever handle.

.2 NPS 3 and under, soldered:

.1 To MSS-SP-110, Class 150, bronze body, chrome plated brass ball, brass stem, PTFE adjustable packing, PTFE seat, steel lever handle.

2.8 BUTTERFLY VALVES

.1 NPS 2-1/2 and over, grooved ends:

.1 Class 300, bubble tight shut-off, bronze body.

.2 Operator:

.1 NPS 6 and under: lever handles.

Part 3 Execution

3.1 INSTALLATION

.1 General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.

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.2 Install components having pressure rating equal to or greater than system operating pressure.

.3 Install piping free of sags, bends, and kinks.

.4 Install fittings for changes in direction and branch connections in hard drawn copper tube.

.5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.6 Install drains at low points and in trapped sections, to ensure entire system can be drained.

.7 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction.

.3 No buried joints.

3.2 PIPING JOINT CONSTRUCTION

.1 Join pipe and fittings as follows:

.1 Ream ends of pipe and tube and remove burrs to restore full inside diameter.

.2 Remove scale, slag, dirt, and debris from inside and outside of pipe, tube, and fittings before assembly.

.3 Soldered Joints: Construct joints according to ASTM B 828.

.4 Brazed Joints: Construct joints according to ANSI/AWS C3.4.

.5 Threaded Joints: Construct in accordance with industry standard practices and manufacturer’s recommendations.

.6 Flanged Joints: Construct in accordance with industry standard practices and manufacturer’s recommendations.

.7 Mechanical Joints: Grooved copper tube and grooved-tube fitting joints shall be assembled with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer’s standard written procedure. Grooved ends on copper and copper alloy tube shall be roll-formed only using the appropriate roll-groove tool to construct a groove meeting the coupling and fitting manufacturer’s written specifications. Cut grooving methods shall not be used on copper and copper alloy tube.

3.3 PIPING CONNNECTIONS

.1 Make piping connections as specified below:

.1 Install solder-joint to male-thread adapters, or solder-joint to male-thread unions meeting the requirements of ASME B16.18 or ASME B16.22, adjacent to each threaded valve and threaded equipment connection in a copper tube system.

.2 Install ASME B16.24 cast copper alloy pipe flanges adjacent to each flanged valve and flanged equipment connection in a copper tube system.

3.4 VALVES

.1 Isolate equipment, fixtures and branches with ball valves, unless otherwise indicated.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.5 PRESSURE TESTS

.1 Refer to Common Work Results for Plumbing.

.2 Test pressure: 1.5 times maximum system operating pressure or 860 kPa, whichever is greater.

3.6 FLUSHING, CLEANING AND DISINFECTION

.1 Flush, clean and disinfect the entire system in accordance with applicable standards, to the requirements of the authority having jurisdiction.

.2 Upon completion of flushing, cleaning and disinfection, draw off sample from longest run and submit to laboratory for testing. Provide laboratory test reports on water quality for Departmental Representative approval.

.3 Provide necessary fittings, valves and connections as required to flush, clean and disinfect the system.

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation of metallic drainage waste and vent piping.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM B32, Specification for Solder Metal.

.2 ASTM B306, Specification for Copper Drainage Tube (DWV).

.3 ASTM/ASME B16.29, Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV.

.4 ASTM B 813, Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube

.5 ASTM B 828, Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings

.2 American Society of Mechanical Engineers (ASME)

.1 ASME B16.23, Cast Copper Alloy Solder Joint Drainage Fittings: DWV

.3 Canadian Standards Association (CSA International).

.1 CSA B67, Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.

.2 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.

.3 CAN/CSA-B125, Plumbing Fittings.

.4 CAN/CSA-B602, Mechanical Couplings for Drain, Waste and Vent Pipe and Sewer.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary, and vent: Type DWV to ASTM B306.

.1 Fittings.

.1 Cast brass: to ASME B16.23.

.2 Wrought copper: to ASTM/ASME B16.29.

.2 Solder and flux: to ASTM B32, ASTM B 813, ASTM B 828.

2.2 CAST IRON PIPING AND FITTINGS

.1 Above ground, storm, sanitary and vent: to CAN/CSA-B70.

.1 Joints.

.1 Mechanical joints to: CAN/CSA-B602.

.2 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.

.3 Stainless steel clamps.

Part 3 Execution

3.1 BURIED PIPE

.1 Install as follows, unless otherwise recommended by the manufacturer or directed by Departmental Representative:

.1 Provide 150 mm sand bedding below pipe and 150mm of sand over pipe for initial backfill.

.2 Balance of fill and amount of compaction to be the same as specified for the slab above.

.3 For sizes under 150 mm minimum grade to be 2%.

3.2 ABOVE GROUND SANITARY, STORM AND VENT: TO CAN/CSA-B70.

.1 Joints:

.1 Hub and spigot:

.1 Caulking lead: to CSA B67.

.2 Mechanical joints:

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.1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

.2

3.3 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

.3 Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

.1 Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

.2 Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

.3 Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 30 kPa (10-ft WC). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

.4 Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 250 Pa (1-in wg). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

.5 Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

.6 Prepare reports for tests and required corrective action.

.4 Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

.1 Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

.2 Cap and subject piping to static-water pressure of 345 kPa (50 psig) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

.3 Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

.4 Prepare reports for tests and required corrective action.

END OF SECTION

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Part 1 General

1.1 REFERENCES

.1 American National Standards Institute/Canadian Standards Association (ANSI/CSA)

.1 ANSI Z21.10.3A-2007/CSA 4.3-2007, Gas Water Heaters - Volume III - Storage Water Heaters, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, paddling and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 WARRANTY

.1 For the Work of this Section 22 30 05 - Domestic Water Heaters, 12 months warranty period prescribed in subsection GC 32.1 of General Conditions "C" is extended to number of years specified for each product.

.2 Contractor hereby warrants domestic water heaters in accordance with CCDC2, but for number of years specified for each product.

Part 2 Products

.1 Sustainable Requirements:

.1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements.

2.2 ELECTRIC WATER HEATER

.1 To CAN/CSA E335-1 & E335-2-35.

.2 To ANSI, ANSI/UL Standard 499.

.3 Tankless electric water shall be equipped with a bare wire nichrome type heating element housed in fiberglass reinforced high temperature plastic containment.

.4 The housing of the unit shall be made of high impact polycarbonate plastic.

.5 The flow switch shall be of mechanical pressure differential type.

.6 The unit shall be equipped with a safety high-limit switch with manual reset.

.7 Water connections shall be designed for standard 3/8” O.D. flexible braided stainless steel hose type connectors.

.8 The unit shall be mounted with water connections facing either top or bottom only.

.9 The unit shall be provided with a minimum wire size of AWG #10.

2.3 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation in[concrete support pad structural steel support in accordance with Section 03 30 00 - Cast-in-Place Concrete 05 50 00 - Metal fabrications.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.

.2 Provide structural steel for instantaneous heaters.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 The supply and installation of plumbing fixtures and trim.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA-B45 Series, Plumbing Fixtures.

.2 CAN/CSA-B125 Series, Plumbing Fittings.

.3 CAN/CSA-B651, Barrier-Free Design.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit to the Departmental Representative a complete brochure of all the new fixtures and accessories for review before placing a firm order.

.3 Confirm styles, space, and quantities with Architectural drawings before submission.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures:

.1 Manufacture in accordance with CAN/CSA-B45 series.

.2 Confirm colour with Architect.

.3 Free of discoloration and flaws.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 All exposed plumbing brass, metal supplies, traps, escutcheons, pipes, valves, fittings, etc. shall be chrome plated.

.4 Number, types, locations: architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

.7 Fixture piping:

.1 Hot and cold water supplies to each fixture:

.1 Chrome plated rigid supply pipes each with screwdriver stop, reducers, and escutcheon.

.2 Waste:

.1 Brass P-trap with clean out on each fixture not having integral trap.

.8 Sealant: Colour- white, confirm with the Architect.

2.2 BARRIER-FREE PLUMBING FIXTURES

.1 Provide approved barrier-free fixtures and brass where indicated on mechanical or architectural drawings.

.2 Provide offset P-traps.

.3 Leg protection:

.1 Lavatories: shroud/knee contact guard, colour – white, unless otherwise specified by the Architect.

.2 All exposed piping shall be completely covered, including screwdriver stops.

2.3 PLUMBING FIXTURES

.1 Refer to Plumbing Fixture Schedule.

2.4 ACCESSIBILITY

.1 Refer to 22 05 02 Common Work Results for Plumbing.

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Part 3 Execution

3.1 GENERAL

.1 Coordinate wall and floor construction to suit fixture layout.

.2 Provide all hangers, supports, brackets reinforcement, 1.9 mm steel backup plates, etc., for the proper installation and support of fixtures and their respective supply fittings.

.3 All connections shall be watertight, including supplies, traps, etc.

3.2 INSTALLATION

.1 The fixtures shall be set level and square with relation to interior finish, floor, and wall lines. Locate with equal spacing on both sides, unless specifically shown otherwise.

.2 Mounting heights:

.1 Standard: to comply with the manufacturer's recommendations unless otherwise indicated or specified.

.2 Physically handicapped: to comply with the most stringent of either NBCC or CAN/CSA B651.

.3 Vanity and counter sinks: ensure location in counter is in accordance with the manufacturer's recommendations and the Architect's requirements.

.4 Chrome plated piping: use only strap wrenches on chrome plating piping and fittings. Replace any damaged by wrench marks. Joints to be threaded or slip union type.

.5 Fixtures shall be piped complete in a first class manner.

.6 Apply sealant to all joints where fixtures come in contact with floors, walls and/or counters. Joints shall be made watertight with a smooth bead of sealant applied in a neat, workmanlike manner.

.7 After installation, fixtures shall be protected from damage, dirt and paint. Replace damaged materials. Clean only with manufacturer approved non-abrasive cleansers.

3.3 ADJUSTING

.1 Adjustments:

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

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.3 Adjust flush valves to suit site conditions.

.4 Adjust metering valve timing mechanisms.

.5 Adjust temperature limit and safety controls.

.6 Adjust brass for easy, drip-free operation.

.2 Checks:

.1 Aerators: operation, cleanliness.

.2 Strainers: cleanliness.

.3 Vacuum breakers, backflow preventers: operation under all conditions.

.3 Thermostatic controls:

.1 Verify temperature settings, operation of control, limit and safety controls.

3.4 DEMONSTRATION

.1 Demonstrate all special fixtures to the Departmental Representative, including operation and maintenance.

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for plumbing specialties and accessories.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM A536, Specification for Ductile Iron Castings.

.3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA).

.1 AWWA C116/A21.16, American National Standard for Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service.

.2 AWWA C700, Cold Water Meters-Displacement Type, Bronze Main Case.

.3 Canadian Standards Association (CSA International).

.1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.

.2 CSA-B79, Floor, Area and Shower Drains, and Cleanouts for Residential Construction.

.3 CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.5 Plumbing and Drainage Institute (PDI).

.1 PDI-WH 201, Water Hammer Arresters.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit following additional information:

.1 Submit a single set of shop drawing for all backflow prevention devices.

.2 Indicate the location and type of each backflow preventer.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 DRAIN PUMP

.1 Refer to Plumbing Fixture Schedule.

2.2 WATER COOLER

.1 Refer to Plumbing Fixture Schedule.

2.3 WATER FILTRATION

.1 Refer to Plumbing Fixture Schedule.

2.4 CLEANOUTS

.1 Cleanouts:

.1 Walls: heavy lacquered cast iron body.

.2 Floors: heavy lacquered cast iron body with adjustable head suitable for recessed access cover, and neoprene gasket or inside caulk connection. Provide anchor flange with clamping collar for units located in waterproof floors.

.3 Plugs: tapered threaded bronze with raised head, gas- and water-tight seal.

.2 Access Covers:

.1 Walls: flush mounted, square, prime-coated, 1.9 mm thick steel construction with concealed hinge, door with rounded corners, and screwdriver-operated cam lock.

.2 Floors:

.1 Unfinished concrete: nickel bronze, heavy duty, round scoriated top with retaining screws.

.2 Tile: nickel bronze, square scoriated top with retaining screws.

.3 Sheet goods: nickel bronze, round scoriated top with retaining screws.

.4 Carpet: nickel bronze, round scoriated top with carpet marker and retaining screws.

2.5 WATER HAMMER ARRESTERS

.1 Stainless steel construction, bellows type: tested and certified to PDI-WH 201.

2.6 STRAINERS

.1 860 kPa (125 psi) maximum working pressure, Y-type with 20 mesh, removable stainless steel screen.

.2 NPS 2 and under, bronze body, screwed ends, with brass cap.

.3 NPS 2-1/2 and over, cast iron body, flanged ends, with bolted cap.

Part 3 Execution

3.1 CLEANOUTS

.1 Size: line size up to NPS 4. Not less than NPS 4 on larger pipes.

.2 Install cleanouts where easily utilized, at the base of soil and waste stacks, and rainwater leaders, at locations required by local code and authority having jurisdiction, and as indicated.

.3 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.4 In finished areas, ensure a neat installation level within the surrounding floor or wall. Beneath vanities located as high as permissible for good access and minimum visibility.

3.2 WATER HAMMER ARRESTERS

.1 Provide water hammer arresters:

.1 At all equipment utilizing quick closing valves such as automatic dishwashers, clothes washers, etc.

.2 On branch supplies to fixtures or group of fixtures.

.3 Where recommended by Plumbing and Drainage Institute Standard PDI-WH 201 "Water Hammer Arresters".

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.4 Where indicated on the drawings.

.2 Size in conformance with Plumbing and Drainage Institute Standard PDI-WH 201 "Water Hammer Arresters".

3.3 STRAINERS

.1 Install with sufficient room to remove screen.

.2 Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

3.4 TESTING AND ADJUSTING

.1 Access doors:

.1 Verify size and location relative to items to be accessed.

.2 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.3 Water hammer arresters:

.1 Verify proper installation of correct type and size of water hammer arrester.

.4 Strainers:

.1 Clean out repeatedly until clear.

.2 Verify accessibility of cleanout plug and basket.

.3 Verify that cleanout plug does not leak.

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Common work results for HVAC.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 90.1, Energy Standard for Buildings except Low-Rise Residential Buildings

.2 Electrical Equipment Manufacturers' Advisory Council (EEMAC)

.3 Canadian Standards Association (CSA)

.1 CAN/CSA-C22.2 No. 100, Motors and Generators

.2 CAN/CSA-C747, Energy Efficiency for Single- and Three-Phase Small Motors

.3 CAN/CSA-C390, Energy Efficiency Test Methods for Three-Phase Induction Motors

.4 Underwriter's Laboratories of Canada (ULC)

.5 SMACNA

.1 HVAC Air Duct Leakage Test Manual

.2 HVAC Duct Construction Standards – Metal and Flexible

1.3 REGULATORY REQUIREMENTS

.1 Refer carefully to other parts of the specifications.

.2 Conform to the requirements and recommendations of all local municipal, provincial and federal codes, by-laws and ordinances.

.3 Do not reduce the quality of work specified and/or shown on the drawings because of the Regulatory requirements.

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1.4 APPLICABLE CODES AND STANDARDS

.1 In general and as applicable, the physical and chemical properties, the characteristics and the performance of items in this Division shall be as noted in the following:

.1 Canadian Standards Association.

.2 American National Standards Institute.

.3 Provincial Building Code.

.4 Civic Building By-Laws.

.5 Civic Water Works By-Laws and Sewer By-Laws.

.6 Provincial Fire Code.

.7 Worker's Compensation Board Requirements.

.8 American Society for Testing and Materials.

.9 Canadian Government Specifications Board.

.10 National Fire Protection Association.

.11 Canadian Council of Ministers of the Environment Codes.

.12 Underwriters' Laboratories of Canada.

1.5 LATEST EDITIONS

.1 The latest edition of all codes and standards, of the date of tender submission, shall apply; except for specific editions referenced by overriding codes.

1.6 AUTHORITIES HAVING JURISDICTION (AHJ)

.1 Comply with all requirements of Authorities with competent jurisdiction, AHJ, including authorized inspectors, without additional compensation.

1.7 PERMITS, FEES AND CERTIFICATES

.1 In addition to the requirements in Division 01, obtain all required Certificates of Inspection for the work and deliver same to the Departmental Representative before request for substantial performance. These include but are not limited to:

.1 Equipment start-up reports.

.2 Fire, smoke, and combination fire/smoke damper test reports.

.2 Correct installed work as directed by the local Authorized Inspector of the Regulatory body without extra compensation.

1.8 CONSTRUCTION SCHEDULE

.1 The following requirements are in addition to those specified elsewhere. All reports refer to the final successful report. Include other tasks requested by the Departmental Representative.

.2 Schedule individual HVAC tasks at no more than 4 weeks. Split larger tasks by floor or other approved means, to ensure individual tasks do not exceed the duration limit. Similarly, limit all tasks to maximum one-week duration during the last 6 weeks prior to Substantial Completion, and to Total Completion.

1.9 EQUIPMENT LIST

.1 Compile a complete list of HVAC equipment and materials to be used on this project and forming part of tender documents by adding manufacturer's name, model number and details of materials, and submit for approval.

.2 Submit for review within ten (10) days after award of contract.

1.10 SAFETY FEATURES

.1 Provide safety features on all equipment to ensure safe operation and maintenance including belt, coupling, and other guards, screened fan intakes and discharges where inadequate ductwork for protection, safety interlocks and labels.

1.11 QUALITY OF MATERIALS

.1 Furnish new materials, apparatus or products required for the work, of first class quality, delivered, erected, connected up and finished in every detail.

.2 The use of any or all materials is subject to the approval of the Departmental Representative.

.3 Unless otherwise specified, all products shall be CSA approved.

.4 All fire protection materials and products shall be ULC approved.

.5 If materials, apparatus or products are not CSA or ULC approved, obtain approval of the provincial regulatory authority. Pay all applicable charges levied and make all modifications required for approval.

.6 Confirm colours with the Architect before ordering.

1.12 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product data for all products and equipment specified within Division 22 must be submitted to the Departmental Representative for review.

.3 Shop drawings and product data shall show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances (e.g. access door swing spaces).

.4 Shop drawings and product data shall be accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify as to current model production.

.5 Certification of compliance to applicable codes.

1.13 SPECIFIED EQUIPMENT AVAILABILITY

.1 If specified equipment is not available (due to delays in delivery) at scheduled installation time an acceptable alternate shall be installed AT THE CONTRACTOR'S EXPENSE and replaced with the specified equipment when the specified equipment becomes available with no additional compensation.

1.14 COORDINATION

.1 Coordinate design with other disciplines, taking into account all project requirements.

.2 Coordinate installation with other trades. To avoid conflicts, early in the project discuss proposed routing of ductwork, piping and locations of equipment with other trades.

1.15 ELECTRICAL WORK

.1 Division 23 is responsible for the supply, physical installation, and operation of all electric motors, temperature and humidity controls systems, combustion controls systems, and other electrical devices and systems specified under its portion of the work. Bear full responsibility for factory installed wiring and equipment on packaged equipment, be responsible where detailed in equipment requirements for controlling devices such as,

but not restricted to, pump and liquid level controls, multi-speed motor controllers, boiler controls, etc., which are necessarily integrally mounted on packaged equipment.

.2 Submit detailed composite wiring diagrams for all control systems as specified and as required for the HVAC work for review by the Departmental Representative. Distribute copies of reviewed drawings to the Electrical Division for their reference.

.3 Provide all wiring in approved rigid conduit to suit temperature and moisture conditions of area through which wire is to run. All wiring is in accordance with the relevant Electrical Codes, and in no case smaller than #12 AWG. Comply fully with the electrical specifications for all electrical work.

1.16 ELECTRICAL CHARACTERISTICS

.1 Check with the electrical trade and provide all mechanical items with correct electrical characteristics to suit the electrical work.

.2 If correct characteristics are not available from the specified equipment manufacturer, contact the Departmental Representative prior to the close of tenders.

.3 At time of ordering HVAC equipment, confirm electrical characteristics with the electrical contractor, and ensure that they have been confirmed with the power authority.

.4 No additional compensation will be paid for problems arising from incorrect electrical characteristics.

1.17 PAINTING

.1 Refer to Section 09 91 00 – Painting.

.2 All paint shall be top quality enamel or as approved by the Departmental Representative, applied in strict accordance with the manufacturer's recommendations and the Departmental Representative instructions.

.3 Prime and touch up marred finished paintwork to match original. Unmatched painting is not acceptable.

.4 Finishes that have been damaged too extensively to be simply primed and touched up shall be restored to new condition and Departmental Representative satisfaction.

.5 Be responsible for advising the painter as to the colors and identification of the piping, flow directions, etc.

1.18 CUTTING, PATCHING, REPAIRING, MAKING GOOD

.1 In addition to the requirements in Division 01, each trade requiring such work shall be responsible for necessary cutting. Patching by appropriate trade. All work to be performed by experienced tradesmen.

.2 Neatly perform cutting and patching work to blend smoothly with surrounding surfaces.

.3 Patch and make good disturbed surfaces to match existing adjacent work. Leave finished, neat, to Departmental representative approval.

.4 Perform X-ray examination of wall and floors prior to making openings, where required to avoid damage to structural reinforcements and electrical conduits.

1.19 TESTS

.1 In addition to the requirements in Division 01, carry out all tests hereinafter noted, as required by the regulatory agencies and as requested by the Departmental Representative and furnish all labour and equipment required for such tests without extra compensation.

.2 Before activating systems, recheck equipment, check all connections, set all controls for proper start-up, obtain necessary clearances from the electrical division, etc.

.3 Submit to the Departmental Representative, legible report for all tests conducted, within one week of the test.

.4 Notify the Departmental Representative at least two (2) working days ahead of all tests, so that the tests can be witnessed on a random basis.

1.20 TRIAL USAGE

.1 Departmental Representative may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

1.21 CLEANING

.1 Refer to Section 01 74 11 – Cleaning.

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.2 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

1.22 FUNCTIONAL TESTING

.1 Test all HVAC equipment, devices and systems. Test as required by the AHJ and Departmental Representative, submitting comprehensive reports. Example forms are available from the Departmental Representative.

.2 Ensure all tests demonstrate compliance with the specified and manufacturers' shop drawing and catalogued performance, as well as compliance with applicable standards.

1.23 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 In addition to the requirements in Division 01, supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Manufacturers, or expert suppliers, to provide demonstrations and instructions.

.3 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Where deemed necessary, Departmental Representatives may record these demonstrations on videotape for future reference.

.6 Submit training schedule and scope description to the Departmental Representative for review and approval for each training topic. Training shall not commence until approval of training schedule and scope if given by the Departmental Representative.

1.24 SPARE PARTS

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals and as follows:

.1 One set of packing for each packed pump.

.2 One mechanical seal for each size and type of pump utilizing a mechanical seal.

.3 One casing joint gasket for each size and type of pump.

.4 One head gasket for each tube-in-shell heat exchanger.

.5 One plate gasket set for each plate-and-frame heat exchanger.

.6 One glass for each gauge glass.

.7 One set of filter media/cartridges, for each filter or filter bank in addition to final operating set.

.8 One set of belts for each piece of belt-driven equipment.

1.25 SPECIAL TOOLS

.1 Provide one set of special tools required to service equipment in accordance with Section 01 78 00 - Closeout Submittals and as recommended by manufacturers.

.2 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.26 CLOSEOUT SUBMITTALS

.1 In addition to the requirements of Section 01 78 00 – Closeout Submittals, provide the following in the Operating and Maintenance Manuals. Edit all general data to specifically apply to this project. Pay particular attention to safety requirements.

.2 Operation data provided by manufacturer, and to include:

.1 Control schematics for each system including environmental controls.

.2 Description of each system and its controls.

.3 Description of operation of each system at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for each system and each component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valve schedule and flow diagram.

.7 Colour coding chart.

.3 Maintenance data provided by manufacturer, and shall include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task duration.

.3 Parts list including model numbers for replacement parts. Include contact name and phone number.

.4 Performance data to include:

.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified elsewhere.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.5 Additional data:

.1 Prepare and insert additional material into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

.6 Submit for review by Departmental Representative, and make final additions and adjustments as directed.

1.27 RECORD DRAWINGS

.1 Maintain neat record of changes on a set of prints during construction.

.2 Submit to Departmental Representative a minimum of five (5) working days before Substantial Completion.

.3 Contractor shall certify and check the accuracy of each drawing.

.4 Record additional changes and submit final record drawings at Total Performance.

1.28 SUBSTANTIAL COMPLETION / CERTIFICATION BY DEPARTMENTAL REPRESENTATIVE / LIFE SAFETY SUBMISSIONS

.1 Provide minimum notice of ten (10) working days to the Departmental Representative prior to request to declare project substantially complete. Failure to do so may result in site review by Departmental Representative being delayed.

.2 In addition to the requirements of Division 01 submit the following (as applicable) a minimum of five (5) working days ahead of required proposed date of substantial completion (unless a longer period of time is dictated by Authorities Having Jurisdiction):

.1 All certificates and documentation required by Authorities Having Jurisdiction.

.2 Fire and smoke damper test reports.

.3 Equipment start-up reports.

.4 Control systems commissioning reports pertaining to equipment/systems required for life safety system operation (i.e. ventilation interlocks/unit operation, CO detection/exhaust systems, etc.).

.5 Test reports for backflow prevention devices with test taps.

.6 Written confirmation that propane system is approved by the utility and/or Authority Having Jurisdiction, and turned on.

.7 Record ('As-Built') drawings.

.8 Operation and Maintenance Manuals, complete with revisions as directed.

.9 Written confirmation that all life safety and health systems are fully functional, including but not limited to ventilation, both supply and exhaust.

.10 Written confirmation that all HVAC equipment is operational and under control, indicating exceptions and temporary controls/arrangements.

.11 All other life safety and health reports and certificates.

.3 Confirm, in writing, systems are ready for occupancy and use for intended purpose in every respect.

.4 Before certification date submit detailed written confirmation of completion of deficient life safety work noted in the documentation listed above, including date completed.

.5 Before certification date submit detailed written confirmation of completion of deficient non-life safety work, including that noted in Departmental Representative reports, listing each deficient item. Submit schedule for completion of all deficient non-life safety work that will not be completed prior to the certification date, listing each deficient item for consideration.

.6 These requirements apply to each phase of a phased project.

1.29 FAN CONNECTIONS

.1 Inlet and discharge conditions are critical to proper fan performance. Review proposed fan installations and ensure that proper conditions are provided; add straightening vanes or turning vanes where required.

.2 In general, provide a minimum of three (3) wheel diameters of straight duct immediately upstream of the fan inlet.

.3 Review special cases with the Departmental Representative and TAB Contractor prior to installation.

Part 2 Products

2.1 MOTORS

.1 Motors to be high efficiency, in accordance with local Hydro company standards, the requirements of ASHRAE 90.1, and National Energy Code of Canada

.2 Comply with all Canadian Electrical Code requirements, and in particular CSA C22.2 No. 100, c/w CSA label, unless otherwise specified.

.3 Motors included in the scope of CAN/CSA-C747 shall have a nominal full-load efficiency not less than the minimum specified in that standard. Efficiency ratings of motors included in the scope of this standard shall be based on a statistically valid quality control procedure conforming to the standard. Nameplates shall list the nominal full-load motor efficiency.

.4 Motors included in the scope of CAN/CSA-C390 shall have a nominal full-load efficiency not less than the minimum specified in that standard. Efficiency ratings of motors included in the scope of this standard shall be based on a statistically valid quality control procedure conforming to the standard. Nameplates shall list the nominal full-load motor efficiency.

.5 In general, motors are EEMAC Class B (for standard torque applications), 1,800 RPM, continuous duty, open drip proof, ball bearing, 40°C temperature rise above 40°C ambient, 1.15 service factor. Motors are squirrel cage induction unless specifically noted otherwise. Special motors are specified with the equipment driven.

.6 Single-phase motors shall be equipped with integral thermal overload protection.

.7 Provide adequate capacity on each motor to operate the associated driven device under all conditions of load and service without overloading and be of at least the power specified.

.8 Refer to Division 26 and provide motor characteristics within +5% of power source, or get written approval from the Departmental Representative.

.9 Co-operate with Division 26 during start-up and provide all necessary assistance in commissioning.

.10 Acceptable motor manufacturers may be listed under the Section 23 05 03 – Acceptable HVAC Manufacturers/Contractors.

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.11 If delivery of specified motor will delay delivery or installation of equipment, install motor approved by Departmental Representative for temporary use. Final acceptance of equipment will not occur until specified motor is installed.

2.2 COUPLING FOR DIRECT DRIVE EQUIPMENT

.1 Couplings shall be sized such that it will endure an infinite number of starts when equipment is fully loaded. All couplings shall be covered with a removable safety guard.

2.3 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.

.3 For motors under 7.5 kW: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave to be determined during commissioning.

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

.8 Supply one set of spare belts for each set installed.

2.4 GUARDS

.1 Provide guards for all drives as specified and required by Authorities Having Jurisdiction.

.2 Guards for belt drives (minimum requirements):

.1 Expanded galvanized metal screen welded to galvanized steel frame.

.2 Minimum 1.2 mm thick galvanized sheet metal tops and bottoms.

.3 Prime coat for painting.

.4 38 mm diameter holes on both shaft centres for insertion of tachometer.

.5 Allow movement of motors for adjusting belt tension.

.3 Guards for flexible couplings (minimum requirements):

.1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.

.2 Prime coat for painting.

.4 Guards are to be readily removable to permit servicing of equipment.

.5 Provide means to permit lubrication and use of test instruments with guards in place.

.6 Ensure that all guards are securely fastened in place, sufficiently sturdy to provide the required safety and free of rattles and excess vibration.

2.5 FIRE SEPARATION REPAIR

.1 Refer to Section 07 84 00 – Firestopping.

.2 Cooperate fully with other trades to ensure maintenance of the rating of fire separations that are penetrated, in strict compliance with the manufacturer's recommendations and requirements of the AHJ.

2.6 ACCESSIBILITY

.1 Refer to Section 10 90 00 – Miscellaneous Specialties for access door specification.

.2 Be responsible for supplying and locating all access panels in the ceiling, wall, partitions, etc., where openings are necessary for the inspection, servicing and/or removal of equipment, valves and other items that require periodic access. Panel type to suit the construction of the ceilings, walls, partitions, etc., in which they are located. Determine the location subject to the approval of the Departmental Representative. Access panels to be installed by trade experienced in work with surface in which the panel is to be installed.

.3 Mark mechanical access points in accessible ceilings with distinctive but inconspicuous tags properly attached to the ceiling grid. Obtain sample approval before purchase and installation. Indicate on record drawings.

.4 Accessibility shall be defined as:

.1 Ability to place both hands on equipment or device, with no duct, pipe or other equipment in the way.

.2 Must be accessible while standing on maximum 2400 mm high stepladder.

.3 Must be in plain view.

.5 Mark mechanical access points in accessible ceilings with distinctive but inconspicuous tags properly attached to the ceiling grid. Obtain sample approval before purchase and installation. Indicate on record drawings.

2.7 SLEEVES AND PENETRATIONS

.1 Install sleeves for all piping passing through floors and walls.

.2 Sleeves as specifically noted, or through structural walls shall be Schedule 40 steel. All other sleeves are 6 mm galvanized sheet steel.

.3 Fit sleeves flush on either side of the wall through which they pass, extend sleeves through floors and terminate 50 mm above finished floor. Adjust as necessary to accommodate the requirements of through-penetration fire-stopping systems.

.4 Where passing through walls, make sleeves a minimum 6 mm clear of the piping, through floors make sleeves a minimum of 20 mm clear of the piping. Pack for full depth with fiberglass insulation & finish with a lagging compound. Penetrations through fire separations shall be repaired to maintain rating.

.5 Provide escutcheon plates with setscrews to completely cover openings for all exposed pipes passing through walls, subject to the approval of the Departmental Representative. Provide chrome-plated plates in finished areas unless otherwise approved.

.6 Be responsible for maintaining integrity of building envelope when making penetration to install equipment or devices. Enlist services of qualified trade to make openings in and/or repairs to building envelope.

.7 Sleeving through steel beams shall be permitted only where approved by the Departmental Representative in writing or where expressly indicated on the Contract Documents. Sleeves are NOT permitted in concrete beams.

.8 Seal all sleeves to make watertight.

2.8 COUNTER FLASHINGS

.1 In addition to the requirements in Division 01, provide watertight, non-corroding, counter flashings for all penetrations of the building envelope, painted to match adjacent materials after proper preparation and painting. Refer to drawings, including building drawings, for additional information.

.2 Installation to allow for movement and accommodate high temperatures where necessary.

.3 For short pipes, the flashing may overlap the end, in lieu of attachment to the pipe. Minimum 300 mm high above the roof, c/w water break above maximum water level on the roof, to negate wind effects.

.4 All galvanized material to be 0.7 mm thick minimum.

.5 In exposed locations, flashings must be aesthetically acceptable to the Departmental Representative.

.6 Co-ordinate with all other trades including roofer and metal wall panel installer.

.7 For copper pipe use 0.82 mm sheet copper, soldered to pipe end c/w solder joints.

.8 For galvanized ducts use galvanized sheet metal soldered to the duct and c/w soldered joints.

.9 For cast iron and steel pipes at normal temperature, use manufactured stretch fit heavy neoprene flashings c/w galvanized protective layer.

.10 For hot pipes clamp galvanized to the pipe with a temperature rated gasket and stainless steel worm gear clamp.

.11 For aluminum and stainless steel, use the same materials for the flashing.

.12 For manufactured hoods, fans and rooftop unit mounting, apply a low density neoprene gasket all around and fasten securely.

Part 3 Execution

3.1 GENERAL

.1 All Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Do not scale the Drawings. Consult the Architectural Drawings and details for exact locations of fixtures and equipment; where some are not definitely located, obtain this information from the Departmental Representative.

.2 Follow Drawings as closely as possible in laying out work and check Drawings of all other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. When headroom or space conditions

appear inadequate, notify the Departmental Representative before proceeding with the installation.

.3 Make reasonable modifications in the layout as needed without extra compensation to prevent conflicts with work of other trades or for proper execution of the work. This shall include, but not necessarily be confined to, offsets in piping or ducts, transformation in ductwork and relocation of ducts and piping up to 3.0 m either way on each item as required to suit on site job conditions.

.4 Where variances occur between the Drawings and Specifications or within either document itself, include in the contract, the item or arrangement of better quality, greater quantity, and higher cost or clarify before tenders close. The final decision on the item and manner in which work is installed rests with the Departmental Representative.

.5 Provide, with all trades involved, marked-up drawings, when requested, of mechanical spaces indicating all dimensions for all installations prior to the work being done. Report any discrepancies to the Departmental Representative. Any conflicts arising that may have been resolved by laying the work out in this manner will be resolved WITHOUT ADDITIONAL COMPENSATION.

.6 Provide 48 hours minimum notice to Departmental Representatives of all work before it is concealed. Expose concealed work for inspection, upon request, when proper notice was not provided and pay all costs therefore, including making good other trades' work.

3.2 SURVEYS AND MEASUREMENTS

.1 Base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements shown on the Drawings at the site, and check the correctness of same as related to the work.

.2 Notify the Departmental Representative if any discrepancy is discovered between the actual measurements and those indicated which prevent following good practice or the intent of the Drawings & Specifications. Do not proceed with the work until receiving instructions from the Departmental Representative.

3.3 CO-ORDINATION

.1 Give full co-operation to those doing work under other Divisions of the specifications and furnish in writing with copies to the Departmental Representative any information necessary to permit the work of all Divisions to be installed satisfactorily and with least possible interference or delay.

.2 Discuss work with other Divisions prior to installation. Confirm proposed locations for equipment installed by this Division will not interfere with work installed by others.

.3 If work is installed before coordinating with other trades or so as to interfere with work of other trades, make necessary changes in the work to correct the conditions without extra compensation.

.4 When requested, provide marked up drawings indicating required clearances for installation of plumbing equipment. Provide section drawings indicating location of other equipment not installed by Division 23, such as other equipment and piping,, cable trays, etc. Report any discrepancies to the Departmental Representative.

3.4 ACCESSIBILITY

.1 Locate all equipment that must be serviced, operated or maintained in fully accessible positions, with minimum interference and maximum usable space. If required for better accessibility, furnish access doors for this purpose. Make deviations from Drawings to allow for good accessibility, obtaining prior approval for changes of magnitude.

3.5 SCAFFOLDING, RIGGING, HOISTING

.1 Unless otherwise specified, furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of any equipment apparatus furnished. Remove same from the premises when no longer required.

.2 Take precautions not to overload the structure in any manner nor provide inadequate scaffolding and rigging so as to endanger the safety of personnel on the site whether under this Division's employ or otherwise.

3.6 CUTTING AND PATCHING

.1 Cutting shall be performed neatly by this trade. No hammering or other methods are permitted without approval of the Departmental Representative and other trades affected. Utilize a rebar detector and stud finder to ensure cutting does not damage other elements.

.2 Patching is to be done by the appropriate trade. Arrange and pay for all patching not specifically specified elsewhere in these specifications, including fire rated patching at fire separations.

.3 Fill voids around pipes and ducts with fiberglass batt insulation and sheet metal closure strips. For fire separations, install fire stop material in accordance with manufacturer's

details as required to meet the UL classification and to match separation rating. Ventilate adequately during curing. Provide adequate structural support in larger spaces. Install slightly above floors to provide positive drainage away from pipe or duct.

.4 Provide a structural shop drawing stamped by a Professional Engineer showing all reinforcements required for openings through the structure. Allow for all costs of the reinforcement.

3.7 SUPPORTS

.1 Provide all necessary and recommended supports for all equipment furnished under this Division. Co-ordinate and facilitate all necessary and recommended foundations, pads, bases and piers provided under other Divisions for equipment furnished or installed under this Division.

3.8 WATERPROOFING

.1 Obtain approval for the installation method employed where any work pierces waterproofing concrete and waterproofing. Furnish all necessary grout rings sleeves, caulking, curbs, counter flashing and flashing required to make openings through roofs, walls, floors, etc., absolutely watertight. This applies to, but is not restricted to, roof exhausters, relief vents, penthouses, ducts, grilles, pipes, etc. Work involving the roofing is done in conjunction with the roofing Division. Work passing through roofing is to be done in accordance with applicable C.R.C.A. "FL" Series details.

3.9 PROTECTION

.1 Protect the work and material of all other sections from damage and make good all damage thus caused, to the satisfaction of the Departmental Representative.

.2 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

3.10 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.2 All dirt, rubbish, or grease on walls, floors or fixtures for which this Division is responsible must be removed and the premises left in first class condition in every respect.

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.3 Perform cleaning operations in accordance with manufacturer's recommendations.

.4 Clean all HVAC piping and equipment and leave in a condition to receive paint.

.5 Clean the interior of all ductwork. Ducts 750 x 300 mm and larger shall be vacuumed by hand. Power vacuum ducts smaller than 750 x 300 mm through duct openings, etc.

3.11 EQUIPMENT START-UP

.1 HVAC contractor shall ensure that all electrical/HVAC components match and that it is safe to start-up HVAC equipment.

.2 All support such as electrical contractor, controls contractor, etc., shall be arranged by the mechanical and all trades directly involved in equipment being started shall be present for start-up.

3.12 MANUFACTURERS' RECOMMENDATIONS

.1 Install, adjust, test, start-up, and maintain all equipment in strict accordance with the manufacturer's recommendations. If in conflict with the drawings and specifications, contact the Departmental Representative for clarification.

.2 Ensure that the manufacturer recommends the product for its intended use. If in doubt, contact the Departmental Representative.

3.13 PERSONNEL PROTECTION

.1 In addition to the requirements in Division 01, provide visual warning signs and/or markers and mechanical protection devices for all mechanical items mounted below the minimum limits listed below and suspended more than 1500mm clear of the floor.

.1	Occupied spaces	2286 mm (7'-6").
.2	Service spaces	2133 mm (7'-0").
.3	Crawl spaces	1524 mm (5'-0").

.2 Visual warning devices to be yellow tape with black stripes adhered to the entire perimeter of the item infringing on the occupied space. This will include but not be limited to:

.1 Length of pipes or equipment below specified height.

.3 Mechanical protection devices to be 7 mm (¼") wire mesh guard and/or 25 mm thick 'Armaflex' type insulation. This will include but not be limited to:

.1 Pipe and equipment hangers.

.2 Valves.

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Material and installation of pipe work in general.

1.2 REFERENCES

.1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B24, Cast Copper Alloy Pipe Flanges and Flanged Fittings.

.2 ANSI/ASME B39, Malleable Iron Threaded Pipe Unions.

.3 ANSI/ASME B42, Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300.

.2 American Society for Testing and Materials (ASTM)

.3 American Society of Mechanical Engineers (ASME)

.1 ASME B31.9 – Building Services Piping.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 GENERAL

.1 Installations shall include all devices, attachments, equipment, components and piping necessary to form a complete working system to code requirements.

2.2 VALVES

.1 Refer to the specific pipe specification sections for valve types.

.2 All valves of one type (e.g. gate valves) must be of one manufacturer. Ensure that working pressure, size and manufacturer's name are cast or stamped into the body of each valve.

.3 Use O. S. & Y. design on all valves 100 mm and larger unless specifically noted otherwise.

.4 Provide valves with hand wheels accessible for operation.

2.3 STRAINERS

.1 Provide Y-type strainers where, indicated on the drawings and where specified herein, in piping system, full size of the connected piping ahead of each pump, control valve, meter, etc. Install bucket or basket strainers only where indicated on the drawings.

.2 All strainers shall have the same end connections and working pressure as the attached piping is specified.

.3 Use monel screens with a reinforced edge. Perforations shall be 0.8 mm for steam, 1.6 mm for condensate, 3.2 mm for chilled and hot water, and 3.2 mm ahead of pumps.

.4 Provide 20 mm blow-off lines with ball valves, piped directly to drain on all strainers over 50 mm.

2.4 DIELECTRIC PIPE FITTINGS /UNIONS

.1 Dielectric fittings factory certified to withstand a minimum of 600 volts on a dry line with no flashover. Unions rated at 1.7 MPa conforming to ANSI B16.39. Flanged fittings rated at 1.2 MPa conforming to ANSI B16.24 (bronze) and B16.42 (iron).

2.5 PIPE SLEEVES AND SEALS

.1 Where piping penetrates below grade walls or floors:

.1 Seal: modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening complete with 316 stainless steel fasteners. Seal elements shall be sized and selected per manufacturer's recommendations and be suitable for the required fire-resistance rating and anticipated environmental conditions. Standard of acceptance: 'Link-Seal".

.2 Sleeve: custom-sized molded HDPE sleeves matched to the mechanical seal dimensions complete with reinforcing ribs, end caps, and integrally formed hollow water stop having a minimum outside diameter 100 mm larger than the diameter of the sleeve itself and allowing 13 mm movement between wall forms to resist pour forces. Standard of acceptance: 'Century-Line'

.2 Elsewhere: Schedule 40 black steel pipe sleeve.

Part 3 Execution

3.1 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping is subject to movement.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, and components.

3.3 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.

.4 Provide air vents as required to assist in draining the piping.

.5 Drain valves: Ball valves unless otherwise approved, NPS 3/4 minimum. Provide hose end male thread, cap and chain where not piped to drain

3.4 AIR VENTS

.1 Install manual air vents at high points in piping systems.

.2 Install isolating valve at each automatic air vent.

.3 Install drain piping to approved location and terminate where discharge is visible.

3.5 DIELECTRIC COUPLINGS

.1 General: Compatible with system, to suit pressure rating of system.

.2 Locations: Where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: Isolating flanges.

3.6 PIPEWORK INSTALLATION

.1 Install exposed piping, equipment, rectangular cleanouts and similar items approximately as shown, parallel or perpendicular to building lines and as close to the structure as possible.

.2 Conceal all piping except where otherwise approved. Install concealed piping to minimize furring space, maximize headroom, and conserve space.

.3 Exposed piping must be carefully installed to be pleasing to the eye and meet the Architect's requirements.

.4 Install all pipe mounted control devices, such as control valves and wells.

.5 Assemble piping using fittings manufactured to ANSI standards.

.6 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main. Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.7 Use only eccentric reducing fittings at pipe size changes, installed with the piping in line at the top to ensure positive drainage and venting.

.8 Use only long radius welding or soldered fittings in expansion loops, not screwed fittings.

.9 American National Taper pipe thread must be used for all thread connections. Remove burrs and chips and ream or file the pipe ends out to size of bore.

.10 Leave not more than 2 threads exposed on threaded joints when made up.

.11 Screwed fittings jointed with Teflon tape.

.12 Do not use

.1 running nipples.

.2 threaded protectors as couplings.

.3 direct welded or screwed connections to valves, equipment or other apparatus.

.13 Protect openings against entry of foreign material.

.14 Ream pipes, remove scale and other foreign material before assembly.

.15 Slope piping for positive drainage and venting.

.16 Arrange piping to permit flushing.

.17 Group piping, wherever possible.

.18 Provide anchors and sway braces to Departmental Representative approval.

.19 Provide for thermal expansion.

.20 Provide for movement due to seismic events as required by the NBC and applicable NFPA standards.

3.7 EXPANSION OF PIPING

.1 Install all piping systems with due regard and provision for expansion avoiding strain or damage to the building and equipment. Where pipe runs past building expansion joints, provide expansion compensation.

.2 Only major expansion configurations and fittings have been detailed on the drawings. Provide all required additional compensators, loops and swing connections as specified herein, and in accordance with good trade practice.

.3 Use swing connections with a minimum of 3 elbows (i.e. four fittings including the tee) where required. These swing connections are not always shown on the piping drawings for reasons of clarity; they must however, be installed. Where close tolerances do not permit the installation of a complete swing connection, consult the Departmental Representative prior to the closing of tender.

.4 Install expansion loops cold spring 50 percent of the calculated expansion. Use compensator type expansion joints with suitable pressure ratings for radiation piping where required. Install compensators with double guides on inlet and outlet with distances in accordance with manufacturer's instructions. Where not indicated, calculate compensator expansion equal to 38 mm per 30 m of run between the anchors.

.5 Schedule for Expansion Loops:

.1 Maximum Distance between Anchors:

.1 Heating Hot Water; copper 30 m, steel 45 m.

.2 Loop Size Required:

Pipe Size NPS	Loop Size (m)
3/4	1.22
1	1.27
1-1/4	1.32
1-1/2	1.37
2	1.42
2-1/2	1.53
3	1.68
4	1.98

.6 If the length between anchors is 50% of the maximum listed above, then the loop can be reduced to 67% of that listed.

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.7 Loops shall be located midway between guides.

3.8 PIPE GUIDES

.1 Provide alignment guides where required for proper operation of the system.

3.9 PIPE ANCHORS

.1 Provide substantial pipe anchors. Anchors shall be suitably attached to the structure and the pipe to prevent movement.

3.10 PIPE SLEEVES AND SEALS

.1 General: Install where pipes pass through masonry structures, concrete structures, beams, fire rated assemblies, and elsewhere as indicated. Be responsible for maintaining the integrity of the building envelope when making penetrations. Enlist the services of qualified trade(s) to make openings in, and/or repairs to, building envelope.

.2 Sleeve Sizes:

.1 Walls and beams: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.2 Floors: 20 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.3 Sleeve Installation:

.1 Concrete walls, masonry walls, beams, and concrete floors on grade: Terminate flush with finished surface.

.2 Other floors:

.1 Terminate 50 mm above finished floor.

.2 Adjust as necessary to accommodate the requirements of through-penetration fire-stopping systems.

.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.4 Sealing:

.1 Foundation walls and below grade floors: Fire retardant, waterproof, modular mechanical seal.

.2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.

.3 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.

.4 Ensure no contact between copper pipe or tube and sleeve.

3.11 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: One piece type with set screws. Chrome or nickel plated brass or stainless steel.

.3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.12 PREPARATION FOR FIRESTOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Firestopping.

.2 Uninsulated unheated pipes not subject to movement: No special preparation.

.3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.

.4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.13 FLUSHING OUT OF PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

.2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning supplemented as specified in relevant sections of Division 23.

.3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.14 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Departmental Representatives 48 hours minimum prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections of Division 23 where specified, otherwise test to requirements of ASME B31.9.

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.3 Test all piping, with the exception of atmospheric vents and sanitary piping, hydraulically to 1½ times the operating pressure but not less than 860 kPag.

.4 Prove piping with less than 14 kPa pressure drop and no visible leakages for a period of 24 hours with a hydraulic test.

.5 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or test media.

.6 Conduct tests in presence of Departmental Representative or designate approved by the Departmental Representative.

.7 Pay costs for testing, repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

.8 Insulate or conceal work only after approval and certification of tests by Departmental Representative. Test underground piping prior to backfilling.

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 This section includes a list of manufacturers whose products are approved for installation in the work, provided the product chosen meets with the required design characteristics as particularly noted in the specifications and equipment schedules, and matches the design features of the item where a particular trade name and model is given, and suits the installation. Conform to space limitations on products, which are approved as equal in design characteristics. If the model or size selection is doubtful, contact the Departmental Representative to ensure acceptability.

.2 Related Sections:

.1 Everything in this Project Manual is a requirement for this Division. The following references constitute assistance to the Contractors. Refer to the Table of Contents for additional guidance.

.1 Sections beginning with 23 05.

1.2 APPROVED MANUFACTURER APPROVAL

.1 The Drawings and Specifications are based upon manufacturers whose products are specified for installation in the work.

.2 Any other manufacturers requesting "approved equal" status must request approval from the Department Representative by letter stating specifically the items on which he wishes to quote and enclosing all necessary engineering data. Submit electronic copies of all requests. Include the appropriate specification and/or drawing references. Requests should be made at least 14 days prior to closing of tenders, and an addendum may then be issued by the Departmental Representative, prior to closing of tenders, listing any further Acceptable Manufacturers. Late requests may not be approved. Provide additional information requested by the Departmental Representative to facilitate evaluation.

.3 The Departmental Representative may also take other factors into account.

1.3 CHANGES DUE TO USE OF DIFFERENT MANUFACTURERS

.1 Where the Contractor proposes to use an item of equipment other than that detailed on the Drawings which requires any redesign of the structure, partitions, foundations, piping, wiring or of any other part of the mechanical, electrical or architectural layout, all such redesign and all new Drawings and details required shall, with the approval of the Departmental Representative, be prepared by the Contractor at his own expense.

.2 Where deviations are approved requiring a different quantity or arrangement of ductwork, piping, wiring, conduit and equipment from that indicated on the Drawings, this Division is responsible to furnish and install all such ductwork piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system, without additional compensation.

Part 2 Products

2.1 HEATING, VENTILATION & AIR CONDITIONING ACCEPTABLE MANUFACTURERS LIST

Equipment		Acceptable Manufacturers
.1	Vibration Isolation	Amber/Booth, Mason, VAW Systems, Vibron
.2	Grilles, Registers, Diffusers	Nailor, Price, Titus
.3	Air Filters	AAF, Camfil Farr
.4	Ceiling Exhaust Fans	Cook, Greenheck, PennBarry
.5	In-Line Cabinet Fans	Cook, Greenheck, PennBarry
.6	Split Air Conditioning Systems	Mitsubishi, Daikin, LG
.7	Variable Air Volume Boxes	EH Price, Titus, Nailor
.8	Chemical Treatment	Match the Existing Manufacturer
.9	Duct Sealer	Duro-Dyne, McGill Airseal
.10	Flexible Ductwork	Flexmaster, Thermaflex
.11	Fire Dampers	Greenheck, Nailor, NCA, Price, Ruskin
.12	Volume Extractors	Nailor, Price, Titus
.13	Backdraft Dampers	Greenheck, Nailor, Ruskin
.14	Flexible Duct Connector	Carlisle Hardcast, Duro Dyne, Dyn/Air
.15	Welding Fittings	Anvil, Comco, Crane

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.16	Malleable Iron Fittings, Flanges, Flange Gaskets	Anvil, Crane, Mueller
.17	Mechanical Pipe Joints	Gruvlok, Star, Victaulic
.18	Pipe Hangers and Saddles	Anvil, Crane, Myatt
.19	Alignment Guides	Adsco, Anvil, Flexon, Fulton, Yarway
.20	Ball Valves	Apollo, Crane, Kitz, Toyo
.21	Drain Valves	Crane, Toyo
.22	Gate and Globe Valves - Rising Stem	Crane, Toyo, Velan
.23	Horizontal Check Valves – up to ∅50mm	Crane, Toyo, Velan
.24	Horizontal Check Valves – ∅64mm and larger	Check-Rite, Crane, Tyco, Velan
.25	Vertical Check Valves – up to ∅50mm	Val-Matic 1400S, Durabla WLC
.26	Vertical Check Valves – ∅64mm	Val-Matic 1400, Durabla C-1
.27	Vertical Check Valves – ∅75mm and larger	Val-Matic 1800, Durabla GLC
.28	Butterfly Valves	Bray, Keystone
.29	Balancing Valves - Manual	Armstrong, Danfoss, Griswold, Tour & Andersson
.30	Safety and Relief Valves	Cash-Acme, Conbraco, Consolidated, Kunkle
.31	Expansion Joints and Flexible Connections	Fulton, Hyspan, Senior Flexonics, Yarway, VAW
.32	Air Vents	Dole, Maid-O-Mist, Spirotherm
.33	Strainers	Armstrong, Spirax Sarco, Toyo, Watts
.34	Pressure Gauges and Thermometers	Ashcroft, H.O. Trerice, Winters
.35	Auxiliary Test Ports	Peterson Equipment “Pete’s Plug II”, Sisco, Watts
.36	Refrigerant Piping and Accessories	Mueller Brass, Sporlan
.37	Acoustic Duct Lining	CertainTeed, Knauf, Manson, Johns Manville, Owens Corning
.38	Mechanical Insulation – Fiberglas	Knauf, Manson, Johns Manville, Owens Corning

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.39	Mechanical Insulation – Flexible Cellular Polyolefin	Armaflex, Imcoa, Merryweather
.40	Mechanical Insulation – Fire Retardant Canvas	Fattal, Radley, Robson
.41	Electric Motors	Baldor, G.E., Leeson, Toshiba, Westinghouse

Part 3 Execution

.1 Not used.

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Mechanical identification of piping, ducts, accessories, and equipment.

.2 Related sections:

.1 Refer to sections beginning with 21 05 for Common Work Results for Fire Protection.

.2 Refer to sections beginning with 22 05 for Common Work Results for Plumbing.

.3 Refer to sections beginning with 23 05 for Common Work Results for HVAC.

.4 Section 01 33 00 - Submittal Procedures.

.5 Section 09 91 23 - Interior Painting.

1.2 REFERENCES

.1 Canadian Gas Association (CGA)

.1 CSA/CGA B149.1, Natural Gas and Propane Installation Code.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3, Identification of Piping Systems.

.3 National Fire Protection Association

.1 NFPA 13, Installation of Sprinkler Systems.

.2 NFPA 14, Standpipe and Systems.

1.3 PRODUCT DATA

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

.2 Product data to include paint colour chips, other products specified in this section.

1.4 SAMPLES

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

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers to be raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: Manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: Use size # 5.

.2 Equipment in Mechanical Rooms: Use size # 9.

.5 Identification for PWGSC Preventive Maintenance Support System (PMSS):

.1 Use arrangement of Main identifier, Source identifier, Destination identifier.

.2 Equipment in Mechanical Room:

.1 Main identifier: Size #9.

.2 Source and Destination identifiers: Size #6.

.3 Terminal cabinets, control panels: Size #5.

.3 Equipment elsewhere: Sizes as appropriate.

2.4 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Natural gas: to CSA/CGA B149.1 .

.2 Propane gas: to CSA/CGA B149.1.

.3 Sprinklers: to NFPA 13.

.4 Standpipe and hose systems: to NFPA 14.

2.5 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:

.1 Where required, to Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 All other pipes: Pressure sensitive [plastic-coated cloth] [vinyl] with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100%RH and continuous operating temperature of 150oC and intermittent temperature of 200oC.

.7 Colours and Legends:

.1 Where not listed, obtain direction from Departmental Representative.

.2 Colours for legends, arrows: To following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Chilled water supply	Green	CH. WTR. SUPPLY
Chilled water return	Green	CH. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HOT GLYCOL
Hot glycol heating supply	Yellow	HEATING SUPPLY
Hot glycol heating return	Yellow	HOT GLYCOL RETURN
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Waste water	Green	WASTE WATER
Storm water	Green	STORM
Sanitary	Green	SAN

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Contents	Background colour marking	Legend
Plumbing vent	Green	SAN. VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
Natural gas	to Codes	
Gas regulator vents	to Codes	
Sprinklers	Red	SPRINKLERS

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

2.7 VALVES, CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.9 LANGUAGE

.1 Identification to be in English.

Part 3 Execution

3.1 TIMING

.1 Provide identification only after all painting specified Section 09 91 23 - Interior Painting has been completed.

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3.2 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and or CSA registration plates as required by respective agency.

.3 Identify systems, equipment to conform to PWGSC PMSS.

3.3 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection

.1 Do not paint, insulate or cover in any way.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: At not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction and where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.

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.9 Identification to be easily and accurately readable from usual operating areas and from access points.

.1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 CONCEALED EQUIPMENT

.1 Where equipment or valves are located above accessible ceilings or behind access panel, provide lemuroid label to indicate location of concealed equipment. Label shall indicate valve or equipment tag. In the case where the valve or equipment does not have a tag, identify with descriptive wording (example “Dom. Water Valve”).

3.6 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S"hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Testing, adjusting and balancing HVAC systems and equipment.

1.2 REFERENCES

.1 Associated Air Balance Council (AABC)

.1 AABC National Standards for Total System Balance

.2 AABC Test and Balance Procedures

1.3 GENERAL

.1 TAB means to test, adjust and balance in accordance with requirements of Contract Documents and to do other work as specified.

.2 TAB to be done by an independent AABC certified testing company. The TAB company must be a firm specializing in such work, equipped with a full range of calibrated instruments, and experienced in adjustment and operation of mechanical systems.

1.4 QUALIFICATIONS OF TAB PERSONNEL

.1 Names of personnel proposed to perform TAB to be submitted and approved by Departmental Representative within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

1.5 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

.2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.6 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.7 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, final adjustments and re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with affected systems.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.8 INSTRUMENTS

.1 Prior to TAB, submit to Departmental Representative list of instruments to be used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative, prior to start of TAB work on site.

1.9 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit to the Departmental Representative, prior to commencement of TAB:

.1 A written description of approach to TAB for each system, written specifically for the project, outlining sequence and procedures for the work. Include relevant information including, but not limited to, location of main duct traverses, approach to optimizing system setpoints, concerns affecting other trades such as weatherstripping and penetration sealing, and possible limitations of specified equipment and design that may affect TAB. Identify deviations in methodology from referenced standards and commonly accepted industry practice.

1.10 PRELIMINARY TAB REPORT

.1 Submit for review and approval by Departmental Representative, prior to submission of formal TAB report:

.1 Details of instruments used.

.2 Details of TAB procedures employed, if different from procedures submitted earlier.

.3 Calculations procedures.

.4 Preliminary measurements.

1.11 TAB REPORT

.1 Format to be in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 System schematics.

.2 TAB data.

.3 Discussion of results, with focus on system where measurements deviated significantly from design values along with possible cause and/or recommendations for correcting problem.

.3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English, spiral or Cerlox bound with covers, complete with index tabs.

1.12 VERIFICATION

.1 Reported results subject to verification by Departmental Representative.

.2 Provide manpower and instrumentation to verify up to 30 % of reported results.

.3 Number and location of verified results to be at discretion of Departmental Representative.

.4 Bear costs to repeat TAB as required to satisfaction of Departmental Representative.

1.13 SETTINGS

.1 After TAB is completed to satisfaction of Departmental Representative, return systems and equipment to final operation condition. Replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Markings shall not be covered in anyway and shall be permanent and not easily eradicated.

.1 Mark position of balancing dampers using permanent pen, indicating position of damper handle on duct or quadrant.

.2 Set memory stop function on calibrated balancing valves. If ball or globe valves have been used for TAB, install locking quadrant or other means of permanently identified TAB setpoint.

1.14 COMPLETION OF TAB

.1 TAB to be considered complete when final TAB Report received and reported approved by Departmental Representative in writing.

1.15 INSTRUMENT TEST PORTS AND HOLES

.1 Coordinate test openings with Division 23.

.2 Utilize permanent test ports where installed by Division 23.

.3 Where permanent test ports are not installed, make openings as required to facilitate the TAB. Seal test port openings in ductwork using rubber plugs or material with similar properties, which are not easily removed. Hard or semi-flexible plugs such as nylon or polyethylene will not be accepted. Submit samples for each side to the Departmental Representative for approval prior to installation. Alternately, patch ductwork using sheet metal patch screwed to duct and seal with aluminium tape or duct sealant.

1.16 DRIVE CHANGES FOR BELT DRIVEN EQUIPMENT

.1 Allow for drive changes on all belt driven equipment.

.1 Include sheaves and bushings for driver and driven equipment, belts and other equipment and tools necessary to make drive change.

.2 Include all manpower necessary to make drive change, including removal and reinstallation of guards.

.3 For belt driven equipment forming part of life safety systems, such as pressurization or smoke exhaust fans, allow for minimum of two drive changes for each piece of equipment where less than 5 pieces are installed, or if more than 5 are installed, allow for total of 10 drive changes.

1.17 DESIGN INTENT APPLICABLE TO TAB WORK

.1 Arrange a meeting with the Departmental Representative to review design intent for all systems prior to the start of TAB. Obtain all information relevant to TAB work prior, including, but not limited to minimum outside air volume flowrates, relative pressurization setpoints and locations, temperature, humidity setpoints.

1.18 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

.1 Not used.

Part 3 Execution

3.1 GENERAL

.1 Investigate all problems and resolve with the contractor's help, to ensure all values are within range. Obtain direction from the Departmental Representative when necessary.

.2 Perform coil testing, adjusting and balancing only when outside conditions are commensurate with design conditions for the given system.

3.2 PRE-TAB REVIEW

.1 Review contract documents and submit documentation specified below in writing to the Departmental Representative prior to the installation of any systems that will require TAB.

.2 Arrange and attend a meeting with the Departmental Representative and appropriate trades to review and discuss adequacy of provision for TAB and other aspects of design and installation pertinent to success of TAB. Meeting to occur at least 2 weeks before installation of any mechanical systems that will require TAB.

.3 Review proposed location of sensors and test ports with other trades to confirm that locations are suitable for TAB equipment and will permit repeatable measurements to permit recalibration on HVAC controls sensors.

.4 Review location of balancing dampers and control valves for adequacy with respect to successful TAB completion.

.5 Confirm in writing to Departmental Representative adequacy of provisions for TAB, noting any inadequacies that may require attention.

.6 Review specified standards and report to Departmental Representative in writing all proposed procedures that vary from standard.

3.3 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere.

3.4 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

3.5 START OF TAB

.1 Notify Departmental Representative 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.1 Installation of ceilings, doors, windows, other construction affecting TAB. Application of weatherstripping, sealing, caulking.

.2 All pressure, leakage, other tests specified.

.3 All provisions for TAB installed and operational.

.4 Areas served by air system are clean and dust producing activities have been suspended.

.3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Clean filters in place.

.2 Duct systems and equipment, including inside of air handlers, clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 Grilles, register and diffusers installed, volume control dampers open.

.3 Liquid systems:

.1 Flushed, filled, vented.

.2 Correct pump rotation.

.3 Strainers in place, baskets clean.

.4 Isolating and balancing valves installed, open.

.5 Calibrated balancing valves installed, at factory settings.

.6 Chemical treatment systems complete, operational.

3.6 APPLICATION TOLERANCES

.1 All balancing to meet AABC requirements.

.2 Do TAB to following tolerances of design values:

.1 Air systems: plus or minus 10% of the quantities shown on the drawings for each component, and to within 5% of design requirements for the overall system. Small systems below 250 l/s to be balanced within 20% or 20 l/s.

.2 Hydronic systems: plus or minus 10% of the quantities shown on the drawings for each component, and to within 5% of design requirements for the overall system.

.3 Check all change orders and clarifications to ensure current information is utilized.

3.7 ACCURACY TOLERANCES

.1 Measured values to be accurate to within plus or minus 2 % of actual values.

3.8 VERIFICATION OF CONTROLS SYSTEMS

.1 TAB contractor shall assist in verification, demonstration and calibration of the HVAC controls systems, specified under Division 23.

.2 Perform measurements at test ports to confirm calibration of controls sensors, including temperature, pressure, flow rate and humidity and report on measured versus sensed values.

3.9 AIR SYSTEMS

.1 Standard: TAB to be to most stringent of this section or TAB standards of AABC or NEBB.

.2 Do TAB of systems, equipment, components, controls specified in Division 23.

.3 Qualifications: personnel performing TAB to be current member in good standing of AABC or NEBB.

.4 Quality assurance: Perform TAB under direction of supervisor qualified by standards of AABC or NEBB.

.5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, and controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, current draw, noise, vibration.

.6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:

.1 Fan coil discharge and return,

.2 Fresh supply to each fancoil,

.3 Discharge at each diffuser,

.4 Inlet flow at each exhaust inlet.

.7 Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

.8 Measure and report quantity of outside air at minimum and maximum airflow for each system having an outside air connection.

3.10 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

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.2 Building pressure conditions:

.1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions at all times.

.2 Measure and report on building pressure during different operating mode and at various quantities of outside air. Report measurements at different percentages of outside based on total system air volumes, in increment of 10%. Perform measurements when all systems are in normal operating modes.

3.11 FIRE AND SMOKE DAMPERS

.1 Refer to 23 33 16 Dampers – Fire and Smoke.

3.12 SCHEDULE

.1 Schedule the balancing to suit the progress of the work. Make every attempt to complete the work, or at least the affected local work, prior to occupancy or partial occupancy.

.2 In phased projects, complete the work in each phase, as it is completed. Make final checks and corrections as required to all phases at the completion of the entire project.

3.13 FINAL ADJUSTMENT

.1 Allow for a final adjustment, as directed by the Departmental Representative. Revise the reports accordingly.

3.14 POST- OCCUPANCY TAB

.1 Measure DBT, WBT (or %RH), air velocity, air flow patterns, noise levels, in occupied zone as directed by Departmental Representative once building as occupied.

.2 Participate in systems checks twice during Warranty Period – first visit approximately 3 months after acceptance and 2nd within 1 month of termination of Warranty Period.

END OF SECTION

□

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Material and installation of insulation and fire rating material for ductwork.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IESNA 90.1, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).

.2 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.3 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.4 ASTM C553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.5 ASTM C612, Specification for Mineral Fiber Block and Board Thermal Insulation.

.6 ASTM C795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.

.7 ASTM C921, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701, Thermal Insulation Polystyrene, Boards and Pipe Covering.

1.3 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.4 “k” factor – refers to a measure to thermal conductivity/resistance and is measured in Watts per square meter per degree Celsius

.2 TIAC Codes:

.1 CRD: Code Round Ductwork.

.2 CRF: Code Rectangular Finish.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit following additional information: Manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.5 SAMPLES

.1 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.6 QUALIFICATIONS

.1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather and construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions recommended by manufacturer.

1.8 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Provide and apply insulation in accordance with TIAC National Insulation Standards Specification 1502, Commercial Duct and Plenum, and as herein specified:

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 oC mean temperature when tested in accordance with referenced standard.

.3 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.4 Type D-1: Rigid mineral fibre board with FSK reinforced foil and paper jacket.

.1 Mineral fibre: to ASTM C612.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum “k” factor: 0.0337 W/m°C at 24°C.

.4 Density: 48 kg/m3.

.5 Type D-2: Mineral fibre blanket with FSK reinforced foil and paper jacket.

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: 0.0337 W/m°C at 24°C.

.4 Density: 16 kg/m3.

.6 Type D-3: Flexible Cellular Polyolefin.

.1 Insulation: ASTM C1427.

.2 Maximum "k" factor: 0.036 W/m°C at 24°C.

2.3 FIRE RATED MATERIAL

.1 Applies to Area of Refuge (AOR) system ductwork that is not with in fire rated shaft, or in an AOR, or is in AOR but serves more than one AOR.

.2 Fire resistant duct insulation wrap with insulation totally encapsulated in foil to meet the durability requirements of NFPA-96.

.3 Ceramic based core insulation material with high temperature stability, low thermal conductivity and corrosion resistance.

.4 Product must be approved for 2hr fire rating and zero clearance with butt-joint (non-overlapping) installation.

2.4 JACKETS

.1 Canvas:

.1 220 gm/m2 fire resistant cotton, plain weave, to ASTM C921 and ULC listed.

.2 Lagging adhesive: inorganic, water-based fire-resistive lagging adhesive and coating, ULC listed.

.2 Aluminium:

.1 Jacket: To ASTM B209, minimum H-14 temper with heat-laminated moisture barrier liner.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Stucco embossed.

.4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.5 ACCESSORIES

.1 Vapour retarder lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.

.4 Outdoor Vapour Retarder Mastic:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m2.

.5 Tape: self-adhesive, aluminum, plain, 50 mm wide minimum.

.6 Contact adhesive: quick-setting

.7 Canvas adhesive: washable.

.8 Tie wire: 1.5 mm stainless steel.

.9 Banding: 19 mm wide, 0.5 mm thick stainless steel.

.10 Fasteners: 14 gauge diameter pins with 30mm diameter or 927 mm2 square clips, pin length to suit thickness of insulation.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of ductwork systems complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION - INSULATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer's instructions and as indicated.

.3 Use two layers with staggered joints when required nominal thickness exceeds 50mm. Where multiple layers are required, layer nearest duct need not require jacket.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.2 Seal all penetrations and joints with tape or vapour retarder adhesive.

.5 Supports, Hangers in accordance with 'Hangers and Supports for HVAC Piping and Equipment'.

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: At 300 mm on centre in horizontal and vertical directions, minimum two rows each side.

.7 Where ducts are internally insulated, thickness of internal lining may be deducted from external insulation.

.8 Type D-2 insulation may be substituted for Type D-1 insulation on rectangular ductwork if the ductwork has no dimension greater than 500mm.

.9 Round ducts greater than 600mm diameter requiring insulation, apply Type D-1 rigid board scored to accommodate curvature of duct.

.10 Duct dimensions shown on drawings are clear inside internal duct insulation

3.3 INSTALLATION – FIRE RATING MATERIAL

.1 Install as per manufacturer's written instructions.

3.4 JACKETS

.1 Applied to insulation where located as follows:

.1 Indoor, concealed:

.1 No additional finish required.

.2 Indoor, exposed:

.1 Rectangular: To TIAC Code CRF/2: Apply continuous metal corner bead and apply vapour barrier tape. Cover with canvas with fabric adhesive, and apply one (1) coat of fabric coating.

.2 Round: To TIAC Code CRD/2: Cover with canvas with fabric adhesive, and apply one (1) coat of fabric coating.

.3 Outdoor:

.1 Aluminium jacket.

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3.5 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: Conform to following table:

	Type	Vapour Retarder	Thickness (mm)
Rectangular and round >600mm dia. cold and dual temperature supply air ducts,	D-1	yes	25
Round cold and dual temperature supply air ducts <600mm dia.	D-2	yes	25
Return air ducts	None	n/a	n/a
Rectangular warm air ducts	D-1	no	25
Round warm air ducts >600mm dia.	D-1	no	25
Round warm air ducts <600mm dia.	D-2	no	25

END OF SECTION

□

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Material and installation of insulation of HVAC pipes and fittings, including well water piping.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1, Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings

.2 American Society for Testing and Materials (ASTM)

.1 ASTM B209, Specification for Aluminum and Aluminum Alloy Sheet and Plate

.2 ASTM C335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.6 ASTM C921, Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.7 ASTM C547 Standard Specification for Mineral Fiber Pipe Insulation

.8 ASTM C1136 Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

.9 ASTM C533 Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

.10 C1427 Specification for Extruded Preformed Flexible Cellular Polyolefin Thermal Insulation in Sheet and Tubular Form

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts

.4 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

.5 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.3 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings

1.3 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" – plumbing piping in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.2 TIAC ss:

.1 CRF: Code Rectangular Finish.

.2 CPF: Code Piping Finish.

1.4 QUALIFICATIONS

.1 Installer to be specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather, construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

1.6 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Provide sample board with all types of insulation and proper labelling.

1.7 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Provide and apply insulation in accordance with TIAC National Insulation Standards Specification 1501, Piping, and as herein specified:

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 oC mean temperature when tested in accordance with ASTM C335.

.3 Type P-1: Rigid moulded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C547.

.2 Maximum "k" factor: 0.033 W/m°C to ASTM C547.

.3 Acceptable material: Knauff, Manville Micro-lok

.4 Type P-2: Flexible Cellular Polyolefin.

.1 Insulation: ASTM C1427.

.2 Maximum "k" factor: 0.036 W/m°C at 24°C to ASTM C1427.

.3 Acceptable material: Imcoa Imcolok

.5 Type P-3: Calcium Silicate.

.1 High temperature abuse resistant.

.2 ASTM C 411 to 649 C (1200 F).

.6 Type P-4: Cellular Glass.

.1 Insulation to ASTM C552

2.3 INSULATION SECUREMENT

.1 Tape: Self-adhesive, fibreglass reinforced foil-white kraft paper lamination, 50 mm wide minimum.

.2 Contact adhesive: low VOC, air-drying adhesive.

.3 Canvas adhesive: Washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

2.4 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.5 INDOOR VAPOUR RETARDER FINISH

.1 Water based, fire retardant type, compatible with insulation.

2.6 OUTDOOR VAPOUR RETARDER FINISH

.1 Water based, fire retardant type, compatible with insulation.

.2 Reinforcing fabric: polyester fibre with PVA finish.

2.7 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type and sheet with pre-formed shapes.

.2 Colour and finish: white, gloss.

.3 Service temperature range: -18oC to 66oC.

.4 Moisture vapour transmission: 0.02 perm.

.5 Thickness: 0.50 mm.

.6 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.2 Canvas:

.1 220 gm/m2 fire resistant cotton, plain weave, to ASTM C921 and ULC listed.

.2 Lagging adhesive: inorganic, water-based fire-resistive lagging adhesive and coating, ULC listed.

.3 Aluminium:

.1 Jacket: To ASTM B209, minimum H-14 temper with heat-laminated moisture barrier liner.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Stucco embossed.

.4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

.4 Stainless steel:

.1 Type: 304.

.2 Thickness: 0.25 mm.

.3 Finish: 4.7mm Corrugated, dull.

.4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

.5 Laminate Foil Film:

.1 Five-ply laminate foil film consisting of 3 layers of aluminum foil, and 2 layers of polyester with factory-applied pressure sensitive acrylic adhesive.

2.8 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: At valves, primary flow measuring elements and flanges and unions at equipment. Apply to expansion joints only where permitted by the expansion joint manufacturer's recommendations.

.2 Design: To permit periodic removal and replacement without damage to adjacent insulation. For expansion joints, design to permit full range of motion for expansion joint.

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.3 Insulation:

.1 Insulation, fastenings and finishes: same as for piping.

.2 Jacket: as scheduled.

2.9 WEATHERPROOF CAULKING FORJACKETS INSTALLED OUTDOORS

.1 Silicones sealant:

.1 One part formulation, industrial grade, clear.

Part 3 Execution

3.1 PRE- INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION - GENERAL

.1 Install in accordance with TIAC National Standards, following manufacturer's instructions and this specification. In case of conflict between TIAC National Standard's, manufacturer's instructions and this specification, this specification shall govern, unless otherwise directed by the Departmental Representative.

.2 Use two layers with staggered joints when required nominal insulation thickness exceeds 75 mm.

.3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.4 Supports, Hangers:

.1 Apply high compressive strength insulation, as indicated below, at oversized saddles where insulation shoes have not been provided.

.1 Hot piping: Calcium silicate or Perlite.

.2 Cold piping: cellular glass or high density foam.

.3 Wood blocks or plastic inserts are acceptable only where approved by the Departmental Representative.

.5 Insulate valves, valve bonnets, strainers, flanges and fittings unless otherwise specified to same requirements as associated piping.

.6 Carry insulation through floors and walls on services above 121°C (250°F) or below room temperature.

.7 Ensure adequate ventilation is provided upon initial heating of insulation, where manufacturer indicates that fumes and odors may be released.

3.3 INSTALLATION OF TYPE P-1 INSULATION (FIBREGLASS):

.1 Without integral jacket: mechanically fasten at 300mm centres.

.2 With integral jacket: staple flap on 75mm centres.

.3 Insulation with self-sealing lap seal integral to jacket requires no additional fastening.

.4 Seal butt joints with self-sealing butt strips, minimum 50mm wide.

3.4 INSTALLATION OF TYPE P-2 INSULATION (ELASTOMERIC)

.1 Follow manufacturer's instructions.

3.5 JACKETS

.1 Canvas:

.1 Make jacket ready to receive painted finish by applying lagging adhesive and coating to entire surface.

.2 Aluminum and Stainless Steel:

.1 Outdoor installations:

.1 Water-proof installation.

.2 Apply silicone sealant under longitudinal and circumferential lap joints. Further apply silicone sealant along seam of longitudinal and circumferential joints.

.3 Locate longitudinal joints in jacket at bottom of pipe.

3.6 HEAT TRACED PIPES

.1 Provide insulation oversized to accommodate the heat tracing without any gaps.

.2 Confirm compatibility of insulation with the heat tracing before ordering.

.3 Insulation and tracing to extend in through the outside wall.

3.7 SPECIFIC APPLICATIONS

.1 Thickness:

.1 As listed in following table.

.2 Runouts:

.1 Runouts up to 50mm to individual terminal units, not exceeding 3.7m in length, may have insulation thickness reduced to 13mm.

.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

.3 Jackets:

.1 Type P-1 insulations:

.1 Exposed indoors:

.2 Pipe: Canvas.

.3 Valves and Fittings: PVC.

.2 Exposed in mechanical rooms:

.1 Pipe: Stainless steel.

.2 Valves and Fittings: Stainless steel.

.3 Concealed, indoors: canvas on valves, fittings. No further finish.

.4 Outdoors:

.1 Inaccessible areas, such as roofs: Aluminum.

.2 Accessible areas: Stainless steel.

.5 On Type P-2 insulation:

.1 Indoors:

.1 No further finish required.

.2 Outdoors:

.1 PVC.

3.8 INSULATION SCHEDULE

Service	Sizes	Type	Thick	VB	Fittings
Refrig Suction Piping (indoors)	ALL	P-2	25mm	YES	YES

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Refrig Hot Gas (indoors)	ALL	P-2	19mm	NO	NO
Refrig Suction Piping (outdoors)	ALL	P-2	25mm	YES	YES
Hydronic Chilled Water Piping	13-50mm	P-1	25mm	YES	YES

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for:

.1 Controls and instrumentation.

.2 Energy monitoring and control system.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 DEFINITIONS

.1 Average Effectiveness Level (AEL): ratio between a thirty day test period less any system down time accumulated within that period, and the thirty day period.

1.4 WORK INCLUDED

.1 Provide DDC controls for VAV boxes, to match existing on-site control system and connect directly to the existing network(s) and existing web-server operator interface software. Controls contractor shall supply actuator to terminal unit manufacturer for installation. If actuator is supplied by terminal unit manufacture, ensure compatibility with other controls equipment.

.2 Interface BACnet adapters supplied by air conditioner manufacture with BMS. Controls contractor shall review air conditioner shop drawings and shall provide all necessary components to interface with existing BMS. BMS shall be capable of remote monitoring of all Air Conditioner functions, including status, set points, and alarms.

.3 Components and interconnecting systems to be installed by trained technicians, regularly employed by this Division. Technician must be qualified and approved to work on existing BMS which is Siemens.

1.5 DESIGN REQUIREMENTS

.1 Provide direct digital controls, management, and monitoring for all new equipment to integrate with existing building controls system.

.2 Monitor new bypass VAV boxes, split air conditioning system, and ensure any existing equipment controls are maintained. Including but not limited to existing fan coils and perimeter heating controls.

.3 System to function as Energy Monitoring and Control System (EMCS).

.4 Provide digital controllers, programmable and independently operable (stand alone). Provide system immune to voltage fluctuations and spikes, radio frequency interference, power failures, and surges.

.5 Incorporate high speed communications network using industry standard protocol to link independent controllers, local terminals and the command and management centre. Ensure that communications link permits access and information transfer between points within network.

.6 Provide connection point in mechanical rooms for portable computer to permit access to information and system communications network.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Co-ordinate submittal requirements and provide submittals.

.3 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for:

.1 Provide for purchased components.

.2 Include complete technical information regarding operating ranges, input and output capabilities.

.4 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Manufacturer's Field Services: submit reports within three days of receipt from manufacturer.

.7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include data as follows:

.1 Indicate: brief description of self-contained packaged heating, cooling or ventilation units.

.2 Provide for units, manufacturer's name, type, year, number of units, and capacity.

.3 Submit complete start-up report indicating start-up and system verification sequences.

.4 Submit manufacturer's standard warranty, executed by authorized company official.

1.7 WARRANTY

.1 For Work of this Section, 12 months warranty period.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and 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.

Part 2 Products

2.1 COMPONENTS

.1 Sensors: use industry standard digital or analog signal ranges.

.2 Motors and Relays: electric-electronic type, heavy duty construction, designed for industrial environment.

.3 Monitoring Software:

.1 Integrate with existing system and add menus and graphics as required.

2.2 CONTROLS

.1 Monitor status of and control following systems:

.1 New VAV boxes

.2 New split air conditioning system

.3 All existing equipment that is currently being monitored shall continue being monitored.

.2 Thermostats: wall mounted, equipped with lockable lexan guards. Use remote space temperature sensors in public areas.

Part 3 Execution

3.1 SEQUENCE OF OPERATIONS

.1 VAV Bypass Boxes:

.1 Cooling only

.1 On a rise in room temperature, the thermostat will call for cooling and modulate the actuator open. The actuator slowly rotates the damper shaft to increase the cold air to the room.

.2 On fall in room temperature, the thermostat reverses the above action. The actuator slowly rotates the damper shaft clockwise to decrease the cold air to the room.

.2 Split air conditioning systems shall have packaged controls and sequences of operations. The system shall come with a BACnet interface and the building control system shall be able to monitor status, temperatures, set points and alarms.

.1 Cooling only

.1 On a rise in room temperature, the thermostat will call for cooling and initiate space air conditioner.

.2 On fall in room temperature, the thermostat reverses the above action.

.3 Meeting Room Transfer Fans:

.1 Fans are manually activated with room speed controller.

.4 Existing fan coils and perimeter heating sequences to remain the same. Confirm all sequences with existing controls systems.

.1 Fan Coils

.1 On a rise in room temperature, the thermostat will call for cooling and modulate the chilled water valve open.

.2 On a fall in room temperature, the thermostat will reverse the above action.

.2 Perimeter heating.

.1 On a fall in room temperature, the thermostat will call for heating and modulate the hot water valve open.

.2 On a rise in room temperature, the thermostat will reverse the above action.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.3 INSTALLATION

.1 Install components to manufacturer's written instructions.

.2 Exposed wiring: run in conduit or EMT.

.3 Run control pipe and tubing parallel to building structure. Bundle tubing together and run in ladder trays where applicable.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Have manufacturer of products, supplied under this Section, 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: 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, or other Work, on which the 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 the Work, after cleaning is carried out.

.4 Obtain reports, within 3 days of review, and submit, immediately, to Departmental Representative.

.2 Performance Verification:

.1 Operate equipment and verify that performance criteria specified in this section has been achieved.

.2 Perform periodic site inspection visits by manufacturer's representative to verify that installation complies with manufacturer's instructions:

.1 After delivery and storage of products.

.2 When preparatory Work upon which product installation depends is complete.

.3 Twice during installation progress at 25% and 60% complete.

.4 After installation and cleaning is complete.

3.5 DEMONSTRATION

.1 Demonstrate equipment to 01 79 00 - Demonstration and Training.

.2 Provide instructors to train designated personnel. Include adjustment, operation, maintenance and safety requirements of equipment and system provided, specific to this installation.

.3 Training Materials: provide training English manual for trainees.

3.6 COMMISSIONING

.1 Commission equipment of this Section to 01 91 13 - General Commissioning (Cx) Requirements.

.2 Verify operation of subsystems, including field components.

.3 Conduct final operational test of not less than 30 consecutive days, 24 hours per day, on entire control system.

.1 Average effectiveness level (AEL): minimum 99%.

.2 Extend test period each day until required AEL is reached for 30 consecutive calendar days.

.4 Advise Departmental Representative when proper system operation is established. Departmental Representative will perform point by point check of hardware and software items including graphics and displayed data.

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END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Materials and installation for steel piping, valves and fittings for hydronic systems in building services piping.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME).

.1 ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings.

.2 ASME B16.3, Malleable Iron Threaded Fittings.

.3 ASME B16.5, Pipe Flanges and Flanged Fittings.

.4 ASME B16.9, Factory-Made Wrought Buttwelding Fittings.

.5 ASME B16.20, Metallic Gaskets for Pipe Flanges: Ring Joint Spiral Wound and Jacketed

.6 ASME B16.21, Nonmetallic Flat Gaskets for Pipe Flanges

.7 ASME B18.2.1, Square and Hex Bolts and Screws (Inch Series).

.8 ASME B18.2.2, Square and Hex Nuts (Inch Series).

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.

.2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.

.3 ASTM A536, Standard Specification for Ductile Iron Castings.

.4 ASTM B61, Standard Specification for Steam or Valve Bronze Castings.

.5 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.

.6 ASTM E202, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.

.3 Canadian Standards Association (CSA International).

.1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.

.2 CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).

.4 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67, Butterfly Valves.

.2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71, Cast Iron Swing Check Valves Flanged and Threaded Ends.

.4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.5 MSS-SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

.5 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).

.1 ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch).

.2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.6 American Society for Testing and Materials International, (ASTM).

.1 ASTM A276, Specification for Stainless Steel Bars and Shapes.

.2 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.3 ASTM B283, Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).

.4 ASTM B505/B505M, Specification for Copper-Base Alloy Continuous Castings.

.7 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

.1 MSS-SP-25, Standard Marking System for Valves, Fittings, Flanges and Unions.

.2 MSS-SP-80, Bronze Gate Globe, Angle and Check Valves.

.3 MSS-SP-110, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 MAINTENANCE

.1 Extra Materials.

.1 Provide following spare parts:

.1 Valve seats: one for every ten valves, each size. Minimum one.

.2 Discs: one for every ten valves, each size. Minimum one.

.3 Stem packing: one for every ten valves, each size. Minimum one.

.4 Valve handles: two of each size.

.5 Gaskets for flanges: one for every ten flanges.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:

.1 Chilled water, hot water heating, glycol piping services:

.1 To NPS 10: Schedule 40.

2.2 PIPE JOINTS

.1 Except as noted below:

.1 NPS2 and under: screwed fittings with PTFE tape or lead-free pipe dope.

.2 NPS2-1/2 and over: grooved couplings and fittings or welded

.2 Branch connections to radiation/wall fin up to 25mm may be formed on mains using manufactured threaded connection fittings, manufactured by ASTM A181, Grade 1.

.3 Pipe thread: taper.

2.3 FITTINGS

.1 Screwed fittings: malleable iron, to ASME B16.3, Class 150

.2 Pipe flanges and flanged fittings:

.1 Cast iron: to ASME B16.1, Class 125.

.2 Steel: to ASME B16.5, Class 150.

.3 Forged carbon steel flanges. Use 1034 kPa flanges on water system operating up to 682 kPa. Use 2068 kPa flanges on systems operating above 682 kPa.

.4 Plain face for connecting to materials of lesser strength, such as cast iron or bronze.

.5 Raised face when connecting to materials of equal strength. Provide raised face on only one flange of each joint, unless otherwise recommend by manufacturer.

.3 Flange gaskets: to ASME B16.21

.4 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.

.5 Butt-welding fittings: steel, to ASME B16.9.

.6 Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.

.7 Use long radius elbows.

.8 Orifice flanges: slip-on raised face, 2100 kPa.

.9 Dielectric Flanges and Unions:

.1 Provide where pipes of dissimilar metals are joined. Unions to be rated to 150C.

.10 Provide unions or flanges for pipe 50mm and smaller and flanges on piping 64mm and larger.

2.4 VALVES

.1 General:

.1 Application for each valve type indicated is for general information only. Refer to drawings and other specifications sections for additional valve applications.

.2 Except for specialty valves, to be single manufacturer.

.3 All products to have CRN registration numbers.

.4 Connections:

.1 NPS2 and smaller: screwed ends.

.2 NPS2.1/2 and larger: Flanged ends.

.2 Ball valves: to MSS-SP-110:

.1 NPS 2 and under:

.1 Body and cap: cast high tensile bronze to ASTM B62.

.2 Pressure rating: Class125.

.3 Connections:

.1 Screwed ends to ANSI B1.20.1. and with hexagonal shoulders.

.4 Stem: tamperproof ball drive.

.5 Stem packing nut: external to body.

.6 Ball and seat: replaceable chrome-plated brass solid ball and teflon seats.

.7 Stem seal: TFE with external packing nut.

.8 Operator: removable lever handle

.3 Gate valves: to MSS-SP-70 and MSS-SP-82, as applicable

.1 Application: Isolating equipment, control valves, pipelines .

.2 NPS 2 and under, rising stem, solid wedge disc, Class 125

.1 Body: bronze, screwed connections with hexagonal shoulder.

.2 Bonnet: screwed with stem retaining nut.

.3 Packing: PTFE

.4 Operator: non-ferrous handwheel.

.5 Use non-rising stem only where space is constrained, upon approval of the Departmental Representative.

.3 NPS 2 1/2 - 8, non rising stem, inside screw, bronze trim, solid wedge disc, Class 125:

.1 Body, bonnet: cast iron to ASTM B209 Class B, bolted bonnet.

.2 Connections: flanged ends to ANSI B16.1.

.3 Disc: solid offset taper wedge, bronze to ASTM B62.

.4 Packing and gaskets: non-asbestos.

.5 Seat rings: renewable bronze to ASTM B62, screwed into body.

.6 Stem: bronze to ASTM B62.

.7 Operator: Handwheel, die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49. Nut of bronze to ASTM B62.

.4 Globe valves: to MSS-SP-80 and MSS-SP-85, as applicable.

.1 Application: Throttling, flow control, emergency bypass:

.2 NPS 2 and under, composition disc, Class 125:

.1 Body: bronze, screwed connections with hexagonal shoulder.

.2 Bonnet: union bonnet.

.3 Packing: PTFE

.4 Disc and seat: renewable rotating, PTFE disc, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.

.5 Operator: non-ferrous handwheel.

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.6 Use non-rising stem only where space is constrained, upon approval of the Departmental Representative.

.3 NPS 2 1/2 - 8, outside screw and yoke, rising stem, bronze trim, solid bronze disc, Class 125:

.1 Body: with multiple-bolted bonnet.

.2 Bonnet-yoke gasket: non-asbestos.

.3 Disc: bronze to ASTM B62, fully guided from bottom, securely yet freely connected to stem for swivel action and accurate engagement with disc.

.4 Seat ring: renewable, regrindable, screwed into body.

.5 Stem: bronze to ASTM B62.

.6 Operator: Handwheel.

.5 Balancing, for Testing, Adjusting and Balancing:

.1 Application: measurement and flow adjustment at equipment, branch and main pipelines.

.1 NPS 2 and under:

.1 Body: bronze with brass ball, carbon filled TFE seat rings, with differential pressure read-out ports across valve seat.

.2 Connections: screwed or sweat

.3 Read-out ports: fitted with check valve, internal insert.

.4 Calibrated nameplate, memory stop feature to permit closing of valve for service without affecting balance setting.

.2 NPS 2 ½ to 3:

.1 Body: cast iron with brass ball, carbon filled TFE seat rings, with differential pressure read-out ports across valve seat.

.2 Connections: flanged

.3 Read-out ports: fitted with check valve, internal insert.

.4 Calibrated nameplate, memory stop feature to permit closing of valve for service without affecting balance setting.

.3 NPS 4 and larger:

.1 Body: cast iron with bronze seat, replaceable bronze disc, EPDM seal insert, with differential pressure read-out ports across valve seat.

.2 Connections: flanged

.3 Read-out ports: fitted with check valve, internal insert.

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.4 Calibrated nameplate, memory stop feature to permit closing of valve for service without affecting balance setting.

.6 Drain valves:

.1 Application: to permit draining of equipment and pipelines.

.1 Pipe sizes up to NPS 10:

.1 NPS ¾ ball valve with ¾" male threaded hose connection, cap and chain.

.7 Swing check valves: to MSS-SP-71 and MSS-SP-80, as applicable.

.1 Application: at inlet to pumps, bypass lines.

.1 NPS 2 and under, Y-pattern swing type, bronze disc, Class 125:

.1 Body: bronze, screwed connections with hexagonal shoulder.

.2 Cap: screwed.

.3 Disc: brass to NPS ¾, bronze to NPS 2

.2 NPS 2 ½ and over: Swing check valves, Class 125:

.1 Body and bolted cover: with tapped and plugged opening on each side for hinge pin.

.2 Flanged ends: plain faced with smooth finish.

.1 Up to NPS 16: cast iron to ASTM A126 Class B.

.3 Disc: rotating for extended life..

.1 Up to NPS 6: bronze to ASTM B 62.

.2 NPS 8 and over: bronze-faced cast iron.

.4 Seat: renewable bronze to ASTM B62 screwed into body.

.5 Hinge pin, bushings: replaceable brass.

.8 Multi-purpose valves (combination check/balancing/isolation valve):

.1 Application: on discharge side of pumps

.2 NPS 2 and under, straight pattern:

.1 Body: bronze, screwed connections.

2.5 STAINLESS-STEEL BELLOW, FLEXIBLE CONNECTORS

.1 Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.

.2 End Connections: Threaded or flanged to match equipment connected.

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.3 Performance: Capable of 20-mm (3/4-inch) misalignment.

.4 CWP Rating: 1035 kPa (150 psig).

.5 Maximum Operating Temperature: 121 deg C (250 deg F).

Part 3 Execution

3.1 PIPING INSTALLATION

.1 Install piping approximately as shown, with all lines being carried parallel to building walls and as close to the structure as possible.

.2 Conceal all piping except where otherwise approved. Exposed piping must be carefully in a neat and tidy manner and must meet the Architect's requirements with respect to visual appearance.

.3 Grade water and glycol lines up in direction of flow to aid in venting.

.4 Cold spring piping where change in directions are shown for expansion compensation.

.5 Where existing equipment is relocated, extend hydronic piping and relocate valves and accessories.

3.2 VALVES

.1 Install valves of type suitable to the application at the following locations and as indicated on the drawings:

.1 Isolation valves:

.1 Inlet and outlet to each piece of equipment.

.2 Ahead of control valves.

.3 Provide isolation valve on discharge of balancing valves.

.4 Base of risers..

.5 On each branch line adjacent to main, where branch serves more that one piece of equipment.

.6 Use ball valves for service on water and glycol service.

.2 Drain valves:

.1 Low points of piping systems.

.2 At each piece of equipment.

.3 Check valves:

.1 Discharge of pumps.

.4 Balancing valves:

.1 Discharge of pumps.

.2 Outlet piping from coils, radiation, unit and force flow heaters.

.2 Install rising stem valves in upright position with stem above horizontal.

.3 Provide 3 valve by-passes at the following locations:

.1 Pressure reducing valves.

.2 Around coil control valves where design entering air temperature is less than 5C.

.4 Provide union or flange downstream of isolation valves to permit removal of equipment.

3.3 WELDING

.1 Make pipe to pipe welded joints with open, secure butt welds, reinforced by metal in excess of the net throat dimensions by at least 1.5 (1/16") built up to give a gradual increase in thickness from edge to centre. Clean all rust, paint, oil, grease or foreign matter from all welding faces and adjoining pipe surfaces for a depth of at least 12 (½") from the edge of welding groove. Maintain a surface clearance of 1.5 (1/16"). Carefully align piping using proper clearances and tacking before welding. Leave welded surfaces clean.

.2 Welding must be performed by welders with proper certificates. All field welding must be in accordance with the procedures of CSA-W55.2-1957 and CSA-W117.2-1974 and the current edition of ASME Code for Power Piping. Do not caulk or pean welds. Perform all welding above 4.4°C (40°F) if necessary preheat to at least 21°C (70°F).

3.4 FLEX CONNECTIONS

.1 Install flexible connections at connections to base-mounted pumps. Flexible connections not required on inline pumps unless recommended by pump manufacturer.

.2 Install to absorb vibration and misalignment.

.3 Insulate same as pipe.

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3.5 CIRCUIT BALANCING VALVES

.1 Install valve of size appropriate to design flow expected through valve. Coordinate with TAB contractor and confirm sizing with valve manufacturer.

.2 Provide straight pipe lengths upstream and downstream of valve to manufacturer's recommendations. Relocate valve if necessary to accommodate these requirements, subject to approval of the Departmental Representative.

3.6 CLEANING, FLUSHING AND START-UP

.1 In accordance with Section – 'Cleaning and Start-Up of Mechanical Piping Systems'.

3.7 TESTING

.1 Test system in accordance with Section 23 05 02 Installation of Pipework.

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Refrigerant piping and accessories

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.22, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.

.2 ASME B16.24, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.

.3 ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.

.4 ASME B31.5, Refrigeration Piping.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 ASTM B280, Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.3 Canadian Standards Association (CSA)

.1 CSA B52, Mechanical Refrigeration Code.

.4 Environment Canada (EC)

.5 EPS 1/RA/1, Environmental Code of Practice for the Reduction of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 TUBING

.1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.

.1 Hard copper: to ASTM B280, type ACR.

.2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.2 FITTINGS

.1 Service: design pressure 2070 kPa and temperature 1210C.

.2 Brazed:

.1 Fittings: wrought copper to ASME B16.22.

.2 Joints: silver solder, copper-phosphorous, 95% Cu-5%P and non-corrosive flux.

.3 Flanged:

.1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.

.2 Gaskets: suitable for service.

.3 Bolts, nuts and washers: to ASTM A307, heavy series.

.4 Flared:

.1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

.1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

.1 22 mm and under: Class 500, 3.5 MPa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.

.2 Over 22 mm: Class 375, 2.5 MPa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

2.5 REFRIGERANT

.1 Refrigerant type used shall be R410A

Part 3 Execution

3.1 GENERAL

.1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5.

3.2 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

3.3 PIPING INSTALLATION

.1 General:

.1 Soft annealed copper tubing: bend without crimping or constriction

.2 Hard drawn copper tubing: do not bend. Minimize use of fittings.

.2 Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

.3 Install refrigerant piping according to ASHRAE 15.

.4 Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

.5 Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

.6 Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

.7 Install piping adjacent to machines to allow service and maintenance.

.8 Install piping free of sags and bends.

.9 Install fittings for changes in direction and branch connections.

.10 Select system components with pressure rating equal to or greater than system operating pressure.

.11 Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

.12 Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as required if valves or equipment requiring maintenance is concealed behind finished surfaces.

.13 Install refrigerant piping in protective conduit where installed belowground.

.14 Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

.15 Slope refrigerant piping as follows:

.16 Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.

.17 Install horizontal suction lines with a uniform slope downward to compressor.

.18 Install traps and double risers to entrain oil in vertical runs.

.19 Liquid lines may be installed level.

.20 When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

.21 Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:

.22 Shot blast the interior of piping.

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.23 Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.

.24 Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.

.25 Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.

.26 Finally, draw a clean, dry, lintless cloth through the tube or pipe.

.27 Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.

.28 Install pipe sleeves at penetrations in exterior walls and floor assemblies.

.29 Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."

.30 Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

.31 Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

.32 Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.

.33 Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2MPa and 1MPa on high and low sides respectively.

.3 Test Procedure: Build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

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3.5 DEHYDRATION AND CHARGING

.1 Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 130C for at least 12 hours before and during dehydration.

.3 Use copper lines of largest practical size to reduce evacuation time.

.4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5Pa absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:

- .1 Twice to 14Pa absolute and hold for 4 h.
- .2 Break vacuum with refrigerant to 14kPa.
- .3 Final to 5Pa absolute and hold for at least 12 h.
- .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
- .5 Submit test results to Departmental Representative.

.7 Charging:

- .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
- .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
- .3 Re-purge charging line if refrigerant container is changed during charging process.

.8 Checks:

- .1 Make checks and measurements as per manufacturer's operation and maintenance instructions.
- .2 Record and report measurements to Departmental Representative.

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END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation of galvanized ductwork, joints and accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.1 ASHRAE Handbook – Fundamentals.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM A924/A924M, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.3 Canadian Standards Association (CSA International)

.1 CAN/ULC-S109M, Standard for Flame Tests of Flame-Resistant Fabrics and Films.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 HVAC Duct Construction Standards - Metal and Flexible.

.2 HVAC Air Duct Leakage Test Manual.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, G90/Z275 zinc coating, with tolerances to ASTM A924/A924M.

.2 Thickness, fabrication and reinforcement: to SMACNA HVAC Duct Construction Standards.

.3 Joints: to SMACNA HVAC Duct Construction Standards.

2.2 PRESSURE CLASSIFICATION

.1 Pressure Class: to match maximum design external static pressure of fans systems.

2.3 DUCTWORK

.1 Construction - round and oval.

.1 Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA HVAC Duct Construction Standards.

.2 Transverse joints up to 900 mm: slip type with tape and sealants.

.3 Transverse joints over 900 mm: Vanstone flanges.

.2 Construction - rectangular:

.1 Ducts: factory fabricated to SMACNA HVAC Duct Construction Standards.

.2 Transverse joints: to SMACNA HVAC Duct Construction Standards.

2.4 FITTINGS

.1 Fabrication: to SMACNA HVAC Duct Construction Standards.

.2 Radiused elbows:

.1 Rectangular: smooth radius. Centreline radius: 1.5 times width of duct.

.2 Round and oval: smooth radius or five-piece (for 90 degrees) and three-piece (for 45 degrees). Centreline radius: 1.5 times duct diameter.

.3 Mitred elbows:

.1 To 750 mm duct height in plane of turn: with single-thickness turning vanes.

.2 Over 750 mm duct height in plane of turn: with double-thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: connection with 45 degree entry.

.2 Round main and branch: conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.5 Transitions:

.1 Diverging: 10 degrees maximum angle each side; 20 degrees maximum included angle for symmetrical fittings.

.2 Converging: 22.5 degrees maximum angle each side; 45 degrees maximum included angle for symmetrical fittings.

.6 Offsets:

.1 Full radiused or mitred elbows: as specified above.

.7 Obstruction deflectors: maintain full cross-sectional area of duct.

.1 Maximum included angles: as for transitions.

2.5 SEAL CLASSIFICATION

.1 Seal class:

Systems	Pressure Class (Pa)	Seal class
supply air	+500	B
exhaust air	-500	B
Misc. exhaust discharge	+250	B
Misc. exhaust suction	-500	C

.2 Seal Classification:

.1 Class B: longitudinal seams, transverse joints and connections made airtight with sealant and tape or combination thereof.

.2 Class C: transverse joints and connections made air tight with sealant and tape or combination thereof. Longitudinal seams unsealed.

2.6 SEALANT

.1 Sealant: oil resistant, water-based, polymer type flame resistant duct sealant.

.2 Flame spread rating shall not exceed 25 and smoke developed classification shall not exceed 50.

.3 Operational temperature range of minus 32 degree C to plus 93 degree C. Application temperature range of plus 4 degree C to plus 43 degree C.

2.7 REINFORCING TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

.2 Meets the flame-resistance requirements of CAN/ULC-S109M.

2.8 HANGERS AND SUPPORTS

.1 Hangers and Supports:

.1 Hanger configuration, design, and construction: to SMACNA HVAC Duct Construction Standards.

.2 Strap hangers: Maximum rectangular duct size supported by strap hanger: 500 mm on longest side.

.1 Straps of same material as duct but next sheet metal thickness heavier than duct.

.2 Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

.3 Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

.3 Band hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum round or oval duct size supported by strap hanger: 500mm diameter.

.4 Trapeze hangers and Riser Supports: ducts over 500 mm diameter or longest side, to SMACNA HVAC Duct Construction Standards.

.1 Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

.2 Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

.3 Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

.5 Hangers: galvanized steel angle with galvanized steel rods to SMACNA HVAC Duct Construction Standards.

.6 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamps.

.3 For steel beams: manufactured beam clamps.

.7 Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with SMACNA HVAC Duct Construction Standards unless directed otherwise by Departmental Representative.

.2 First class workmanship is required for fabrication and installation. Submit samples and/or detailed shop drawings of different types of fittings, joints, supports, sealants, etc, when requested by the Departmental Representative.

.3 Locate ductwork approximately as shown on drawings unless otherwise prevented by jobsite conditions. Carefully coordinate duct layouts with other services, particularly where exposed in occupied spaces. Conceal all ductwork unless otherwise directed and approved by the Departmental Representative. Report all layout deviations to the Departmental Representative for approval prior to installation.

.1 Ductwork on drawings are based on existing drawings. Not all ductwork is visible. Therefore, contractor shall allow for deviations in ductwork layout and offsets as required for installation.

.4 Construct ducts in accordance with the dimensions shown on the drawings. Alter the duct dimensions, while maintaining the equivalent round duct diameter, where necessitated by jobsite conditions. Equivalent duct dimensions to be determined using ASHRAE Handbook duct design procedures.

.5 Duct dimension shown on drawings are inside dimensions. If ducts are internally lined or insulated, increase duct size such that clear dimensions after application of lining/insulation are equal to those shown on drawings.

.6 Adjust duct dimensions to suit standard control damper sizes.

.7 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.8 Support risers at each floor penetration. Provide neoprene pads between riser supports and the building structure. On exposed ductwork, provide galvanized angle collars to conceal the above work on both sides of the floor penetration.

.9 Lap all joints in the direction of air flow wherever possible.

.10 Provide a smooth interior surface at all seams and joints.

.11 Provide a straight collar, not less that 300 mm long, at the connection to each diffuser. Where this is not possible provide adjustable multi-blade type flow equalizing grid in the diffuser neck.

3.2 FITTINGS

.1 Fitting geometry to be in accordance with specifications and drawing details unless otherwise directed and approved by the Departmental Representative.

.2 Provide mitred elbows with turning vanes where jobsite conditions prevent installation of radiused elbows.

3.3 HANGERS

.1 Strap and band hangers: install in accordance with SMACNA HVAC Duct Construction Standards.

.2 Angle hangers: install in accordance with SMACNA HVAC Duct Construction Standards, complete with locking nuts and washers.

.3 Hanger spacing: in accordance with SMACNA HVAC Duct Construction Standards.

.4 Do not break continuity of insulation vapour barrier with hangers or rods.

3.4 SEALING AND TAPING

.1 Apply sealant to outside of joint in accordance with SMACNA HVAC Duct Construction Standards and to manufacturer's recommendations.

.2 Use reinforcing tape on all ducts with seal Class A; ducts with seal Class B or C and a pressure classification in excess of 500 Pa; and for larger gaps.

.3 Bed reinforcing tape in sealant and recoat with minimum of one coat of sealant to manufacturer's recommendations.

.4 Seal all joints including, but not limited to, at coils, terminal units, grilles and diffusers.

.5 Eliminate all audible noise caused by air leakage.

3.5 WATERTIGHT DUCT AND DRIP PANS

.1 Provide watertight duct for:

.1 Exhaust and relief air outlets.

.2 Outside air intakes.

.3 Minimum 3000 mm from duct mounted humidifier in all directions.

.4 As directed by Departmental Representative.

.2 Provide watertight drip pan below:

.1 Open-ended intakes for roof mounted equipment and hoods where condensation may occur.

.2 Cold equipment not insulated including pumps and water meters.

.3 As directed by Departmental Representative.

.3 Form bottom of horizontal duct or drip pan without longitudinal seams.

.1 Solder or weld joints of bottom and side sheets.

.2 Seal other joints with duct sealer.

.4 Slope horizontal branch ductwork down towards hoods served.

.1 Slope header ducts down toward risers.

.5 Fit base of riser with 150 mm deep drain sump and 25 mm drain, with deep seal trap and trap primer, discharging to open funnel or hub drain.

.6 Drip pan to be 75 mm wider all around ductwork or equipment served and complete with 75 mm deep drain sump. Elevated drip pans to be provided with 25 mm drain discharging to open funnel or hub drain. Provide sufficient clearance above drip pan to facilitate access and to permit unimpeded airflow to equipment or intake above.

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.7 Provide angle iron supports under sumps and drip pans adequate to support weight when full.

.8 Install drip pans level to maximize holding capacity.

.9 Fill sumps and drip pans with water to demonstrate strength, level and waterproof, when requested by Departmental Representative.

3.6 LEAKAGE TESTS

.1 Conduct tests in accordance with SMACNA HVAC Duct Leakage Test Manual.

.2 Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.

.3 Coordinate testing requirements with the TAB contractor who will perform leakage tests. Provide temporary caps and make duct modifications required to conduct the tests.

.4 Do leakage tests in sections.

.5 Leakage testing shall include HVAC equipment and terminal units. Where sections include equipment and terminal units, do not perform leakage testing until final connections have been made.

.6 Conduct trial leakage tests to demonstrate workmanship.

.7 Do not install additional ductwork until trial tests have been passed.

.8 Complete testing before installation of insulation or concealment Work.

.9 Give seven days' advance notice for testing.

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for duct accessories including flexible connections, access doors, turning vanes, balancing dampers, pressure gauges and thermometers.

1.2 REFERENCES

.1 Air Movement & Control Association International Inc.

.1 AMCA Standard 500-D, Laboratory Methods of Testing Dampers for Rating.

.2 AMCA Standard 511, Certified Ratings Program for Air Control Devices.

.2 Canadian Standards Association (CSA International)

.1 CAN/ULC-S109M, Standard for Flame Tests of Flame-Resistant Fabrics and Films.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 HVAC Duct Construction Standards - Metal and Flexible.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA HVAC Duct Construction Standards.

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.2 General: construction and air tightness suitable for duct air velocities and pressure class. The following are minimum requirements. Provide additional features where required to suit the Work.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: 75 mm wide galvanized sheet metal frame, 0.7 mm thick, with fabric clenched by means of double locked seams.

.2 Material:

.1 Indoor application: fire-resistant, self-extinguishing, neoprene-coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, 0.63 mm thick, and density of 1.02 kg/m2. Meets the flame-resistance requirements of CAN/ULC-109M.

.2 Outdoor application: fire-resistant, self-extinguishing, DuPont 'Durolon'-coated glass fabric, temperature rated at minus 40 degrees C to plus 120 degrees C, 0.61 mm thick, and density of 0.81 kg/m2.

2.3 ACCESS DOORS IN DUCTS

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: closed cell neoprene, continuous, between door and frame.

.4 Hinges: steel, zinc-plated, piano type, 90 mm wide x 90 mm minimum length unless otherwise specified.

.5 Sash Locks: steel, zinc-plated, cam type.

.6 Handles: corrosion-resistant zinc-aluminum alloy, steel and sponge shaft washers, inside and outside handles, plain finish.

.7 Hardware:

.1 Up to 300 mm on hinge (long) side: continuous piano hinge and one sash lock.

.2 301 to 600 mm on hinge (long) side: continuous piano hinge and two sash locks.

.3 601 to 900 mm on hinge (long) side: continuous piano hinge and minimum three sash locks.

.4 901 to 1500 mm on hinge (long) side: three piano hinges and three handles.

2.4 TURNING VANES

.1 Factory or shop fabricated of same material as duct.

.2 Single Thickness Vanes:

.1 Use for duct heights up to 750 mm in plane of turn.

.2 To 400 mm duct width in plane of turn: 51 mm radius with 19 mm trailing edge, 41 mm vane spacing.

.3 Over 400 mm duct width in plane of turn: 114 mm radius with 41 mm trailing edge, 83 mm vane spacing.

.3 Double Thickness Vanes:

.1 Use for duct heights over 750 mm in plane of turn.

.2 To 400 mm duct width in plane of turn: 51 mm radius, 41 mm vane spacing.

.3 Over 400 mm duct width in plane of turn: 114 mm radius, 83 mm vane spacing.

.4 Vane Runners: embossed.

2.5 INSTRUMENT TEST PORTS

.1 Cast aluminum or zinc-plated steel to suit duct material.

.2 Heavy duty leak-proof screw cap.

.3 Inside diameter to allow insertion of pitot tubes and other testing instruments. Length to suit insulation thickness.

.4 Neoprene mounting gasket, flat or curved to suit duct profile.

2.6 SPLITTER DAMPERS

.1 Of same material as duct but one sheet metal thickness heavier, with appropriate stiffening.

.2 Double thickness construction.

.3 Control rod with locking device and position indicator.

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.4 Rod configuration to prevent end from entering duct.

.5 Pivot: piano hinge.

.6 Folded leading edge.

.7 Vibration-free operation.

2.7 SINGLE BLADE DAMPERS

.1 Of same material as duct, but at least one sheet metal thickness heavier.

.2 Size and configuration to recommendations of SMACNA,

.3 Rectangular: V-groove stiffened blade, maximum height 200 mm.

.4 Round: frame with stiffening beads, continuous shaft for blades over 200 mm diameter.

.5 Locking quadrant with shaft extension to accommodate insulation thickness.

.6 Inside square end bearing and outside spring-loaded round end bearing.

.7 Vibration-free operation.

2.8 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Opposed-blade configuration, metal thickness and construction to recommendations of SMACNA.

.3 Maximum blade height: 150 mm.

.4 Maximum blade length: 1200 mm. Use multi-sectional dampers for applications exceeding 1200 mm.

.5 Bearings: pin in bronze bushings or self-lubricating nylon.

.6 Linkage: shaft extension to accommodate insulation thickness with locking quadrant.

.7 Channel frame of same material as adjacent duct, complete with angle stop.

.8 Vibration-free operation.

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2.9 VOLUME EXTRACTORS

.1 Factory manufactured of material compatible with duct.

.2 Zinc-plated cold rolled steel blades and frame.

.3 Gang-operated curved parallel blades, 25 mm blade spacing.

.4 Controls both air flow rate and direction, pivots from full open to fully closed with blades overlapping for tight shut-off.

.5 Key-operated mechanism for adjustment through grille face; otherwise adjusting rod with external set screw lock.

.6 Vibration-free operation.

2.10 BACKDRAFT DAMPERS

.1 Factory manufactured of material compatible with duct, licensed to bear the AMCA seal, rated in accordance with AMCA Standards 500-D and 511.

.2 Parallel blade configuration, designed for installed orientation.

.3 Frame: minimum 1.6 mm thick extruded aluminum with blade stop and flanges to suit application.

.4 Blades: minimum 1.6 mm thick extruded aluminum with extruded PVC seals.

.5 Axles: plated steel, full length.

.6 Bearings: self-lubricating nylon.

.7 Linkage: face type, aluminum tie bar.

.8 Finish: mill.

.9 Counter Balancing: external adjustment to permit setting for varying differential static pressure.

.10 Smooth rattle-free operation.

2.11 BAFFLES FOR MIXED AIR PLENUMS

.1 Hinged baffles with chains.

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.2 Corrosion resistant construction reinforced to prevent vibration and buckling.

2.12 DUCT PRESSURE GAUGES

.1 Magnahelic, pressure or differential pressure, with 121 mm bezel, red-tipped pointer with stops, accuracy + 2 % of full scale.

.2 Photohelic, pressure or differential pressure, with 140 mm dial, red-tipped pointer with stops, accuracy + 2 % of full scale, complete with electromechanical high limit relay with external adjustment knobs for remote monitoring by building automation system.

.3 Select range to provide all normal readings in the mid 50 percent of full scale.

2.13 DUCT THERMOMETERS

.1 Ducts less than 600 mm maximum dimension:

.1 Variable angle type with 175 mm case for locations up to 2,100 mm above the floor; 225 mm case for higher installations.

.2 Stem length to be 300 mm, except for ducts under 300 mm in width.

.2 Larger ducts:

.1 Dial type with 2,400 mm long averaging element, element holder, and single hub duct flange.

.3 Select range to provide all normal readings in the mid 50 percent of full scale.

Part 3 Execution

3.1 INSTALLATION

.1 Install air duct accessories in accordance with recommendations of SMACNA HVAC Duct Construction Standards and manufacturer's instructions.

.2 Provide adequate access for service, adjustment, replacement of all accessories.

.3 Flexible Connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.2 Length of connection: 150 mm maximum.

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.3 Minimum distance between metal parts when system in operation: 75 mm.

.4 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.3 Material does not protrude into the duct.

.4 Access Doors:

.1 Size:

.1 One-hand or viewing access: 200 x 125 mm minimum.

.2 One-hand and viewing access: 300 x 150 mm minimum.

.3 Two-hands and viewing access: 450 x 250 mm minimum.

.4 Head and shoulders access: 525 x 350 mm minimum.

.5 Body entry: 625 x 350 mm minimum.

.6 Body entry plus ladder: 625 x 425 mm minimum.

.2 Locations:

.1 Fire and smoke dampers.

.2 Control dampers.

.3 Devices requiring maintenance.

.4 Required by code.

.5 Duct coils – both sides.

.6 Base of every duct riser.

.7 To allow access for inspection and cleaning; before and after each change in direction, 15 m maximum spacing.

.5 Instrument Test Ports:

.1 Number and arrangement to be determined by the TAB contractor.

.2 Locate to permit easy manipulation of instruments and accurate readings.

.3 Locations:

.1 For traverse readings:

.1 Ducted inlets to roof and wall exhaust fans.

.2 Inlets and outlets of other fan systems.

.3 Main and sub-main ducts.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations as approved by Departmental Representative

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.6 Turning Vanes:

.1 Construct vane edges to project tangents parallel to duct sides. Where inlet and outlet duct widths are not equal, or angle of turn is not 90 degrees, modify vane shape to comply with this requirement; submit shop drawing prior to fabrication.

.2 Locations:

.1 Mitred elbows.

.7 Balancing Dampers:

.1 Install quadrant handles parallel to damper blade(s).

.2 Splitter dampers shall be used only where approved by the Departmental Representative.

.3 Where damper throttling produces excessive noise provide two dampers, duct baffle, volume extractor, or similar device to reduce noise to an acceptable level.

.4 Install as close as practical to main duct but at least two duct widths downstream of branch take-off. Where this is not possible use a volume extractor.

.5 Locations:

.1 Supply, return and exhaust systems: in each branch duct.

.2 Runouts to grilles, registers and diffusers: single blade damper regardless of whether dampers are specified as part of the air outlet assembly.

.6 All dampers to be vibration-free.

.7 Ensure damper operators are observable and accessible.

.8 Volume Extractors:

.1 Volume extractor size to match dimensions of branch duct served.

.2 Where main duct height exceeds branch duct height provide top and bottom baffles for proper performance in accordance with the manufacturer's instructions.

.3 Locations:

.1 Diffusers and registers with short (less than two duct widths) straight branch ducts connected to main supply ducts.

.9 Back draft Dampers:

.1 Locations:

.1 Exhaust duct or exhaust fan discharge nearest to exterior wall or roof opening.

.2 Install square and provide sufficient length of unobstructed straight duct for entire range of blade motion.

.3 Adjust counter-balance and confirm proper operation.

.4 Ensure good seal when closed.

.10 Baffles for Mixed Air Plenums:

.1 Install where poor mixing will occur.

.11 Duct Pressure Gauges:

.1 Provide a Magnahelic gauge at the discharge of each fan rated at over 472 l/s air flow rate.

.2 Provide a Photohelic gauge at each filter location.

.3 Locate where there is a minimum of turbulence.

.12 Duct Thermometers:

.1 Provide one at the following locations in each air handling system:

.1 Outside air intake.

.2 Mixed air section outlet.

.3 Coil inlet and outlet.

.2 Arrange averaging elements carefully to provide good duct coverage and compensate for temperature stratification.

.3 Locate downstream of mixing locations for accurate readings.

.4 Adjust case to facilitate reading from the floor.

.5 Use remote mounted type where required.

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Fire and smoke dampers.

1.2 REFERENCES

.1 Air Movement & Control Association International Inc.

.1 AMCA Standard 500-D, Laboratory Methods of Testing Dampers for Rating.

.2 AMCA Standard 511, Certified Ratings Program for Air Control Devices.

.2 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)

.1 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.2 ANSI/NFPA 80, Standard for Fire Doors and other Opening Protectives

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S112, Standard Methods of Fire Test of Fire Damper Assemblies.

.2 CAN/ULC-S112.1, Standard for Leakage Rated Dampers for Use in Smoke Control Systems.

.3 CAN4-S112.2, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.

.4 ULC-S505, Fusible Links for Fire Protection Services.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 ADDITIONAL SUBMITTALS

.1 Shop drawing submissions shall include the following additional information:

.1 Schedule with the following data (as applicable) for each damper:

.1 Type and model number.

.2 Installed orientation.

.3 Size.

.4 Air flow rate and pressure drop.

.5 Fire resistance rating.

.6 Closure type and temperature rating.

.7 Smoke damper temperature rating and leakage class.

.2 Damper actuator details including mounting, failure position, electrical characteristics and wiring diagrams.

.3 Accessories: including associated electrical data and wiring diagrams.

.4 Manufacturer's installation instructions for each model.

1.5 EXTRA MATERIALS

.1 Provide following:

.1 Six fusible links of each type.

1.6 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency in adherence to all codes and standards required by the authority having jurisdiction.

1.7 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 FIRE DAMPERS

.1 Fire dampers: listed and bear label of ULC, assemblies fire tested and rated in accordance with CAN/ULC-S112, meet requirements of authorities having jurisdiction.

.2 Classified for dynamic closure against maximum design airflow, at 2000 Pa minimum static pressure differential (across closed damper), for installed configurations and locations on systems where fan does not shut down on fire alarm.

.3 Factory fabricated for fire resistance rating requirement and installation orientation to maintain integrity of fire wall and/or fire separation.

.4 Curtain-type design: steel frame with reinforced corners, steel interlocking blades, sheet steel mounting sleeve (factory or field installed), transitions to suit connecting ductwork. Galvanized steel construction where connecting ductwork is galvanized, stainless steel construction where connecting ductwork is stainless steel. Provide sealed high pressure construction where duct pressure class exceeds 500 Pa or Class B or C duct seal is specified.

.5 Closure type: fusible link actuated, weighted to close and lock in closed position when released or having stainless steel negator-type spring closing operator for damper in horizontal position with vertical air flow. Generally fusible links to be rated at 74EC for exhaust and recirculation applications, and 100EC on supply air applications. Revise, with Departmental Representative's approval, as required to meet the needs of special locations. Fusible links shall be readily removable by hand to facilitate testing.

.6 Damper types and transition collars to be selected based on the following criteria unless otherwise directed by the Departmental Representative:

.1 Duct pressure class less than or equal to 500 Pa, unsealed or Class C duct seal, and face velocities less than or equal to 15 m/s:

.1 Type A: square and rectangular ductwork with air velocities less than or equal to 5 m/s and aspect ratios of 2:1 or less.

.2 Type B: square and rectangular ductwork with air velocities exceeding 5 m/s or aspect ratios greater than 2:1.

.3 Type R: round ductwork.

.2 Duct pressure class greater than 500 Pa, Class B duct seal, or face velocities exceeding 15 m/s:

.1 Type C: square and rectangular ductwork.

.2 Type CO: flat oval ductwork.

.3 Type CR: round ductwork.

.7 Factory tested for proper operation.

Part 3 Execution

3.1 INSTALLATION

.1 Refer to Architectural drawings for locations and ratings of fire and smoke separations. Provide dampers and firestop flaps of approved types in all duct penetrations of fire and smoke separations.

.2 Review all damper and firestop flap locations and requirements with Departmental Representative early in the project.

.3 Install in accordance with ANSI/NFPA 90A, requirements of authorities having jurisdiction, and in strict accordance with conditions of ULC listing. Maintain integrity of fire and smoke separations.

.4 Install and test in accordance with NFPA 80.

.5 Install break-away joints of approved design on each side of fire separation unless otherwise directed by Departmental Representative.

.6 Coordinate with TAB contractor early in the project. Review locations and access requirements of all dampers and firestop flaps to facilitate testing.

.7 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.8 Provide access door adjacent to each damper.

.9 Coordinate with installer of firestopping. Any firestopping required by local codes or authorities having jurisdiction shall be done in strict accordance with conditions of ULC listing using approved materials. Fire stop in accordance with manufacturer's installation instructions.

.10 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible for inspection, testing and replacement.

.11 Identify all dampers and firestop flaps clearly and accurately on project record drawings.

3.2 TESTING

.1 Test for proper operation of all smoke and fire dampers, sensors, detectors, installed as component parts of air systems specified Division 23.

.2 Test each fire damper by releasing it twice so as to check whether the damper is binding and is operating in accordance with requirements of the authority having jurisdiction. Reset dampers in accordance with manufacturer's directions. Resolve all problems and then re-test, until satisfactory result is achieved. Permanently mark all dampers with an identification number which shall also appear on the "as-built" drawings. Submit a test report to the Departmental Representative, listing the following data:

.1 Identification of each fire damper corresponding with the "as-built" drawings.

.2 Test results of each damper, including access problems.

.3 Repair procedures, if any, to each damper if not properly working.

.4 State the date of the check(s).

.5 Name of company and checker(s).

.3 Affix tag to duct adjacent fire and smoke dampers indicating date of test, TAB company name and contact info, technician initials.

.4 Include a complete copy of the written report in each Operating/Maintenance Manual.

.5 Confirm closure of smoke and combination fire/smoke dampers on during fire alarm condition and power failure.

.6 Confirm proper operation of smoke dampers and combination fire smoke dampers according to specified sequences of operation, including manual overrides and safeties.

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation of flexible ductwork, joints and accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.2 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.4 National Fire Protection Association (NFPA).

.1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.

.5 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, (Addendum No.1, November 1997).

.2 SMACNA IAQ Guideline for Occupied Buildings under Construction, 1st Edition.

.6 Underwriters' Laboratories Inc. (UL).

.1 UL 181, Standard for Factory-Made Air Ducts and Air Connectors.

.7 Underwriters' Laboratories of Canada (ULC).

.1 CAN/ULC-S110, Fire Tests for Air Ducts.

1.3 SUBMITTALS

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

.2 Co-ordinate submittal requirements and provide submittals required by Section 01 47 15 - Sustainable Requirements: Construction.

.3 Submit Indoor Air Quality (IAR) Management Plan in accordance with Section 01 47 15 - Sustainable Requirements - Construction.

.4 Product Data: submit WHMIS MSDS in accordance with Section 02 81 01 - Hazardous Materials for the following:

.1 Thermal properties.

.2 Friction loss.

.3 Acoustical loss.

.4 Leakage.

.5 Fire rating.

.5 Samples: submit samples with product data of different types of flexible duct being used in accordance with Section 01 33 00 - Submittal Procedures.

1.4 QUALITY ASSURANCE

.1 Certification of Ratings:

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Sustainable Requirements:

.1 Construction requirements: in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

.2 Verification: contractor's verification in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Protect on site stored or installed absorptive material from moisture damage.

.2 Store and manage hazardous materials in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

.3 Waste Management and Disposal:

.1 Separate waste materials for reuse and 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 bins for recycling in accordance with Waste Management Plan.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.6 Ensure emptied containers are sealed and stored safely.

.7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

1.6 INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN

.1 Develop and implement an Indoor Air Quality (IAQ) Management Plan in accordance with Section 01 47 15 - Sustainable Requirements: Construction for construction and preoccupancy phases of building.

.2 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

Part 2 Products

2.1 GENERAL

.1 Factory fabricated to CAN/ULC-S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC - UNINSULATED

.1 Type 1: spiral wound flexible aluminum, stainless steel, as indicated.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

2.3 METALLIC - INSULATED

.1 Type 2: spiral wound flexible aluminum with factory applied, 37 mm thick flexible glass fibre thermal insulation with vapour barrier and vinyl reinforced mylar/neoprene laminate aluminum jacket, as indicated.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

2.4 NON-METALLIC - UNINSULATED

.1 Type 3: non-collapsible, coated mineral base fabric, aluminum foil, mylar type, mechanically bonded to, and helically supported by, external steel wire, as indicated.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.3 Thermal loss/gain: 0.5 W/m2 degree C mean

2.5 NON-METALLIC - INSULATED

.1 Type 4: non-collapsible, coated mineral base fabric, aluminum foil/mylar type mechanically bonded to, and helically supported by, external steel wire with factory applied, 37mm thick flexible mineral fibre thermal insulation with vapour barrier and vinyl reinforced mylar/neoprene laminate jacket, as indicated.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

2.6 METALLIC ACOUSTIC INSULATED - MEDIUM PRESSURE

.1 Type 5: Spiral wound, flexible perforated aluminum with factory applied 37mm thick flexible mineral fibre thermal insulation and sleeved by aluminum foil/mylar laminate Type M vapour barrier, as indicated.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.3 Thermal loss/gain: 0.5 W/m2 degree C mean

2.7 METALLIC - ACOUSTIC INSULATED - HIGH PRESSURE

.1 Type 6: Spiral wound, flexible perforated aluminum with factory applied 37mm thick flexible mineral fibre thermal insulation and encased in spiral wound flexible aluminum jacket, as indicated.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.3 Thermal loss/gain: 0.5 W/m2 degree C mean

2.8 NON-METALLIC - ACOUSTIC INSULATED

.1 Type 7: non-collapsible, coated mineral base perforated fabric type helically supported by and mechanically bonded to steel wire with factory applied flexible mineral fibre acoustic insulation and encased in aluminum foil/mylar laminate Type M vapour barrier, as indicated.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

Part 3 Execution

3.1 DUCT INSTALLATION

.1 Install in accordance with: CAN/ULC-S110, UL-181, NFPA 90A, NFPA 90B, SMACNA.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Materials and installation for acoustic duct lining.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

.2 ASTM C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.3 ASTM C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.4 ASTM C916, Standard Specification for Adhesives for Duct Thermal Insulation.

.5 ASTM C1071, Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

.6 ASTM C1104, Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.

.7 ASTM C1338, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.

.8 ASTM G21, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

.2 North American Insulation Manufacturers Association (NAIMA).

.1 NAIMA AH124, Fibrous Glass Duct Liner Standard.

.3 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA).

.1 HVAC Duct Construction Standards - Metal and Flexible.

.4 Underwriter's Laboratories of Canada (ULC).

.1 CAN/ULC-S102, Methods of Test for Surface Burning Characteristics of Building Materials and Assemblies.

Part 2 Products

2.1 DUCT LINER

.1 General:

- .1 Mineral fibre duct liner: air surface coated with smooth matt acrylic polymer.
- .2 Temperature limit: 121EC.
- .3 Flame spread rating shall not exceed 25 and smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102.
- .4 Water sorption: less than 3% by weight when tested in accordance with ASTM C1104.
- .5 Fungi resistance: to ASTM C1338 and ASTM G21.

.2 Rigid:

- .1 Use on flat surfaces.
- .2 25 mm thick, to ASTM C1071, Type II, fibrous glass rigid board duct liner.
- .3 Density: 48 kg/m3 minimum.
- .4 Thermal resistance to be minimum 0.76 (m2. EC)/W for 25 mm thickness when tested in accordance with ASTM C177 or C518, at 24EC mean temperature.
- .5 Maximum velocity on faced air side: 30 m/sec.
- .6 Minimum NRC of 0.70 at 25 mm thickness based on Type “A” mounting to ASTM C423.

.3 Flexible:

- .1 Use on round or oval surfaces and where otherwise directed by Departmental Representative.
- .2 25 mm thick, to ASTM C1071 Type 1, fibrous glass blanket duct liner.
- .3 Density: 24 kg/m3 minimum.
- .4 Thermal resistance to be minimum 0.74 (m2. EC)/W for 25 mm thickness when tested in accordance with ASTM C177 or C518, at 24EC mean temperature.
- .5 Maximum velocity on coated air side: 30 m/sec.
- .6 Minimum NRC of 0.65 at 25 mm thickness based on Type “A” mounting to ASTM C423.

2.2 ADHESIVE AND SEALANT

.1 Adhesive and sealant: to ASTM C916.

.2 Flame spread rating shall not exceed 25 and smoke developed classification shall not exceed 50. Temperature range minus 29EC to plus 93EC.

.3 Water-based fire retardant type.

2.3 FASTENERS

.1 Weld pins 2.0 mm diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm square.

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with NAIMA AH124, Fibrous Glass Duct Liner Standard and SMACNA HVAC Duct Construction Standards except where specified otherwise by Departmental Representative.

.2 Line inside of ducts where indicated on drawings and all ductwork for motorized equipment within 3m of duct connection.

.3 Duct dimensions listed on drawings are clear inside duct lining.

3.2 DUCT LINER

.1 Install in accordance with manufacturer's recommendations, and as follows:

.1 Fasten to interior sheet metal surface with 100% coverage of adhesive.

.1 Exposed leading edges and transverse joints to be factory coated or coated with adhesive during fabrication.

.2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 450 mm on centres to compress duct liner sufficiently to hold it firmly in place.

.1 Spacing of mechanical fasteners in accordance with NAIMA AH124, Fibrous Glass Duct Liner Standard.

.2 All joints to be tightly butted together with no interruptions or gaps.

.3 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner.

.4 Replace damaged areas of liner at discretion of Departmental Representative.

.5 Provide metal nosing over transverse oriented liner edges facing the airstream at the discharge of fans, at any section of lined duct preceded by unlined duct and where the continuity of liner is interrupted by duct mounted devices (e.g. fire dampers, coils).

.6 Where duct air velocities exceed 20 m/sec provide sheet metal nosing on the leading edge of duct liner at every transverse joint.

.7 Turning vane assemblies, dampers and other devices located inside lined ductwork shall be installed using insulated "build outs" secured to the duct wall.

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Fans, motors, accessories and hardware for commercial use.

.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 Air Conditioning and Mechanical Contractors (AMCA)

.1 AMCA Publication 99, Standards Handbook.

.2 AMCA 300, Reverberant Room Method for Sound Testing of Fans.

.3 AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.2 Capacity: flow rate, static pressure, W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.

.4 Sound ratings: comply with AMCA 301, tested to AMCA 300. Supply unit with AMCA certified sound rating seal.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210. Supply unit with AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.1 Shop Drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

.3 Provide:

.1 Fan performance curves showing point of operation, BHP, kW, and efficiency.

.2 Sound rating data at point of operation.

.4 Indicate:

.1 Motors, sheaves, bearings, shaft details.

.2 Minimum performance achievable with variable speed controllers and variable inlet vanes as appropriate.

.5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

.6 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.1 Spare parts to include:

.1 Matched sets of belts.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:

.1 Bearings and seals.

.2 Addresses of suppliers.

.3 List of specialized tools necessary for adjusting, repairing or replacing.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

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

Part 2 Products

2.1 FANS GENERAL

.1 Motors:

.1 For use with variable speed controllers.

.2 Sizes as indicated specified.

.3 Two speed with two windings and speeds of approximately as indicated.

.4 Two speed with split winding, constant horsepower, constant or variable torque.

.2 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet and or outlet safety screens as indicated. Inlet, outlet dampers and vanes and as indicated.

.3 Factory primed before assembly in colour standard to manufacturer.

.4 Scroll casing drains: as indicated.

.5 Finish on fume hood exhaust fans:

.6 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.7 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

.8 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

2.2 IN-LINE CABINET FANS

.1 Duct mounted exhaust, supply or return air fans shall be of the centrifugal direct drive type. The fan housing shall be constructed of heavy-gauge galvanized steel. The housing interior shall be lined with 13 mm (0.5 in.) acoustical insulation. The outlet duct collar shall include an aluminum backdraft damper and shall be adaptable for horizontal or vertical discharge. The access for wiring shall be external. The motor disconnect shall be internal and of the plug-in type.

.2 The motor shall be mounted on vibration isolators. The fan wheel shall be of the forward-curved centrifugal type and dynamically balanced. All fans shall bear the AMCA Certified Ratings program AMCA Air Performance seal and shall be UL/cUL Listed. Ceiling or wall mount fans shall be model CSP as manufactured by Greenheck Fan Corporation, Schofield, Wisconsin.

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 datasheet.

3.2 FAN INSTALLATION

.1 Install fans as indicated, provide flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.

.2 Provide sheaves and belts required for final air balance.

.3 Bearings and extension tubes to be easily accessible.

.4 Access doors and access panels to be easily accessible.

3.3 ANCHOR BOLTS AND TEMPLATES

.1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Variable volume boxes, constant volume bypass, and fan powered and electronic variable air volume boxes.

.2 Sustainable requirements for construction and verification.

.2 Related Sections:

.1 Sections 23.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.2 ANSI/NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 International Organization of Standardization (ISO)

.1 ISO 3741, Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Methods for Reverberation Rooms.

.4 Underwriter's Laboratories (UL)

.1 UL 181, Factory-Made Air Ducts and Air Connectors.

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from certified ADC (Air Diffusion Council) testing agency signifying adherence to codes and standards.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Test data: to ANSI/AMCA 210.

.1 Submit published test data on DIN (Direct Internal Noise), in accordance with ISO 3741 made by independent testing agency for 0, 2.5 and 6 m/s branch velocity or inlet velocity.

.2 Sound power level with minimum inlet pressure of 0.5 kPa in accordance with ISO 3741 for 2nd through 7th octave band, also made by independent testing agency.

.3 Pressure loss through silencer shall not exceed 60% of inlet velocity pressure maximum.

.2 Shop Drawings:

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

.1 Shop Drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

.2 Indicate the following:

.1 Capacity.

.2 Pressure drop.

.3 Noise rating.

.4 Leakage.

.3 Samples:

.1 Submit duplicate samples and mock-ups in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit mock-ups in accordance with Section 01 45 00 - Quality Control.

.3 Samples and mock-ups are required for following: VAV with by-pass equipment.

.4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 Engineer will make available one (1) copy of systems supplier's installation instructions.

.5 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

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

1.7 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment include:

.1 Bearings and seals.

.2 Addresses of suppliers.

.3 List of specialized tools necessary for adjusting, repairing or replacing.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Terminal units of the same type to be product of one manufacturer.

2.2 CONSTANT VOLUME BYPASS BOXES

.1 Maintains space condition by bypassing supply air to return air or plenum space.

.2 Sizes, capacities, pressure loss, and discharge sound pressure level: as indicated.

.3 Discharge sound pressure level: as indicated.

.4 Unit casings shall be constructed of 22 gauge zinc-coated steel, acoustically and thermally lined with 13 mm insulation which meets the requirements of Standards NFPA 90A and UL181. The liner shall not contain Pentabrominated diphenyl ether CAS#32534-81-9 and Octabrominated diphenyl ether. Units shall incorporate a gate valve with polyethylene bearings which slides in a metal track. Single blade pivoting dampers will not be accepted.

.5 Units shall include integral inlet and bypass balancing dampers for field adjustment as standard components. Static pressure taps shall be provided to facilitate balancing. A minimum air volume stop shall also be provided for field adjustment.

.6 Complete with:

.1 Minimum air volume stop.

.2 Manual balancing damper.

.3 Multiport outlets.

.7 Controls:

.1 Damper and actuators to be provided by controls contractor. Coordinate requirements with controls contractor.

.2 Coordinate controls with controls contractor.

.3 Terminal units shall operate in cooling only where perimeter radiation valve is not present in space. Where the space does contain a radiation control valve, the VAV box shall work in conjunction with the existing heating system such simultaneous heating and cooling does not occur.

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 datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Support independently of ductwork.

.3 Install with at least 1000 mm of flexible inlet ducting and minimum of four duct diameters of straight inlet duct, same size as inlet.

.4 Locate controls, dampers and access panels for easy access.

3.3 FIELD QUALITY CONTROL

.1 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:

.1 Materials and resources.

.2 Storage and collection of recyclables.

.3 Construction waste management.

.4 Resource reuse.

.5 Recycled content.

.6 Local/regional materials.

.7 Low-emitting materials.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Diffusers, grilles and registers.

1.2 REFERENCES:

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.1 ASHRAE Standard 70, Method of Testing for Rating the Performance of Air Outlets and Inlets

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop drawing submissions for approved equal products shall include a schedule with the following additional data for each type of air inlet and outlet to confirm performance equal to the specified item:

.1 Type and model number.

.2 Neck size.

.3 Air flow rate.

.4 Pressure drop (total and static).

.5 Throw and terminal velocity.

.6 Noise criteria.

1.4 CERTIFICATIONS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency in adherence to ASHRAE Standard 70.

1.5 EXTRA MATERIALS

.1 Include:

.1 Keys for volume control adjustment.

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.2 Keys for air flow pattern adjustment.

1.6 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 DIFFUSERS, GRILLES AND REGISTERS

.1 Refer to schedule.

.2 General requirements:

.1 To meet the features, capacity, pressure drop, terminal velocity, throw, noise level, and neck velocity of the scheduled product.

.2 Frames:

.1 Appropriate to surrounding construction material.

.2 Plaster frames where set into plaster or gypsum board and where otherwise specified.

.3 Full perimeter gaskets.

.4 Concealed fasteners.

.3 Concealed manual volume control damper operators.

.4 Flow Equalizing Grids: provide in the neck of all ceiling diffusers.

.5 Colour: baked off-white epoxy enamel unless otherwise directed by the Departmental Representative.

.6 Grilles, registers and diffusers of same generic type to be the product of one manufacturer.

.3 Features and performance: as scheduled. Scheduled characteristics govern where they conflict with the general requirements herein.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

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.2 Adjust locations of air inlets and outlets to conform to architectural features, symmetry and lighting arrangement. Obtain approval of Departmental Representative prior to installation.

.3 Install with flat or oval head screws in countersunk holes where fastenings are visible.

.4 Install air inlets and outlets to ductwork with air-tight connections. Attach round neck diffusers to ductwork using drawbands.

.5 Bolt grilles, registers and diffusers in place in gymnasia and similar game rooms.

.6 Provide concealed safety chain on each grille, register and diffuser in gymnasia and similar game rooms and elsewhere as directed by the Departmental Representative.

.7 Paint ductwork visible behind air inlets and outlets Matte Black, especially where eggcrate style grilles are connected to unlined ducts.

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Material and installation of split type room air conditioning system, including indoor evaporator unit and outdoor condensing unit.

.1 Indoor Evaporators: AC-1 through 10

.2 Condensing Units: CU-1 and CU-2

.2 Related Sections:

.1 Everything in this Project Manual is a requirement for this Division. The following references constitute assistance to the Contractors. Refer to the Table of Contents for additional guidance.

.1 Sections beginning with 23 05.

.2 Section 23 23 00 Refrigerant Piping and Accessories.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA B52, Mechanical Refrigeration Code.

.2 CAN/CSA-C656, Performance Standard for Single Package Central Air-Conditioners and Heat Pumps.

.2 Environment Canada, (EC)/Environmental Protection Services (EPS)

.1 EPS 1/RA/2Code of Practice for Elimination of Fluorocarbons Emissions from Refrigeration and Air Conditioning Systems.

.2 Environment Canada, Ozone-Depleting Substances Alternatives and Suppliers List.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 In addition to the requirements specified elsewhere, include the following additional information:

.1 Indicate major components and accessories including sound power levels of units.

.2 Type of refrigerant used, R-410A.

1.4 WARRANTY

.1 Provide 5 year warranty including material and labour on compressors.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 GENERAL

.1 VRF (variable refrigerant flow), 2-pipe, multiple split air conditioning system. The system will utilise air cooled condensing unit supplying a maximum of twenty two indoor fan coil units. The system will be capable of cooling.

2.2 INDOOR AIR CONDITIONING UNITS

.1 It will be possible for the total capacity of the indoor units to be between 50 and 130% of the capacity of the outdoor unit (applicable to AC-1 through 9).

.2 AC-10 shall be capable of -40 C low ambient operation.

.3 Each indoor unit will have a heat exchanger which shall be constructed from copper tubing with aluminum fins. The flow of refrigerant through the heat exchanger will be controlled by a linear expansion valve. This valve will be controlled by two pipe thermistors and a return air thermistor and shall be capable of controlling the variable capacity of the indoor unit between 25% and 100%.

.4 Each indoor unit will require a 208-230 vac power supply. Control will be via the 30vdc data control signal from the outdoor unit.

.5 4 Way Discharge Cassette

.1 The units will be manufactured from galvanized steel plate insulated with closed cell expanded polyurethane foam. The ceiling panel will be manufactured from ABS plastic.

.2 Air will be discharged by an aerofoil bladed centrifugal turbo fan through four outlets on the perimeter of the ceiling panel. The four outlets shall each include electronically adjustable vanes to alter the angle of the airflow. The room air will be returned to the unit through one grille in the centre of the panel. The return air to the unit will be filtered through a synthetic fibre washable filter installed in the unit.

.3 The unit will have a drain lift up mechanism fitted as standard.

.6 Wall Mounted Unit

.1 The unit will be manufactured from ABS plastic.

.2 Air will discharged by a tangential line flow fan through an outlet in the bottom front edge of the unit. The outlet will have electronically adjustable vanes to enable variable air discharge through the horizontal to vertical downward planes. The outlet shall also include manually adjustable guide vanes to alter the airflow pattern in the horizontal directional plane.

.3 Air will be returned to the unit through grilles mounted in the front face of the unit above the outlet. The return air will filtered by synthetic fibre washable filters mounted behind the return air grilles.

2.3 OUTDOOR CONDENSING UNITS

.1 Condensing Unit CU-1:

.1 The outdoor unit will be constructed from steel plate and painted with acrylic paint.

.2 The outdoor unit will have two air cooled heat exchange coils constructed from copper tubing with aluminum fins. The coils will be set in a 'V' formation with air being drawn in through two sides of the unit and discharged out of the top of the unit. The Y Series systems will have a single fan mounted on top of the two coils. The coils will be capable of being dividing into 20,30,50,70,80,100 % sections to enable the outdoor unit capacity to match the capacity required by the indoor units.

.3 The outdoor unit will have one inverter controlled hermetic scroll compressor capable of controlling the compressor frequency in 1Hz increments.

.4 Extra sub-cooling will be provided by a Heat Interchange Circuit (HIC), which allows better refrigerant distribution and control with electronic expansion valves.

.5 The refrigeration process of the outdoor unit will be maintained by pressure and temperature sensors controlling solenoid valves, check valves and bypass valves. The heating or cooling mode of the outdoor unit will be controlled by a 4 way

valve which will reverse the cycle of the refrigerant to change the mode of the outdoor unit. Condensate shall be removed from the condensing unit by means of a drain pipe connector located on the bottom of unit.

.6 The outdoor unit will have one liquid discharge pipe which will supply high pressure liquid to the indoor units or to the condensing unit, depending on the mode of operation. Refrigerant return to the outdoor unit will be via one suction pipe. Both pipes shall be insulated.

.7 The system will be capable of total pipe runs of up to 300m.

.8 The outdoor unit will require a 208-230 vac 3 phase power supply and have a starting current of no more than 10 amps. Control will be via a 30vdc signal generated by the outdoor unit. This signal will be sent to the indoor units via a 16 AWG 2 core non polar screened cable.

.2 Condensing Unit CU-2:

.1 Condensing unit shall be capable of low ambient (-40 C) operation

.2 The indoor units must be of the same capacity as the outdoor unit.

.3 The outdoor unit will be constructed from steel plate and painted with acrylic paint.

.4 The fan grille shall be of polypropylene (PP) plastic.

.5 The unit shall be furnished with DC fan motors for direct drive propeller fan.

.6 The motor bearings shall be permanently lubricated

.7 The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front.

.8 The L shaped condenser coil shall be of copper tubing with flat aluminum fins.

.9 The coil shall be protected with an integral metal guard.

.10 The compressor shall be hermetic rotary type with variable compressor speed inverter technology

.11 The compressor crankcase shall be heated by intermittent low speed compressor motor rotation.

.12 The outdoor unit shall have high pressure and over current protective device.

.13 The unit electrical power shall be 208/230 Vac, 1 phase, 60 hertz.

.14 The unit shall operate within voltage limits of 198Vac to 253Vac.

.15 The unit shall have a power factor of 98%.

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2.4 CONTROLS

.1 It will be possible to use a range of different controllers to control the indoor fan coil units. These controllers will be capable of being connected on any part of the non polar 16 AWG two core screened control cable from the outdoor unit. The controls options will be as follows:-

.2 Reduced Function Zone Controller

.1 This controller shall be wall mounted and hard wired to the indoor fan coil units. It will be manufactured in ABS plastic with an LCD display and will be the manufacturer's standard colour.

.2 The controller will be capable of switching on/off and altering the set point and mode of up to sixteen indoor fan coil units. The controller will also display unit fault codes.

.3 Provide one per indoor unit.

.3 Centralized Controller (Up to 50 units)

.1 This controller shall be wall mounted and hard wired to the outdoor unit. It will be manufactured in ABS plastic with an LCD display and will be the manufacturers standard colour. The controller will require an additional power pack which will be housed in a galvanized steel box.

.2 The controller will be capable of individually controlling the following functions on fifty indoor fan coil units:-

.1 on/off.

.2 operating mode.

.3 set point.

.4 fan speed.

.5 louvre position.

.6 timer settings.

.7 test run.

.4 The controller shall also be capable of displaying the following information individually for fifty indoor fan coil units:-

.1 on/off.

.2 operating mode.

.3 set point.

.4 fan speed.

.5 louvre position.

.6 timer settings.

.7 test run.

.8 fault diagnosis.

.5 The centralized controller will be capable to be used as stand alone or each unit can be accessed either locally or remotely via a control PC utilizing standard Internet Explorer IE5 or IE6 software.

.6 Centralized controllers can be networked together using the standard 10baseT Ethernet cabling structure.

.7 Each centralized controller has the ability to automatically send e-mail error under Alarm Condition.

.8 A modular software approach will allow additional features to all centralized controllers for future upgrades; example, Remote time scheduling, Energy consumption data, load shedding, Trend Logging and remote I/O capability, peak power shedding.

2.5 BMS CONTROL

.1 The entire systems shall interface with the BMS via BACnet interface module through the centralized controller. Controlled variables will be ON/OFF, mode operation, set point adjustment, fan speed.

.2 Monitoring will be ON/OFF mode operation, temperature set point, fan speed, return air temperature and fault code.

2.6 OPTIONAL FEATURES

.1 Provide the following features:

.1 Web Browser Monitoring Control Personal Web

.2 Weekly/Annual Scheduling

.3 Proportion Charging System

.4 Email Error Notification

.5 Maintenance Tool

.6 Personal Web - Individual Control

.7 Demand Control - Energy Saving

.8 Demand Control - Peak Cut

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.9 Maintenance Tool

.10 Power supply will be required for the centralized controller

.11 Windscreens for condensing

Part 3 Execution

3.1 GENERAL

.1 Manufacturer to certify installation.

.2 Run drain line from cooling coil condensate drain pan to terminate over nearest floor drain with copper piping. Condensate piping shall not be exposed in finished areas. Where condensate cannot drain by gravity, provide condensate lift pump.

.3 Install air conditioning system in accordance with manufacturer's installation instructions.

.4 Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

.5 The fixing of all air conditioning equipment, installation of all refrigerant pipe work and full commissioning shall be performed by a specialist refrigerant installer who shall be authorized to install manufacturer's equipment. The installation of all internal and external units, refrigerant pipe work, inter-connecting wiring, commissioning and testing shall be carried out by an approved refrigerant systems installers.

.6 Full access shall be afforded to site during the installations stage of the project to allow them to verify that installation methods are fully in accordance with manufacturers requirements and that the equipment warranties will not be invalidated.

3.2 ELECTRICAL WIRING

.1 Install electrical devices furnished by manufacturer but not specified to be factory mounted, in accordance with requirements of Division 26.

.2 Furnish copy of manufacturer's electrical connection diagram submittal to electrical contractor.

3.3 REFRIGERANT PIPING

.1 Supply, install, test and commission all interconnecting refrigeration pipe work between the outdoor and indoor units.

.2 All pipe work to be carried out in refrigerant quality ACR copper tubing and complete with the appropriate headers and joints. All pipe work must be suitable for R410A.

.3 Longest possible lengths of copper pipe should be utilized to minimize joints on site.

.4 Appropriate refrigeration installation tools must be utilized. Dry Nitrogen must be utilized at all times in the system during brazing.

.5 All pipe work (suction and liquid lines) to be insulated with slip on close cell elastomeric pipe insulation having a wall thickness of not less that ½".

.6 After installation of pipe work, and prior to sealing of insulation joints and starting of equipment, pipe work should be pressure tested. 303 kPa (44 PSI) test for 3 minutes minimum, then 1500 kPa (217 PSI) for 3 minimum, then 3300 kPa (478 PSI) for 3 minutes minimum, then strength test to 4140 kPa (600 PSI) check the system for leaks and deformation, then lower the pressure back to 3300 kPa (478 PSI) and pressure test for 24 hours and checked for leaks. Vacuumed/dehydrated to 300 microns, and hold at that vacuum for 12 hours (minimum).

.7 Refrigerant (R410A) charge weight must be calculated, to the actual installed length of pipe work in accordance to Mitsubishi recommendations.

.8 The charging should be carried out with an appropriate charging station.

.9 Pipe work to be properly fixed and supported at a minimum of 1.5 metres (5 feet) centres or as specified by local code and where required should be run on galvanized trays. All pipe work to be labeled with ID number (condensing units ref.) at 3 metre (9 feet) intervals.

.10 Joints in copper pipe shall be brazed. Brazing shall be carried out to the requirements of the local code and as per the Canadian copper & brass development association recommendations.

.11 Support all equipment on roof on manufactured non-penetrating support system with rubber bases and unistrut members.

.12 Refer also to 23 23 00.

3.4 PIPING CONNECTIONS

.1 Install and connect devices furnished by manufacturer but not specified to be factory mounted.

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.2 Connect condensate drain to the air conditioning unit and drain indirectly to nearest janitors room or washroom floor drain. Pitch and trap drain in accordance with manufacturer's instructions and prevailing codes/regulations. Provide condensate pump if flow by gravity is not possible. Piping to be soldered copper tube, hard drawn temper, type L.

.3 Furnish copy of manufacturer's piping connection diagram submittal to piping contractor.

3.5 CONTROLS

.1 Install control devices furnished by manufacturer but not specified to be factory mounted.

.2 Furnish copy of manufacturer's controls connection diagram submittal to the electrical contractor.

.3 All control wiring to be run in conduit.

.4 Provide services of manufacturer's field Departmental Representative to set and adjust equipment for operation as specified.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Requirements for Halocarbon Management.

1.2 REFERENCES

.1 Status of Canada 1999 chapter 33: "Canadian Environmental Protection Act 1999:

.1 SOR/2003-289: "Federal Halocarbon Regulations 2003".

.2 Environmental Code of practice for Eliminations of Fluorocarbon Emissions from Refrigeration and Air conditioning Systems (the Environment Canada " Refrigeration Code of Practice", and the Report EPS 1 RA/2 dated March 1996.

1.3 GENERAL

.1 Contractors and their personnel shall be familiar with the Section and its requirements.

.2 The Contractor will comply with all Federal, Provincial, and Municipal regulatory requirements and guidelines for environmental protection and natural resources conservation, including the References noted above.

.3 It is the Contractor's responsibility to be aware of environmental requirements, the best management practices, and pollution control measures necessary to meet them.

1.4 HALOCARBONS

.1 All work relating to halocarbons to comply with referenced standards outlined above in Paragraph 1.2 – References.

.2 All work related to halocarbon equipment installation, servicing, etc., to be carried out by, or under direct supervision of, a technician licensed by the Province of Manitoba as a refrigeration mechanic.

.3 Technician to provide to Departmental Representative:

.1 Copy of Province of Manitoba license.

.2 Certificate issued by the Heating, Refrigeration, and Air Conditioning Institute of Canada; and,

.3 Ozone Depletion Prevention Substance Awareness Card.

.4 The following are the only halocarbons that are acceptable as refrigerants: (non-halocarbon refrigerants are also acceptable)

.1 R-410a

.2 R-407c

.5 All work related to halocarbon equipment installation, servicing, decommissioning, leak-testing to be documented.

.6 Immediately report all releases of halocarbons to Departmental Representative. Document release on Spill Report form.

.7 Factory-charged halocarbon-containing shall be leak-tested by this Contractor in accordance with the "Refrigeration code of Practice" within one working day after delivery to the site.

.1 No payment for delivery of this equipment to the site will be made until it is documented to be leak-free.

.8 Non-factory-sealed halocarbon-containing equipment shall be leak-tested using "triple evacuation": evacuate the system to 400 micron or less and break the vacuum with dry nitrogen three times.

.1 No payment for delivery of this equipment to the site will be made until it is documented to be leak-free.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 This Section covers items common to Sections of Division 26, 27 and 28. These sections supplement requirements of Division 1.

1.2 REFERENCES

.1 Definitions:

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

.2 Reference Standards:

.1 CSA Group

.1 CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2.

.3 CAN/CSA-C22.3 No.1-10, Overhead Systems.

.4 CAN3-C235-83(R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th 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 review and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit for review fire alarm riser diagram, plan and zoning of building at fire alarm control panel and annunciator.

.4 Submit for review Fire Verification Report.

.5 Submit for review single line electrical diagrams and locate as indicated.

.6 Shop drawings:

.1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.3 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.4 Submit required number of copies of required size drawings to authority having jurisdiction.

.5 If changes are required, notify Departmental Representative of these changes before they are made.

.7 Certificates:

.1 Provide CSA certified equipment.

.2 Where CSA certified equipment is not available, submit such equipment to authority having jurisdiction or inspection authorities for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

.8 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system testing, as described in PART 3 - FIELD QUALITY CONTROL.

.9 Sustainable Design Submittals:

.1 Building Energy and Water Consumption: submit Measurement and Verification Plan following IPMVP for monitoring end-uses as follows:

.1 Lighting systems and controls.

.2 Constant and variable motor loads.

.3 Cooling load.

.4 Building-related process energy systems and equipment.

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 incorporation into manual.

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 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.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirement.

.2 Material and equipment to be CSA certified. Where CSA certified material or equipment is not available, obtain special approval from authority having jurisdiction or inspection authorities before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

.4 Electrical equipment shall be new and of the type and quality specified.

.5 Electrical equipment shall be CSA approved and shall carry the CSA label or CSA testing laboratory listing. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from appropriate Inspection Department.

.6 Provide labour, materials, transportation, equipment and facilities, etc. required for the complete electrical installation as indicated or implied on the drawings and specifications.

2.3 VOLTAGE RATING

.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. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

2.4 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: Control Devices except for conduit, wiring and connections below 50 V which are related to control systems are specified in mechanical sections or as shown on mechanical drawings.

.3 Supplier and installer responsibility is generally indicated on the electrical drawings.

.4 Refer also to mechanical drawings and specifications for all related electrical work and include in tender price.

.5 Control wiring and conduit with exception to equipment supplied by Divisions 25 is the responsibility of Division 26. All conduit, wiring and connections which are related to control systems specified in Division 25 is the responsibility of the controls contractor.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with labels as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, black face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

.2 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 Wording on nameplates labels to be approved by Departmental Representative and Consultant prior to manufacture.

.3 Allow for minimum of twenty-five (25) letters per nameplate.

.4 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.5 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. " as directed by Departmental Representative and Consultant.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

.8 Transformers: indicate capacity, primary and secondary voltages.

2.7 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into operation and maintenance manuals. Operation and maintenance manuals shall be submitted to Owner.

.2 Include detail of design elements, construction features, components function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

.3 Include technical data, product data, supplement by bulletins, component illustration, exploded views, technical description of items, and parts lists. Advertising or sales literature not acceptable.

.4 Include wiring and schematic diagrams and performance curves.

.5 Include name and addresses of local supplier for items included in maintenance manuals.

.6 Maintenance manuals to be submitted to Consultant for review. Manuals that are incomplete shall be returned to electrical subcontractor for completion. Completed manual must be submitted, to the satisfaction of the Consultant, before final payment may be considered to be due.

2.8 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

.1 Submit shop drawings, product data and samples for review by Consultant. Manufacture of equipment must not commence until shop drawings have been reviewed.

.2 Indicate detail construction, dimension, capacities, weights and electrical performance characteristics of equipment or material.

.3 Include wiring, single line and schematic diagrams, wherever applicable.

.4 Include wiring drawings or diagrams showing interconnection with work of other sections.

.5 Shop drawing submissions shall include a photocopy of all applicable specification sections showing a complete compliance/non-compliance listing.

.6 Each drawing submission to bear following signed stamp, and include name of project, equipment supplier and clause number equipment is specified under.

CONTRACTORS CERTIFICATION

This drawing has been reviewed by

(firm name)

All dimensions have been checked and found compatible with the contract drawings and all capacities, quantities, sizes and other data contained in the contract documents have been listed by the supplier on this drawing and have been checked by the undersigned and found correct.

Date

Per

.7 Clearly show division of responsibility. No item, equipment or description of work shall be indicated to be supplied or work to be done `By Others' or `By Purchaser'. Any item, equipment or description of work shown on shop drawings shall form part of the contract, unless specifically noted to the contrary.

.8 Provide field dimensions required by electrical supplier and sub-subcontractors. In cases where fabrication is required prior to field dimensions being available, check all related drawings and obtain clarification from Consultant if necessary.

.9 Check all shop drawings carefully and make all necessary changes, prior to submission to the Consultant for review. If re-submission is required, the Contractor shall ensure that the supplier's drawings have been changed to comply before returning them to Consultant for another review. If the drawings still do not comply, and require additional review by the Consultant, the Consultant shall be reimbursed by the Contractor for the time required for such additional reviews.

.10 Review of the shop drawings by the Consultant shall not relieve the Contractor from responsibility for errors and omissions therein.

.11 Shop drawings reflecting additional design or change in design shall be reviewed by the Consultant and Owner.

.12 Provide shop drawings for all electrical components, including but not limited to wiring devices, receptacles, lamps, starters, luminaires, etc.

.13 Main distribution and utility metering shop drawings must be approved by local utility prior to submission to Consultant.

.14 Quality Control:

.1 Provide CSA or equivalent certified equipment and material.

.2 Where CSA or equivalent certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit, upon completion of Work, load balance report.

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work.

.7 Other requirements as listed in specification.

2.9 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Front End specifications.

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians or apprentices in accordance with authorities having jurisdiction and as per the conditions of Provincial or Territorial Act respecting manpower vocational training and qualification.

2.10 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, 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.

.4 Use colour coded wires in communication cables, matched throughout system.

2.11 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 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Prime	Auxiliary	
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.12 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

2.13 SURFACE MOUNTED RACEWAYS

General:

.1 System: Provide surface raceway systems for branch circuit and data network voice, video and other low-voltage wiring. Surface raceway system shall consist of raceway bases, covers, pre-divided raceway bases, dual covers, appropriate fittings and device mounting plates necessary for a complete installation.

.2 Configuration: Raceways shall be two-piece design with base and snap-on cover, side by side on a common base. Base shall be dividable with a fixed barrier for up to 4 compartments. Provide raceways from a company that can provide custom sizes if required. Raceway covers shall be available in tamper-resistant form with screws on access plates and covers of fittings, but not on standard cover lengths. [Raceways shall be multi-piece design with metal base and snap-on metal covers. Base shall have 2 wiring channels, separated by 1 integral divider, large enough to accept standard power and communication devices without restricting capacity of the adjacent channel. The raceway base shall accept 2 covers that allow separation of services. The cover shall slightly curve and form the raceway sidewall. Provide the base with scored lines to facilitate sectioning of the raceway in 102mm increments and include mounting holes, and tunnel knockouts in the divider wall that will facilitate the crossing over of services.

.1 Fittings: Fittings shall include flat, internal and external elbows, couplings for joining raceway sections, wire clips, blank end fittings, and device mounting brackets and plates as applicable. Where required, provide tamper-resistant form, dividable with barriers and matching the size of the accompanying raceway base. Provide full capacity corner elbows and tee fittings to maintain a controlled 51mm cable bend radius, meeting the specification for Fiber Optic and UTP cabling and exceeding the TIA/EIA-569-A requirements for communications pathways.

.2 Device Brackets and Plates: Provide in sizes to match raceway width and with mounting holes located to ensure proper mounting of devices in up to 4 compartments. Device plates shall be available in any length from 152mm to 1524mm, with cutouts to accommodate various combinations of power and communications devices in up to 4 compartments. Provide 152mm and 305mm long device plates with a flange to overlap the joint of adjacent cover as applicable.

.3 Communications Devices and Accessories: Raceway shall accommodate a complete line of connectivity outlets and modular inserts for UTP (including Category 5, 5e, 6) STP (150 ohm) fiber optic, coaxial, and other cabling types with matching faceplates and bezels to facilitate mounting. Where indicated, provide connectivity outlets and modular inserts.

.4 Classification: Raceway and system components shall be UL and CUL listed.

Surface raceways shall be suitable for use in dry interior locations only, as covered in Article 386 (Surface Metal Raceways) of the Canadian Electrical Code.

Surface metal raceways and fittings shall be listed by Underwriters Laboratories.

Systems shall comply with UL Standard UL5 for Surface Metal Raceways.

.5 Surface Mounted Metal Raceways: Dual-Channel Steel Raceway.

.6 Fittings: Fittings shall include flat, internal and external elbows, tees, entrance fittings, wire clips, cover clips, couplings, support clips, and end caps. Covers for fittings shall overlap adjoining raceway covers a minimum of 10mm. Fittings shall be color matched to the raceway. Supply fittings with a base where applicable to eliminate mitering. Provide fittings with adjustable couplings that integrate with the raceway base. Provide a take-off fitting supporting dual services to adapt to existing flush wall boxes and other series of metallic raceways. Fittings shall have provisions to accept tamper resistant fasteners to fully secure the raceway.

.7 Fiber Optic/UTP/STP Fittings: Corner elbows, tees, and entrance end fittings as required to maintain a controlled 51mm nominal cable bend radius that meets the specifications for Fiber Optic and UTP/STP cabling and exceeds TIA 569 requirements for communications pathways.

.8 Obstacle Avoidance and Offset Fittings: Provide fittings as required to bypass large and small obstacles and small offsets in supporting wall. Small obstacle avoidance fitting capable of being converted into a take off fitting to transition to other metallic raceways.

2.14 POKE-THRU DEVICES

.1 Poke-Thru Devices:

.1 Poke-thru device provides an interface between power and communications cabling in an above grade concrete or steel deck floor and the workstation or activation location where power and or data communication device outlets are required.

.2 Classification and Use: Poke-thru device shall have been examined and tested by Underwriters Laboratories Inc. to comply with UL263, UL514A and/or UL514C, as applicable and tested to Canadian Standard C22.2 and bear the cULus mark. The poke-thru shall conform to the standards set in the National Electrical Code, Section 300-21.

.1 Poke-thru device shall be for use in 2-hour rated, unprotected reinforced concrete floors and 2 hour rated floors employing unprotected steel floor units and concrete toppings or concrete floors with suspended ceilings. Fire resistive designs with suspended ceilings shall have provisions for accessibility in the ceiling below the poke-thru device fittings.

.2 Poke-thru device shall have been evaluated by UL to meet the applicable U.S. and Canadian safety standards for scrub water exclusion when used on tile, terrazzo, wood, and carpet covered floors.

.3 Poke-thru device shall be suitable for use in air handling spaces in accordance with Section 300-22C of the Canadian Electrical Code.

.4 Shall accommodate:

.1 1-Duplex receptacle

.2 1-4 port data outlet

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 installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative and Consultant.
- .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 complete installation in accordance with CSA C22.1 except where specified otherwise.

3.3 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

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 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.

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: 1200 mm.
- .2 Wall receptacles:
  - .1 General: 450 mm.
  - .2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 175 mm.

.4 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets: 450 mm.

.5 Fire alarm stations: 1200 mm.

.6 Fire alarm bells: 2100 mm.

.7 Television outlets: 450 mm or as specified by Architectural.

.8 Clocks: 2100 mm.

.9 Door bell pushbuttons: 1200 mm.

.10 As per Architectural Specifications.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit existing or new 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 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.

.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 - ACTION AND INFORMATIONAL 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 in accordance with Section 01 45 00 - Quality Control.

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm and communications.

.6 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 - ACTION AND INFORMATIONAL 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.

3.8 SYSTEM STARTUP

.1 Instruct Departmental Representative and operating personnel 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 with aspects of its care and operation.

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This Section covers items common to Sections of Division 26, 27 and 28. These sections supplement requirements of Division 1.

1.2 REFERENCES

.1 CSA International

.1 CAN/CSA-C22.2 No.18-98(R2003), Outlet Boxes, Conduit Boxes and Fittings.

.2 CAN/CSA-C22.2 No.65-03(R2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

.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 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 wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

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 wire and box connectors for incorporation into manual.

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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wire and box connectors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper conductors as required.

.2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper conductors 10 AWG or less.

.3 Bushing stud connectors: to NEMA to consist of:

- .1 Connector body and stud clamp for conductors.
- .2 Clamp for stranded copper conductors
- .3 Stud clamp bolts.
- .4 Bolts for copper conductors
- .5 Bolts for aluminum conductors
- .6 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable TECK cable as required to: CAN/CSA-C22.2 No.18.

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 wire and box connectors 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 Remove insulation carefully from ends of conductors and:

- .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
- .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
- .3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
- .4 Install bushing stud connectors in accordance with NEMA.

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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This Section covers items common to Sections of Division 26, 27 and 28. These sections supplement requirements of Division 1.

1.2 REFERENCES

.1 CSA Group

.1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2.

.3 CAN/CSA-C22.3 No.1-10, Overhead Systems.

.4 CAN3-C235-83(R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-[2000], The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 PRODUCT DATA

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

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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 cross-linked thermosetting polyethylene material rated RW90 XLPE Jacketted.

.3 Copper conductors: size as indicated, with thermoplastic insulation type TWH rated at 600 V.

.4 Neutral supported cable: 1, 2, 3 phase insulated conductors of Copper and one neutral conductor of Copper reinforced, size as indicated. Type: Insulation: Type NSF-2 flame retardant rated 600 V.

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Conductors:

- .1 Grounding conductor: copper.
- .2 Circuit conductors: copper, size as indicated.

.3 Insulation:

- .1 Ethylene propylene rubber EP.
- .2 Cross-linked polyethylene XLPE.
- .3 Rating: 1000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking galvanized steel.

.6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

.7 Fastenings:

- .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
- .2 Channel type supports for two or more cables spaced as per CEC.
- .3 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:

- .1 Watertight approved for TECK cable.

2.3 ARMOURED CABLES

.1 Conductors: insulated, copper size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Type: ACWU90 flame retardant jacket over thermoplastic armour and compliant to applicable Building Code classification for this project.

.5 Connectors: anti short connectors.

.6 Utilize for final lighting luminaires connections only.

2.4 ALUMINUM SHEATHED CABLE

.1 Conductors: copper size as indicated.

.2 Insulation: cross linked polyethylene type RA90 rated 600V.

.3 Sheath: aluminum applied to form continuous sheath.

.4 Outer jacket: thermoplastic applied over sheath and to be compliant to applicable Building Code classification for this project.

.5 Fastenings for aluminum sheathed cable:

.1 One hole steel straps to secure surface cables 25 mm and smaller. Two hole steel straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.

.2 Channel type supports for two or more cables.

.3 Threaded rods: 6 mm diameter to support suspended channels.

2.5 CONTROL CABLES

.1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: thermoplastic.

.2 Sheath: thermoplastic jacket.

.2 Type: low energy 300 V control cable: solid or stranded (as required) annealed copper conductors sized as indicated LVT: 2 soft annealed copper conductors

.3 Type: 600 V stranded annealed copper conductors, sizes as indicated:

.1 Insulation: TWH butyl rubber insulation type RW90 (x-link)

.2 Shielding: non-magnetic tape conductors.

2.6 VARIABLE FREQUENCY DRIVE CABLE

.1 Cable:

.1 Variable frequency drive cable to CAN/CSA C22.2 No. 131.

.2 Conductors:

.1 Copper power and ground.

.3 Ground conductors:

.1 Three bare ground conductors spaced evenly around circumference of cable (sectored ground).

.4 Insulation:

.1 Cross linked polyethylene, 1000V.

.5 Armour:

.1 Continuous aluminum sheath formed into corrugates seamless heath.

.6 Outer jacket:

.1 PVC, UV resistant.

.7 Fire rating: FT4, HL and AG14.

.8 Connectors:

.1 As for RA90.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Lay cable in cable trays in accordance with Section 26 05 36 - Cable Trays for Electrical Systems.

.2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.3 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.

.4 Conductor length for parallel feeders to be identical.

.5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.8 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 In surface and lighting fixture raceways in accordance with Section 26 09 43.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable concealed, securely supported by straps and hangers.

3.5 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

.2 Type AC90 armoured cable will not be permitted with the exception of the final connection from the junction box to light fixture when the distance from the junction box to the light fixture is not more than 1.8m, for final connection from junction box to motors and equipment, within millwork and for vertical drop within walls and partitions to receptacles. Looping of BX from fixture to fixture or from receptacle to receptacle will not be accepted.

3.6 INSTALLATION OF ALUMINUM SHEATHED CABLE

.1 Group cables wherever possible on channels.

3.7 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

3.8 INSTALLATION OF NON-METALLIC SHEATHED CABLE

.1 Install cables.

.2 Install straps and box connectors to cables as required.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Refer to all sections of the specifications for related work.

1.2 REFERENCES

.1 CSA Group

.1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2 No.41-13, Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).

.3 CSA C22.2 No.65-13, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

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 connectors and terminations and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Certificates: obtain inspection certificate of compliance covering high voltage stress from Departmental Representative and include it with maintenance manuals.

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 connectors and terminations for incorporation into manual.

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 off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect connectors and terminations from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Copper long barrel compression connectors to CSA C22.2 No.65 as required sized for conductors.

.2 Contact aid for aluminum cables where applicable.

.3 2, 3, 4 way joint boxes type in accordance with Section 26 05 33 - Raceway and Boxes for Electrical Systems.

.4 2, 3, 4 way junction boxes with respective pothead for conductor 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 connectors and terminations installation in accordance with manufacturer's written instructions.

3.2 INSTALLATION

.1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2No.41.

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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Refer to all sections of the specification for related work.

1.2 REFERENCES

.1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

.2 CSA International

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 grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

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 grounding equipment for incorporation into manual.

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 off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect grounding equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size to electrically conductive underground water pipe.

.2 Grounding conductors: bare stranded copper, soft annealed. Verify grounding impedance.

.3 Insulated grounding conductors: green, copper conductors.

.4 Ground bus: copper, complete with insulated supports, fastenings, connectors.

.5 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 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.

- .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.

.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 Avoid loop connections.

.10 Bond single conductor, metallic armoured cables to cabinet at supply end.

.11 Ground secondary service pedestals.

3.3 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to secondary 120/600 V system.

3.4 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, distribution panels, cable trays.

3.5 GROUNDING BUS

.1 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

3.6 COMMUNICATION SYSTEMS

.1 Install grounding connections for sound, fire alarm, security systems, intercommunication systems as follows:

.1 Sound, fire alarm, security systems, intercommunication systems as indicated.

.2 Make connections to pipes on building side of main valves and tanks. Connect jumpers across boilers to supply and return hot water heating pipes.

3.7 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Refer to all sections of the specification for related work.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended or set in poured concrete walls and ceilings.

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 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 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.

.7 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.

.8 For surface mounting of two or more conduits use channels.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative

.13 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 RELATED REQUIREMENTS

.1 Refer to all sections of the specification for related work.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on turned edge covers.

2.2 CABINETS

.1 Construction: welded sheet steel hinged door, handle, lock 2 keys and catch

.2 Type E Empty: surface return flange mounting as indicated.

.3 Type T Terminal: surface return flange mounting containing sheet steel 19 mm plywood backboard.

Part 3 Execution

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.2 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.

.2 Identification Labels: size 2 indicating system name voltage and phase or as indicated.

3.3

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Refer to all sections of the specification for related work.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

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

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

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.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished walls.

2.3 FLOOR BOXES

.1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brushed aluminum faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 73 mm for receptacles and communication outlets.

.2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 27 mm conduit. Minimum size: 73 mm deep.

2.4 CONDUIT BOXES

.1 Cast FS, FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.5 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.

2.6 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 35 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 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Refer to all related sections 26, 27, 28.

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No.40-M1989(R2009), Cutout, Junction and Pull Boxes.

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 raceway and boxes and include product characteristics, performance criteria, physical size, finish and limitations.

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 raceway and boxes for incorporation into manual.

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 off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect raceway and boxes 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 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

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 raceway and boxes installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative and Consultant.

.2 Inform Departmental Representative, DCC 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 Consultant.

3.2 INSTALLATION

.1 Install splice boxes at cable joint, on floor of trench. Tighten armour clamps and fill with compound.

.1 Ground splice boxes as required.

.2 Install junctions boxes on trench floor around cable splice to CSA C22.2 No.40. Connect cable terminals to box contacts.

.1 Ground junction boxes as required.

.2 Fasten lid securely and check for air leaks before trench is backfilled.

.3 Install power level boxes as follows:

.1 Cast iron type: on trench floor, connect cable terminals to box contacts, fasten lid and fill with compound before trench is backfilled.

.2 Steel type: mount on wall of [maintenance holes; connect cables to box terminals; install disconnect links, fasten lid securely check for air leaks.

.3 Ground power level boxes 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.

.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 Refer to all sections of the specification for related work.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.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-M1984(R2003), Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.

.1 Submit cable manufacturing data.

.3 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.

Part 2 Products

2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel or hot dipped rigid galvanized steel threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings or expanded ends.

.4 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.5 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

.6 FRE conduit

.7 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal steel.

.8 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3

2.2 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.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 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.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 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.

2.5 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.

.3 Surface mount conduits in existing walls.

.4 Use rigid galvanized steel threaded conduit except where specified otherwise.

.5 Use epoxy coated conduit in corrosive areas.

.6 Use electrical metallic tubing (EMT) except in cast concrete above 2.4 m not subject to mechanical injury.

.7 Use rigid pvc conduit in corrosive areas.

.8 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without prewired outlet box, connection to surface or recessed fluorescent fixtures or work in movable metal partitions.

.9 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.10 Minimum conduit size for lighting and power circuits: 21 mm.

.11 Install EMT conduit from computer room branch circuit panel to outlet boxes.

.12 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.13 Mechanically bend steel conduit over 19 mm diameter.

.14 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.15 Install fish cord in empty conduits.

.16 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.17 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.

.7 Install surface conduits in mechanical/electrical rooms only.

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 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 RELATED WORK

.1 Refer to all Sections of the specification for related work.

.2 Mechanical Divisions.

1.2 REQUIREMENTS

Motor Size	Voltage System
3/4 HP (0.562 kW) and larger	208V/1Ø, 208V/3Ø and 600 V, 3Ø
1/2 HP (0.373 kW) and smaller	120 V, 1Ø

.1 Provide a complete system of power wiring to motors and controls.

.2 Unless specifically noted otherwise, wire and leave in operation all electrically operated equipment supplied under this Contract. Examine the drawings and shop drawings of all Divisions for the extent of electrically operated equipment supplied by other Divisions.

.3 Where control wiring diagrams are shown illustrate typical control circuits applicable to the equipment. Control circuits may vary with different manufacturers of equipment. Verify all control circuits with the suppliers of the equipment and make any corrections that may be required.

.4 Unless specifically noted otherwise, supply all pushbuttons, relays, starters, etc. necessary for the operation of equipment. Check all starters, relay coils and thermal elements to ensure that they provide the necessary protection for motors.

.5 Do not operate motors and controls until approval is obtained from the trade providing equipment.

.6 Examine drawings and shop drawings of other Divisions to obtain exact location of motors and equipment shown on other Division drawings and specifications. Where necessary, obtain conduit locations from other trades' drawings & shop drawings. The complete list of motors may not be shown on the electrical drawings. Verify and confirm motor sizes and electrical protection before installation.

.7 Assist in placing in operation all mechanical equipment having electrical connections.

.8 Provide three phase starters with primary and secondary fused 120 volt control transformers and overload relays.

.9 In general, wiring for freezestats, firestats, EP switches P.E. switches, dampers, temperature controllers, flow switches, solenoid valves, etc., for heating, ventilating and air conditioning equipment will be by Mechanical Contractor, from control panels supplied and installed by Mechanical Contractor. Provide terminations in starters for control wiring, so that starter control circuits may be extended by Mechanical Contractor. Where 120 volt power is required for mechanical equipment, i.e.: for roll type filters, refrigerated aftercoolers, control cabinets, etc., wiring to the equipment terminals is the work of the Electrical Contractor. Electrical Contractor to wire all 120V AHU internal lighting and receptacles, condensers and rooftops weatherproof outdoor receptacles.

PART 2 Products

2.1 3Ø MOTOR DISCONNECT SWITCHES

.1 Industrial Type "A" having quick-make, quick-break visible blade mechanism, cover interlocks and padlocking switch in the closed or open position. Use EEMAC-4 enclosures outdoors, EEMAC-1 indoors and drip proof shield watertight for areas exposed to sprinklers. Switches to be kW rated, Square "D" Type A heavy duty.

2.2 120V 1Ø DISCONNECT SWITCHES

.1 Manual starter without overload relay.

2.3 208V 1Ø MOTOR DISCONNECT SWITCHES

.1 Manual starter without overload relay.

PART 3 Execution

3.1 GENERAL

.1 For all motors, provide disconnect switches adjacent to the motors.

.2 Wall mount disconnects adjacent to equipment or floor mount at motor locations. Wall mounted disconnects to be 1400 mm above floor.

3.2 CONTROL CABINETS & CONTROLS

.1 Verify the location of all control cabinets, and provide power wiring to each cabinet from the nearest electrical panel where not specifically shown from a particular panel.

.2 Power wiring for mechanical equipment is the responsibility of the Electrical Contractor. Provide circuits and wiring to suit the controls contractor requirements. All control power wiring requirements may not be specifically shown on the drawings.

.3 All control wiring shall be run in conduit. Coordinate with controls subcontractor.

3.3 FLOW SWITCHES

.1 Verify the location of all sprinkler flow switches, valve monitor switches, jockey pumps, etc. with Mechanical. Devices may not be specifically shown on the electrical drawings.

3.4 AIR VOLUME (CAV, VAV) CONTROLLERS

.1 Verify the location of all CAVs or VAVs, etc. with Mechanical Contractor and wire and connect these devices. Devices may not be specifically shown on the electrical drawings.

.1 Provide 120 volt power and control wiring to each CAV or VAV unit.

3.5 COMMISSIONING

.1 Do not start motors until the supplier of the equipment has verified that the electrical connection has been made in accordance with the nameplate information.

.2 Extreme caution must be taken in connection of motors with nameplates having multiple connection diagrams i.e.: WYE-DELTA Start, MULTISPEED.

.3 Be responsible for replacement of motors or other equipment damaged by starting-up prior to being checked by equipment supplier.

END OF SECTION

PART 1 General

1.1 CODES

.1 Comply with latest edition of CSA Z320

.2 Refer to Commissioning Sections for Commissioning Plan and samples

1.2 INCLUDED SYSTEMS AND EQUIPMENT

.1 The following is a partial list of equipment and system test requirements included in this section:

- .1 Distribution systems including phasing, voltage, grounding, load balancing hipot and/or megger testing.
- .2 Circuits originating from central distribution and branch distribution panels.
- .3 Grounding systems.
- .4 Lighting systems and controls, and interior and exterior light level readings.
- .5 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
- .6 Emergency Lighting and power systems.
- .7 Power feeders and systems downstream of new switchgear.
- .8 Receptacles.
- .9 Connections and circuits to Owner supplied equipment.
- .10 Telecommunications systems as outlined in Section 27 05 00.
- .11 Coordinate testing requirements with Commissioning requirements.
- .12 Connections to mechanical equipment.

1.3 DESCRIPTION

.1 This section specifies the functional testing and commissioning requirements for electrical systems and equipment as performed by the electrical contractor. The test requirements for each piece of equipment or system shall contain the following:

- .1 A list of the integral components being tested.
- .2 Pre-functional checklists associated with the components.
- .3 Functions and modes to be tested.
- .4 Required conditions of the test for each mode.
- .5 Special procedures.
- .6 Required methods of testing.
- .7 Required monitoring.
- .8 Acceptance criteria.

.2 Include the cost of testing in the contract price.

.3 In each purchase order or subcontract written, include requirements for submittal data, O&M data and training.

.4 Provide a copy of the O&M manual submittals of tested equipment, through normal channels, to the Consultant for review and approval.

.5 Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure technicians are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests and adjustments.

.6 Prepare O&M manuals according to the Contract Documents. Include clarifying and updating the original sequences of operation to as-built conditions.

.7 Provide training of the Owner's operating personnel.

.8 Immediately prior to building occupancy, test the entire electrical system by performing a loss and return of utility power test.

1.4 TEST EQUIPMENT

.1 Electrical Contractor shall provide all test equipment necessary to fulfill the testing requirements of this Division.

PART 2 Products

.1 Not used

PART 3 Execution

3.1 GENERAL

.1 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.2 Carry out tests in presence of the Departmental Representative.

.3 Give advance notice of proposed time of tests so that the Departmental Representative can be represented at the tests.

.4 Submit test results for review by the Departmental Representative. Complete deficiencies within construction schedule.

.5 Include copy of test results in maintenance manuals.

.6 Testing methods and test results: in accordance with CSA, CEC and regulations of the supply authority, other authorities having jurisdiction and manufactures recommendations.

.7 Conduct dielectric tests, megger tests, insulation resistance tests and ground continuity tests as required by the nature of the various systems and equipment.

3.2 EQUIPMENT TESTING

.1 With the systems completely connected and lamped, conduct the following tests on the power system:

.1 Control and Switching: test all circuits for the correct operation of devices, switches and controls.

.2 Polarity Tests: test all circuits for correct operation of devices, switches and controls.

.3 Voltage Tests: make a voltage test at the last outlet of each circuit. Maximum drop in potential permitted will be 3% on 120V, and 208V branch circuits. 3% on 208V feeder circuits, and 3% on 600V feeder circuits. Correct any deficiency in this respect.

.4 Phase Balance: measure the load on each phase at each switchboard, distribution panelboard and lighting and power panelboards. Report results in writing to the Departmental Representative. Re-arrange phase connections as necessary to balance the load on each phase as instructed by the Departmental Representative with the re-arrangement being restricted to the exchanging of connections at the distribution points mentioned in this paragraph. After marking any such changes, make available to the Departmental Representative, drawings or marked prints showing the modified connections.

.5 Supply Voltage: measure the line voltage of each phase at the load terminals of the main breakers and report the results in writing to the Departmental Representative. Perform this test with the majority of electrical equipment in use.

.6 Motor Loading: measure the line current of each phase of each motor with the motor operating under load and report the results in writing to the Departmental Representative. Upon indications of any imbalance or overload, thoroughly examine the electrical connections and rectify any defective parts or wiring. If electrical connections are correct, overloads due to defects in the driven machines shall be reported in writing to the Departmental Representative. Verify motor full load amps and overload relays are properly sized and adjusted accordingly.

.7 General Operations: energize and put into operation each and every electrical circuit and item. Make repairs, alterations, replacements, tests and adjustments necessary for a complete and satisfactory operating electrical system.

.2 When tests are performed, the Departmental Representative may require that equipment be opened and removed from their housings to examine interior of equipment, terminations and connections. Provide all required labour and tools.

.3 Coordinate the testing of motors with the trades providing the equipment driven by the motors so that they are carried out at the time the driven equipment is put on test. In addition to the motor loading tests, provide labour and instruments to take and record all motor load readings required to supplement the tests on the driven equipment through various load sequences, as required by the trades involved.

.4 General Component Starting and Testing:

.1 Prior to energizing:

.1 Confirm components nameplate data with characteristics of power supply.

.2 Verify supply voltage and phase rotation.

.3 Ensure all testing as specified has been completed and deficiencies have been corrected.

.4 Close and open all devices to ensure proper mechanical operation.

.5 Megger all feeders and record results on approved verification forms.

.5 Load balancing:

.1 At time of acceptance carry out the following work at peak load hours:

.1 Measure load balance on all feeders at distribution centres, motor control centres and panelboards with normal loads (lighting included). If load unbalance exceeds 15%, reconnect circuits to obtain the best possible balance of current between phases. Revise panelboard directories and wiring identification accordingly.

.2 Measure phase voltages at distribution centres, motor control centres and panelboards with normal loads (lighting included). Adjust transformer taps, where required, to within 2% of rated voltage of components.

.6 Insulation Resistance Testing:

.1 After installing cable and terminating reform insulation resistance test with megger on each phase conductor.

.2 Megger all circuits, feeders and components up to 350 V with a 500 V instrument.

.3 Megger all 350-600 V circuits, feeders and components with a 1000 V instrument.

.4 Check insulation resistance to ground before energizing.

.5 Megger cables for one minute, graph results at 10 second intervals. Submit graphs to Consultant and include graphs in O & M manuals.

.6 Minimum insulation resistance to earth or between phases: 100.

.7 Instrument to have minimum of 100 Megaohm resolution in the 0 to 500 Megaohm range.

.8 Check insulation resistance after each termination to ensure that cable system is ready for acceptance testing.

.7 Ground Resistance Testing:

.1 Measure ground resistance with earth test megger to verify compliance with CSA C22.2 No. 0.4 and Canadian Electrical Code.

.8 Coordination of Protective Devices:

.1 Ensure circuit protective devices such as overcurrent trip relays, fuses are installed to values and settings determined by the Coordination Study.

.9 Arc Flash Protection:

.1 Ensure circuit protective devices such as overcurrent trip relays, fuses are installed to values and settings determined by the Arc Flash Study.

.10 L.V. Power Distribution:

.1 Completely isolate from all sources of power, the switchgear enclosure to be tested and inspected.

.2 Remove necessary access panels, doors and cover plates.

.3 Cleaning:

.1 Check for accumulations of dirt especially on insulating surfaces and clean all interiors of compartments thoroughly using a vacuum or blower.

.2 Use only clean, lint free cloth.

.3 Remove all filings caused by burnishing of contact.

.4 Visual and Mechanical Inspection:

.1 Check physical, electrical and mechanical condition.

.2 Compare equipment nameplate data with latest contractual documents/requirements.

.3 Check for proper anchorage, required clearances, physical damage and proper alignment.

.4 Check physical appearance of all doors, panels, and sections for paint, dents, scratches, fit and missing hardware. Lubricate in accordance with manufacturer's instructions.

.5 Inspect all insulators and insulating surfaces for evidence of physical damage, cracks, chips and tracking or contaminated surfaces.

.6 Check condition of all bussing for moisture or other contamination, proper torque using calibrated torque wrench, and clearance to ground. Seal all bolted connections with red lacquer.

.7 Check all mechanical devices for proper operation. Exercise all active components.

.8 Check and verify that circuit breakers comply with latest contractual documents/requirements:

.5 Check condition of all contacts.

.6 Check and report all discovered unsafe conditions.

.7 Check cable and wiring condition, appearance, termination. Perform electrical tests as required.

.8 Inspect for proper grounding of components.

.9 Molded case circuit breakers 150 amp frame and larger:

.1 Visual and Mechanical Inspection:

.1 Check physical, electrical and mechanical condition. Inspect for cracks or other defects.

.2 Compare equipment nameplate data with latest contractual documents/requirements. Check for proper mounting. Ensure correct protection elements.

.3 Operate circuit breaker to ensure smooth operation.

.4 Check tightness of connections using calibrated torque wrench

.2 Electrical Tests:

.1 Megger test.

.2 Mechanical function test

.3 Set all units with adjustable magnetic trip units.

.3 Where solid state protection is provided with large breakers, test units as follows:

.1 Inspect and test in accordance with manufacturer's most recent installation and maintenance brochure.

.2 Perform tests using manufacturer's relay test unit as applicable, with corresponding test instruction

.3 Proof test each relay in its control circuit by simulated trip tests to ensure total and proper operation of breaker and relay trip circuit by injection of the relay circuit to test the trip operation.

.4 Check C/T and P/T ratios and compare to coordination data.

.5 Record all observations, data and test results.

.10 Molded case circuit breakers to150 amp:

.1 Visual and mechanical inspection as for the larger moulded case breakers.

.2 Mechanical function test.

.3 Set all units with adjustable magnetic trip units.

.4 Record all observations, data and test results.

.11 Protective Relaying:

.1 Set and test protective relays to the settings provided in the coordination study. The manufacturer's instructions for the specific relay must always be used for information concerning connections, adjustments, repairs, timing and data.

.2 Record all observations, data and test results.

.11 Dry Type Transformers up to 600V primary:

.1 Inspect for physical damage, broken insulation, tightness of connections using calibrated torque wrench, defective wiring and general condition.

.2 Thoroughly clean unit prior to making any tests.

.3 Complete verification form for each transformer

.4 Perform insulation resistance test from winding to winding and each winding to ground. Calculate dielectric absorption ratio and polarization index.

.5 Perform core to ground test as for the high voltage transformer.

.6 Test operation of temperature and operation of all associated alarm contacts, where applicable.

.7 Test and calibrate ground fault relays and function test to trip associated breakers, where applicable.

.8 Verify taps and connect to the desired tap.

.9 Energize primary winding with system voltage and measure secondary voltage with secondary load disconnected.

.10 Record all observations, data and test results.

.12 Disconnect Switches - Fused/Unfused:

.1 Visual and mechanical inspection:

.1 Check physical, electrical and mechanical condition. Inspect for cracks or other defects.

.2 Compare equipment nameplate data with latest contractual documents/requirements. Operate switch to ensure smooth operation.

.3 Check tightness of connections using calibrated torque wrench.

.4 Check blade alignment.

.5 Check each fuse holder for adequate mechanical support of each fuse.

.6 Check all electrical and mechanical interlocks.

.7 Check proper phase barrier materials and installation.

.8 Inspect all indicating devices for proper operation.

.9 Clean entire switch using approved methods and materials.

.10 Lubricate to manufacturer's recommendations.

.11 Exercise all active components.

.2 Electrical Tests:

.1 Perform a contact resistance test across each switch blade and fuse holder.

.13 Distribution, Power and Lighting Panelboards:

.1 Conduct load balancing as defined in this section.

.2 Carry out visual inspection

.3 Torque all bus connections using calibrated torque wrench

.4 Record all observations, data and test results

.14 Wiring and Cables:

.1 Test all conductors, including those at distribution centres and panelboards for insulation resistance to ground (megger test).

.2 Test service grounding conductors for ground resistance.

.3 Provide list of test results on approved verification form showing location at which each test was made, circuit tested and results of each test.

.4 Remove and replace entire length of cable if cable fails to meet any of the test criteria.

.15 Grounding:

.1 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction over installation.

.2 Perform tests before energizing electrical distribution.

.3 Provide test report documenting successful test results.

.16 Motor Starters:

.1 Operate switches, contactors to verify correct functioning.

.2 Perform starting and stopping sequences of contactors and relays.

.3 Check that sequence controls, interlocking with other separate related starters, components and control devices operate as per component verification form.

.4 Record all observations, data and test results

.17 Motors:

.1 Prior to starting motors:

.1 Confirm motor nameplate data with motor starter heater overloads, setting of MCP's and sizing of fuses.

.2 Verify rotation.

.3 Ensure disconnects are installed.

.4 Confirm labeling of motors, disconnects and starters.

.18 Receptacles:

.1 Verify all receptacles have been wired correctly using an outlet circuit tester. Provide written test results.

.19 Lighting Systems:

.1 Lighting components:

.1 Function test all light switches, luminaires, dimmers and lighting control components.

.2 Record all time settings.

.3 Verify that correct lamps, drivers and ballasts have been used.

.2 Emergency Lighting:

.1 Check operation of all emergency lights.

.2 Check for proper operation of all emergency battery lights and lighting units.

.3 Record all observations, data and test results.

.3 Lighting Controls:

.1 For lighting control systems, examine all components individually for physical condition and compliance with the latest contractual documents. Also check each component for correct operation. Record all observations, data and test results.

.2 Dimming – Fluorescent:

.1 Complete lighting system start up tests.

.2 Demonstrate that dimming systems are installed as indicated.

.3 Demonstrate that dimming systems operate as designed and that there are no problems in starting lamps, nor in keeping them lit at any setting of dimming intensity control.

.20 Fire Alarm System Testing and Adjusting:

.1 Ensure Manufacturer conducts an inspection of the fire alarm and smoke detection system and equipment including those components necessary to the direct operation of the system such as manual stations, heat detectors, smoke detectors and controls whether or not manufactured by the manufacturer. The inspection tests to conform to CAN/ULC-S537-04 Verification of Fire Alarm Systems and also comprise an examination of such equipment for the following:

.1 Type of equipment installed is as described by these electrical specifications.

.2 Wiring connections to all equipment components show that the installer undertook to have observed ULC and CSA requirements.

.3 Equipment of the manufacturer has been installed in accordance with the manufacturer's recommendations and that all signaling devices of whatever manufacturer have been operated or tested to verify their operation.

.4 Supervisory wiring of those items of equipment connected to a supervised circuit is operating and governmental regulations, if any, concerning such supervisory wiring have been met to the satisfaction of inspection authorities.

.2 The Manufacturer shall supply to the Electrical Contractor reasonable amounts of technical assistance with respect to any changes necessary. During the period of inspection by the manufacturer, the Electrical Contractor shall make available to the manufacturer, electricians as designated by the manufacturer.

.3 To assist the Electrical Contractor in preparing his bid, the manufacturer shall indicate the number of hours necessary to complete the inspection described, prior to closing of tenders.

.4 On completion of the inspection and when all of the above conditions have been complied with, the manufacturer shall issue to the Consultant the following, in accordance with CAN/ULC-S537-04:

.1 A copy of the inspecting technician's report showing the location of each device and certifying the test results of each device.

.2 A certificate of verification confirming that the inspection has been completed and showing the conditions upon which such inspection and certification have been rendered.

.3 Proof of liability insurance for the inspection.

.5 All costs involved in the inspection described herein, both for the manufacturer's and the Electrical Contractor's work shall be included in the Electrical Contractor's total tender price.

.6 Verification procedures, testing requirements, documentation required, etc. shall be in accordance with the requirement of ULC Standard CAN/ULC-S537-04.

.7 Project Substantial Completion Schedule: Schedule witness testing in a timely manner. The successful completion of witness testing with a sealed report is necessary before considering the project substantially completed. Notify Consultant minimum 60 days before project completion that the witness testing has been arranged.

.8 Re-testing:

.1 Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the specifications and complies with applicable standards.

.9 Report of tests and inspections:

.1 Provide a written record of inspections, test, and detailed test results in the form of a test log.

.10 Final Test, Certificate of Completion, and Certificate of Occupancy:

.1 Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy.

3.3 EQUIPMENT COMMISSIONING

.1 Division 26 shall coordinate all required responsible in the commissioning process directed by the CA.

.2 Commissioning requires the participation of Division 26 to ensure all equipment and systems are operating in a manner consistent with the contract documents. Division 26 shall be familiar with all requirements and coordination and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

.3 Include the cost of commissioning in the contract price.

.4 Attend all necessary meetings schedule by the CA to facilitate the commissioning process.

.5 Provide all cut sheets and shop drawing submittals to the CA of commissioned equipment.

.6 Provide all additional requested documentation, prior to normal O&M manual submittals, to the CA for development of start-up and functional testing procedures.

.7 Provide a copy of the O&M manual submittals of commissioned equipment. Through normal channels, to the CA for review and approval.

.8 Provide assistance to the CA in preparation of the specific functional performance test procedures. Sub contractors shall review test procedures to ensure feasibility, safety and equipment protection.

.9 Develop a full start-up and initial checkout plan of equipment and systems. Execute and document the electrical related portions for all commissioned equipment. Provide a copy to the CA.

.10 Provide skilled technicians to execute starting of equipment and to execute functional performance tests.

.11 Perform functional performance testing under the direction of the CA for all commissioned equipment.

.12 Correct all deficiencies.

.13 Provide training of the Owner's operating personnel as specified.

.14 Required commissioned equipment and systems are outlined below:

.1 Occupancy sensors:

.1 Parties responsible:

.1 Electrical Contractor: Provide all testing.

.2 CA: Coordinate and document testing.

.2 Procedure:

.1 Space should be normally furnished and wall, floor and ceiling finishes complete.

.3 Required monitoring:

.1 None.

.4 Acceptable criteria:

.1 Activation of all required luminaires by associated occupancy sensor.

.2 Adjusted sensitivity to accommodate the required space.

.5 Sample strategy:

.1 All occupancy sensors installed.

.2 Electric heaters:

.1 Parties responsible:

.1 Electrical Contractor: Provide all testing.

.2 CA: Coordinate and document testing.

.2 Procedure:

.1 Space should be normally furnished and wall, floor and ceiling finishes complete.

.3 Required monitoring:

.1 None.

.4 Acceptable criteria:

.1 Test cut out protection when air movement is obstructed.

.2 Test fan delay switch to ensure dissipation of heat after shutdown.

.3 Test unit cut off when fan motor overload protection has operated.

.4 Ensure that heaters and controls operate correctly.

.5 Sample strategy:

.1 All electric heaters and associated controls installed.

.3 Connections to mechanical equipment:

.1 Parties responsible:

.1 Electrical Contractor: Confirmation of electrical connection.

.2 CA: Coordinate and document testing.

.3 Mechanical Contractor: Operation of equipment/systems.

.2 Procedure:

.1 Space should be normally furnished and wall, floor and ceiling finishes complete.

.3 Required monitoring:

.1 None.

.4 Acceptable criteria:

.1 Verification of proper electrical connections to mechanical equipment/systems.

.5 Sample strategy:

.1 All mechanical equipment requiring commissioning. Coordinate with CA and Mechanical Contractor.

3.4 TRAINING OF PERSONNEL

.1 The General Contractor shall be responsible for the overall training schedule and shall ensure that all training activities specified herein are completed.

.2 Electrical Contractor: The electrical contractor shall have the following training responsibilities:

.1 Provide designated personnel with comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of tested electrical equipment or system.

.2 Training shall be hands on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.

.3 During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.

.4 The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer’s representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.

.5 Training shall include:

.1 Use the printed installation, operation and maintenance instruction material included in the O&M manuals.

.2 Include a review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.

.3 Discuss relevant health and safety issues and concerns.

.4 Discuss warranties and guarantees.

.5 Cover common troubleshooting problems and solutions.

.6 Explain information included in the O&M manuals and the location of all plans and manuals in the facility.

.7 Discuss any peculiarities of equipment installation or operation.

.6 Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and maintenance of all pieces of equipment.

.7 The electrical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls.

.8 Training shall occur after functional testing is complete, unless approved otherwise by Consultant.

.9 Duration of Training. The electrical contractor shall provide training on each system for suitable period of time, to ensure a reasonable understanding of its operation by the trainee.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This Section covers items common to Sections of Division 26, 27 and 28. These sections supplement requirements of Division 1.

.2

1.2 REFERENCES

.1 CSA International

.1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.

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 network lighting controls and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Complete assembly.

.2 Contact surfaces.

.3 Construction features.

.4 Wiring diagrams.

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 network lighting controls for incorporation into manual.

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 network lighting controls 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 by manufacturer of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan.

Part 2 Products

2.1 OVERVIEW

.1 Provide a complete stand-alone, decentralized, low voltage, digital lighting control system for classrooms, offices or defined spaces as shown on the plans and specified herein.

.2 Lighting control system shall utilize 2-wire, non- polarized, topology free data line networking technology to provide power and data to occupancy/vacancy sensors, daylight sensors, and wall station switches.

.3 The network shall be free topology and therefore not require a serial loop to achieve maximum network distance.

.4 The system shall be offered in factory configured and programmed kit that includes occupancy/vacancy sensors, daylight sensors, and wall station switches.

.5 The controller shall be installed directly onto the knockouts of a 4x4 metal junction box.

2.2 ROOM CONTROLLER

.1 Where indicated on the drawings provide a pre-configured, digitally addressable, plenum-rated room controller.

.2 The Room Controller shall be capable of:

.1 Autonomously controlling a space.

.2 Networking to a central control system.

.3 Networking to a central BACnet based management system.

.3 The Room Controller shall consist of:

.1 A universal voltage type (120Vac/277Vac/347Vac) power supply.

.2 Four 20A rated relays complete with manual override. Circuit Load rating dependent on usage. One circuit dedicated for 20A receptacle control.

.3 Four 0-10V control channels, capable of 100mA current sinking

.4 A port to connect downstream switches, occupancy sensors and daylight sensors. All downstream devices shall connected via two #18AWG, non-polarized, non-shielded, non-twisted conductors.

.5 A port to connect to an upstream Lighting Control Unit.

.6 A port to connect upstream to BACnet IP building management system. The Controller shall communicate using native BACnet command objects appropriate for the application.

.7 An indicating LED to aid in locating the controller in a darkened ceiling space.

.8 Circuit testing buttons

.9 Output 24Vac 120mA

.4 Relay Ratings

.1 20A Suitable for General Purpose Loads @ 120/277/247VAC

.2 20A Suitable for Standard Ballasts and Tungsten Loads @ 120/277VAC

.3 15A Suitable for Standard Ballasts Only @ 347VAC

.4 16A Suitable for Electronic Ballasts @ 120/277VAC

.5 0.5HP @120/277Vac

.6 US & Canada Plenum Rated

.5 The Room Controller relays shall be connected such that 120Vac plug load(s) and 277Vac/347Vac lighting loads can be switched by a single Controller with no additional add-ons or remote modules

.6 The Room Controller shall mount to electrical junction box via threaded ½" chase nipple. No other mounting hardware shall be required.

2.3 UL924 RELAY EXPANSION PACK

2.4 RELAY PANELS

.1 Where indicated on the drawings provide a 2-relay expansion pack consisting of two independently controllable, 20A relays capable of emergency lighting circuit control.

.2 Expansion pack relays shall force EM lights on when the Room Controller loses power.

.3 The expansion pack shall connect to the Room Controller. No wires or tools shall be required to add an expansion pack to a Room Controller. The Room Controller will include a means for remote mounting if required.

.4 Circuit testing buttons

2.5 WALL SWITCH

.1 Switches shall connect to the lighting control network via a common low voltage, 2-wire, non-polarized data line.

.2 Switches shall be factory configured and programmed to control one or more outputs in the lighting control system.

.3 Switches shall be factory configured and included in the Room Controller kit.

.4 Switches can be programmed for preset control to set a specific lighting scene.

.5 Switches, with LED indicators to indicate both ON and OFF output/group status, shall be available with 2 or 4 single button switches per gang. Switch to fit standard Decora opening.

.6 Switches and switch hardware shall mount to standard wall boxes.

.7 Each switch shall provide a location for a label to identify function. The label shall be under a clear plastic cover and shall be field replaceable should the operation of the switch change. Permanently etched switches are not acceptable.

2.6 DIMMER SWITCHES

.1 Dimmer switches shall connect to the lighting control network via a common low voltage 2-wire, non-polarized data line.

.2 Switches shall be capable of raising or lowering light levels of individual or groups of lighting fixtures.

.3 Switches shall include integral LED indication for light levels as well as a button switch for ON/OFF control.

2.7 CEILING OCCUPANCY SENSORS

.1 Sensors shall be recessed ceiling occupancy/vacancy sensors.

.2 Sensing technology shall be Passive Infrared (PIR).

.3 Sensor shall derive its power and data from the lighting control network via a common low voltage 2-wire, non-polarized data line.

.4 Ceiling sensors shall be low profile recessed ceiling sensors that mount into the ceiling.

.5 Ceiling sensor shall not be surface mounted.

.6 Ceiling sensors shall have an adjustable tilt head to direct sensing to, or away from, particular areas or to allow for installation on sloped ceilings.

.7 Sensors shall provide an adjustable time out period from 3 seconds up to 40 minutes.

.8 A Manual Override Switch is to be provided on the sensor to allow the load to be manually switched ON and OFF for the purpose of testing during installation.

.9 Ceiling sensor shall have an Auxiliary Relay for signaling other systems ON/OFF based on room occupancy status

2.8 PHOTO SENSOR AND DAYLIGHT CONTROL

.1 Sensor shall be capable of sensing from 0 to 65,000 lux of direct light.

.2 Sensor shall be capable of closed loop control for Natural Daylight Harvesting.

.3 Sensor shall derive its power and data for the lighting control network via a common low voltage 2-wire, non-polarized data line.

.4 Sensor shall continuously monitor the ambient light level (lux).

.5 Sensor shall broadcast to the Room Controller the existing light level when requested or when there is a change in detected light level.

.6 Sensor shall be capable of setting light level via on-board commissioning dial.

.7 One sensor shall permit different outputs to switch and/or control light levels as ambient light changes. Light levels shall be controlled by 'sensor only' or in combination with a with a dimming switch.

.8 Sensor shall be capable of setting a maximum light level which cannot be exceeded during Natural Daylight operations.

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 network lighting controls 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 General

.1 Products must meet UL and CSA product regulatory requirements.

.2 Product must be installed in a controlled environment of between 14°F to 140°F (-10°C to +60°C) and be a stationary, non-vibrating, non-corrosive atmosphere and non-condensing humidity.

.2 Room controller

.1 Installation shall allow for electrical rough to be done before devices arrive on-site.

.2 Room Controller shall have a lightweight chassis to allow for the device to be installed with integrated chase directly onto standard 4"x4" square metal junction boxes using existing knockouts with no additional mounting hardware.

.3 Chase nipples with locknuts shall be integrated into the chassis for ease of installation with junction boxes.

.4 Shall be installed with either rigid metallic conduit or flexible metallic conduit.

.3 UL924 Relay Expansion Pack

1.1.1. When installing Room Controller with UL924 relay expansion pack, the distance between the ½" chase nipples shall be spaced to fit into two back-to-back 4"x4" square metal junction box knockouts.

1.1.2. Installation shall allow for electrical rough to be done before devices arrive on-site.

1.1.3. Shall have a lightweight chassis to allow for the device to be installed with integrated chase nipples directly onto standard 4”x4” square metal junction boxes using existing knockouts with no additional mounting hardware.

1.1.4. Chase nipples with locknuts shall be integrated into the chassis for ease of installation with junction boxes.

.4 Photocell

.1 Install Lighting Controls daylight sensors as per manufacturer’s recommendations for closed loop control of natural daylight harvesting applications.

.2 Adhere to manufacturer’s recommendations for location, wiring and programming.

.5 Ceiling Occupancy Sensor

.1 Install Lighting Controls Occupancy/Vacancy Sensors so objects do not block the coverage area. Keep away from HVAC vents and light directly from light fixtures.

.2 Adhere to manufacturer’s recommendations for location, wiring and programming.

.6 Low Voltage Wiring

.1 Adhere to manufacturer's recommendations as to maximum wire length.

.2 Power and data for the lighting control network via a common low voltage 2-wire, non-polarized data line.

.7 Line Voltage Wiring

.1 Use #12AWG Section appropriately sized for the branch circuit.

.2 On-device wiring directions shall be included

3.3 FIELD QUALITY CONTROL

.1 On completion of installation, manufacturer representative shall be notified to carry out site inspection and report any inconsistencies to the Departmental Representative. Corrections are to be implemented to comply with manufacturer's report.

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.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by network lighting controls installation.

END OF SECTION

PART 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with Section 26 05 00 Common Work Results – Electrical and all applicable Sections.

PART 2 Products

2.1 TRANSFORMERS

.1 Use transformers of one manufacturer throughout project.

.2 Design 1.

- .1 Type: ANN.
- .2 3 phase, 600 V input, 208/120 V output, 60 Hz, 45 kVA as shown on drawings.
- .3 Copper windings.
- .4 Voltage taps: standard 2 ½% full capacity above and below normal.
- .5 Insulation: Class H, 150°C temperature rise.
- .6 Basic Impulse Level (BIL): standard
- .7 Hipot: standard
- .8 K13 rating
- .9 Average sound level: 55 db maximum.
- .10 Impedance at 170°C: 5% up to 150 KVA, 4-5% over 150 KVA.
- .11 Enclosure: EEMAC 3R, removable metal front panel complete with sprinkler proof hood.
- .12 Complete with external "anti-vibration pads" and "vibration isolators".
- .13 Mounting: floor or wall as required.
- .14 Finish: in accordance with Section 26 05 01 Common Work Results - Electrical.

.3 Two winding or T connected transformers are not acceptable.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 Common Work Results - Electrical.

.2 Label size: 7.

2.3 APPROVED MANUFACTURERS

.1 Approved Manufacturers: Rex, Delta, Cutler Hammer, Square D, Hammond

PART 3 Execution

3.1 INSTALLATION

.1 Mount dry type transformers in accordance with manufacturer's recommendations.

.2 Wall-mount dry type transformers up to 75 kVA.

.3 Ensure adequate clearance around transformer for ventilation as per CEC

.4 Install transformers in level upright position.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Make primary and secondary connections in accordance with wiring diagram.

.8 Energize transformers after installation is complete.

.9 Mount floor mounted transformers on 100mm concrete housekeeping pads.

END OF SECTION

PART 1 General

1.1 RELATED WORK

.1 Refer to all sections of the specification for related work.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with 26 05 00 Common Work Results – Electrical.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

.3 Provide shop drawing of specific product and clearly select equipment model and number. General catalogues' information is not acceptable.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in Section 26 05 00 Common Work Results – Electrical.

1.4 PLANT ASSEMBLY

.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.

PART 2 Products

2.1 PANELBOARDS

.1 Panelboards: product of one manufacturer throughout project.

.2 120/208V central distribution panels (CDP) bus and breakers rated "minimum" 22 KA RMS or as required to meet coordination study.

.3 120/208V branch circuit panelboards bus and breakers rated "minimum" 22 KA RMS or as required.

.4 Sequence phase bussing such that circuit breakers shall be numbered vertically in consecutive order, with each breaker identified by permanent number identification as to circuit number and phase.

.5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as required.

.6 Two keys for each panelboard and key panelboards alike.

.7 Copper bus with neutral of same ampere rating as mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim and door finish: baked grey enamel.

.10 Double tub panels to have tubs bolted together with one common trim.

.11 Flush or surface-mounted tubs as required.

.12 Load centres shall not be accepted.

.13 All surface mounted panelboards shall be sprinklerproof.

2.2 BREAKERS

.1 Breakers: to Section 26 28 21 Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

2.3 TRANSIENT VOLTAGE SURGE SUPPRESSION

.1 Panelboards to be complete with integrally mounted transient voltage surge suppression where indicated.

2.4 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 Common Work Results – Electrical.

.2 Nameplate for each branch circuit panelboard size 4 engraved to indicate panel designation and voltage.

.3 Nameplate for each circuit in distribution panelboards size 3 engraved to indicate each respective load.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

2.5 MANUFACTURERS

.1 Acceptable manufacturers: Cutler Hammer, Schneider, Square D, Siemens.

PART 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square to adjoining surfaces.

.2 Install surface mounted panelboards on plywood painted backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 00 Common Work Results – Electrical or as required.

.4 Connect loads to circuits as indicated.

.5 Connect neutral conductors to common neutral bus. Common neutrals shall be shared by vertically adjacent breakers. Common neutrals shall be identified with mylar/cloth wire markers showing circuit numbers of the circuits sharing the neutral.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This Section covers items common to Sections of Division 26, 27 and 28. These sections supplement requirements of Division 1.

1.2 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).

1.3 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 wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

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 wiring devices for incorporation into manual.

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 wiring devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:

- .1 White 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 Duplex receptacles, NEMA No. 5-20 R, T slot, 125 VAC, U ground, with the following features:

- .1 Nylon face.
- .2 Suitable for #10 AWG back and side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Double wipe contacts and non-riveted grounding contacts.
- .5 Aluminum yokes, blades or terminals or with CU/AL rating will not be accepted.

.3 Single Receptacles, NEMA No. 5-30R, 125V, 30A to CSA 22.2 No. 42 with the following features:

- .1 Black face
- .2 Heavy galvanized steel mounting strap for corrosion resistance.
- .3 Flush mounting within single gang box.
- .4 Wiring from back or bottom

.4 Ground fault circuit interrupting receptacle (GFCI), 15A or 20A as indiated 125V, nylon face, feed-thru feature, contrasting colour band on reset button, screw terminals, white-coloured face.

.5 Other receptacles with ampacity and voltage as indicated.

.6 Receptacles of one manufacturer throughout project.

2.2 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 Stainless steel,1 mm thick cover plates, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.

.4 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

2.3 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 Install suitable common cover plates where wiring devices are grouped.
- .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

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.

3.4 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 RELATED WORK

.1 Refer to all sections of the specification for related work.

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No. 5-[09], Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

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 circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Include time-current characteristic curves for breakers with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage with ampacity of 400A and over.

.4 Certificates:

.1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.

.1 Production certificate of origin must be submitted to Consultant for approval.

.2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.

.3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Consultant. Unless complying with this requirement, Consultant reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.

.4 Production certificate of origin must contain:

.1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.

.2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.

.3 Contractor's name and address and person responsible for project.

.4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.

.5 Name and address of building where circuit breakers will be installed. Include:

.1 Project title:

.2 List of circuit breakers

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 00 - Common Work Results - Electrical

PART 2 Products

2.1 BREAKERS – GENERAL

.1 Moulded-case circuit breakers, ground-fault circuit-interrupters to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation [with temperature compensation for 40 degrees C ambient].

.3 Plug-in moulded case circuit breakers: quick- make, quick-break type, for manual and automatic operation [with temperature compensation for 40 degrees C ambient].

.4 Common-trip breakers: with single handle for multi-pole applications.

.5 Bolt-on moulded case circuit breakers, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C (104°F) ambient.

.6 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-10 times current rating.

.7 Circuit breakers with interchangeable trips as required.

.8 To be of same manufacturer as panelboards.

2.2 THERMAL MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

OPTIONAL FEATURES

.2 Include, as required:

.1 on-off locking devices

.2 under-voltage release

.3 handle mechanism

.4 shunt trip

2.3 MANUFACTURERS

.1 Acceptable manufacturers: To be compatible with existing panels.

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 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 INSTALLATION

.1 Install circuit breakers according to manufacturer's recommendations.

.2 Install on-off locking devices for breakers feeding fire alarm panel, security panels, etc.

.3 Paint fire alarm breaker red.

END OF SECTION

PART 1 General

1.1 RELATED WORK

.1 Refer to all sections of the specification for related work.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 00 Common Work Results - Electrical.

PART 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible and non-fusible disconnect switch in EEMAC `3R' enclosure for interior sprinkler proof application, unless otherwise indicated.

.2 Bus duct plug-in type to match existing.

.3 Provision for padlocking in on-off position.

.4 Mechanically interlocked door to prevent opening when handle in ON position.

.5 Fuses: size as required.

.6 Fuseholders: suitable without adaptors, for type and size of fuse indicated.

.7 Quick-make, quick-break action.

.8 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 nameplates.

2.3 APPROVED MANUFACTURERS

.1 Approved manufacturers: Cutler Hammer, Square D, Siemens.

PART 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses only where specifically indicated.

.2 Install circuit disconnect switches where indicated or where required by the inspection authorities and/or for equipment supplied by other trades.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This Section covers items common to Sections of Division 26, 27 and 28. These sections supplement requirements of Division 1.

.2 REFERENCES

.3 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.

.4 ASTM International Inc.

.1 ASTM F1137-00(2006), Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.5 Canadian Standards Association (CSA International)

.6 ICES-005-07, Radio Frequency Lighting Devices.

.7 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 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 Departmental Representative.

.3 Photometric data to include: spacing criterion.

.3 Quality assurance submittals: provide following in accordance with Section 01 45 00 - Quality Control.

.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 Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Divert unused metal materials from landfill to metal recycling facility.

.4 Disposal and recycling of fluorescent lamps as per local regulations.

.5 Disposal of old PCB filled ballasts.

Part 2 Products

2.1 LUMINAIRES

.1 As specified in the luminaire schedule.

2.2 DRIVERS

.1 LED Drivers

.2 Reliable and consistent operation

.3 High efficiency >90%

.4 Greater than 0.9 PF and Less than 20% THD

.5 Greater that 50,000 hrs life time

.6 5-year limited warranty

.7 ROHS compliance

.8 Safety approbations (UL, CSA, CE, ENEC, PSE, SELV or CQC)

.9 Dimmable and Programmable.

.10 Designed to meet the needs of LED lighting

.11 Available in either dedicated input voltage or Intellivolt options

.12 Dimmable

.13 The Adjustable Output Current (AOC) feature

.14 Specific dimmable versions to enable use of lighting controls to help increase energy saving through a wide variety of protocols, such as 0-10V

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.

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 Clean in accordance with Section 01 74 11 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This Section covers items common to Sections of Division 26, 27 and 28. These sections supplement requirements of Division 1.

1.2 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.

1.3 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.

.3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

Part 2 Products

2.1 STANDARD UNITS

.1 Exit lights: bilingual to CSA C22.2 No.141 and CSA C860.

.2 Housing: extruded aluminum minimum 1.0 mm thick, satin aluminum enamel finish

.3 Face/back plates: cast aluminum alloy

.4 Lamps: LED-5W 347 V 50,000 hours.

.5 Operation: designed for 50,000 hours of continuous operation without relamping.

.6 Letters: 150 mm high x 19 mm, with 13 mm thick stroke, white on red glass reading EXIT-SORTIE.

.7 Face plate to remain captive for relamping.

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 Connect emergency lamp sockets to emergency circuits.

.4 Ensure that exit light circuit breaker is locked in on position.

3.3 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 RELATED REQUIREMENTS

.1 Note Used

1.2 REFERENCES

.1 Refer to section 27 05 00 for references applicable to this project.

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 communications equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Construction/Demolition Waste Management and Disposal in accordance with Section 10 74 21

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 communications equipment 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 Packaging Waste Management: remove for reuse and return 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.

Part 2 Products

2.1 GROUNDING CONDUCTOR

.1 Ground wire: No. 6 AWG stranded annealed copper conductor with colour Green polyvinyl chloride insulation designed for ground connections to protect cable terminals and protectors.

2.2 2-POST TELECOM RACK

.1 EIA compliant 483mm 2-post telecom rack.

.2 Complete with double sided 10/32 tapped holes and EIA universal standard hole pattern.

.3 44 rack units 2.1m high complete with 2 hinged vertical cable management.

.4 Floor mounted ultra heavy welded steel construction.

.5 Black powder coat finish.

.6 Acceptable manufacturers: Middle Atlantic, Electron Metal, Cable Talk

2.3 SMALL EQUIPMENT RACK FOR ROOM 110

.1 EIA compliant 483mm rotating slide-out equipment rack.

.2 Overall dimensions of rack shall be 483mm W x 697 mm H x 588 D with 14 useable rack spaces and a 300 lb. weight capacity.

.3 Rack shall put out 584mm on integrated ball bearing slides and rotate 90° for equipment servicing.

.4 Detachable rack allows for off-site integration.

.5 Front mounted tab shall be used to rotate rack and lock into position.

.6 Front mounted level shall lock rack in extended position.

.7 When rotating rack, locking detent shall allow rack to lock in place at 0°, 60° and 90°.

.8 Rack rail shall be 11-gauge steel with tapped 10-32 holes in universal EIA spacing.

.9 Rack rail shall be finished in black e-coat with marked rack spaces.

.10 rough-in pan shall be 14-gauge steel.

.11 Finish on assembly shall be a durable flat black powder coat.

.12 Trim/locking panel shall lock cabinet in closed position and be 11-gauge aluminum with a black brushed and anodized finish. Equipment cabinet shall be warrantied to be free from defects in material or workmanship under normal use and conditions for a period of 3 years.

.13 Locking trim panel in silver brushed and anodized finish.

.14 Acceptable manufacturers: Middle Atlantic, Electron Metal, Hammond

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.

.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 grounding conductor between new telecom room 104 grounding bus bar and existing telecom room 206.

.2 Install 2-post rack in telecom room 104

.3 Install Small equipment rack in room 110, coordinate with millwork supplier the installation of rack and with Departmental Representative.

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.

2.4 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-B-2011, Joint Standard - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

.2 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA)

.1 TIA/EIA-606-B-2012, 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).

.4 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code 23rd Ed.

.5 Building Industry Consulting Services International (BICSI)

.1 BICSI Telecommunications Distribution Methods Manual 13th Edition

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.

1.3 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.2 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

.1 A Pre-drilled electroplated copper Busbar with holes for use with standard 2 hole lugs with standard NEMA bolt hole sizing and spacing..

.2 Shall be sized accordance with the immediate connection requirements with a minimum of 4 extra sets of holes.

.3 Shall be a minimum size of 6mm thick, 53mm high and variable in length.

.4 Shall include Insulated supports with a minimum of 50mm separation from mount.

.5 Shall be listed by a nationally recognized testing laboratory.

.6 Acceptable Products: Cable-Talk CT-BIBB 2X10-12, Panduit GB2B0306TPI-1, Erico TGB-A14L06PT.

2.2 BONDING CONDUCTOR FOR TELECOMMUNICATIONS

.1 3/0 AWG stranded copper conductor, green insulated marked to: ANSI J-STD-607-B.

2.3 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

.1 3/0 AWG stranded copper conductor, green insulated marked to: ANSI J-STD-607-B.

2.4 GROUNDING EQUALIZER (GE)

.1 3/0 AWG stranded copper conductor, green insulated marked to: ANSI J-STD-607-B.

2.5 EQUIPMENT BONDING CONDUCTOR (EC)

.1 6 AWG stranded copper conductor, green insulated marked to: ANSI J-STD-607-B.

2.6 RACEWAY BONDING CONDUCTOR (RBC)

.1 6 AWG stranded copper conductor, green insulated marked to: ANSI J-STD-607-B.

2.7 BONDING CONDUCTOR TERMINATION

.1 Two-Hole compression lugs, long barrel type, sized as per AWG of cable.

.2 High conductivity wrought copper.

.3 Electro tin plated

.4 Hole spacing as per TMGB and TGB.

2.8 INSULATED CONDUIT GROUND BUSHINGS

.1 Each Metal Conduit originating in the Telecom Entrance Facility, Telecom Room or Equipment Room shall be directly connected to the TMGB or TGB via a compression lug.

.2 Ground bushing shall be insulated.

2.9 BONDING AND GROUNDING CLAMPS

.1 All ground wires originating at the TMGB or TGB shall be clamped to the plywood backboard "B" ground wire clamps.

.2 Shall be mechanically galvanized ASTM B695

.3 5.6mm hole diameter

2.10 CABLE TRAY BONDING CLAMPS

.1 Shall be constructed of malleable iron

.2 Zinc plated

.3 Shall allow for clamping of ground wire of multiple gauges.

2.11 WARNING LABELS

.1 Non-metallic warning labels in English and French to: ANSI J-STD-607-B.

.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 GENERAL INSTALLATION REQUIREMENTS

.1 Install all Bonding Conductors as per CEC. And manufacturers recommended installation procedures.

3.2 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

.1 Install TGB in main terminal/equipment room and each telecommunications room.

.2 Install 3/0 AWG copper bonding conductor from TGB to alternating current equipment ground (ACEG) of serving electrical power panel (panelboard) or main electrical grounding bus bar.

3.3 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 grounding bushing and #6 AWG copper conductor.

3.4 BONDING CONDUCTOR FOR TELECOMMUNICATIONS

.1 Install bonding conductor for telecommunications from TMGB to service equipment (power) ground.

.2 Use approved 2-hole compression lugs for connection to TMGB.

3.5 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

.1 Install TBB from TMGB to each TGB as indicated.

.2 Use approved 2-hole compression lugs for connection to TMGB and TGBs.

3.6 GROUNDING EQUALIZER (GE)

.1 Install GE between TBBs in multi-storey building by bonding TGBs with GE on top floor and every third floor in between top and bottom floors.

3.7 BONDING TO TGB

.1 Bond metallic raceways in telecommunications room to TGB using #6 AWG green insulated copper conductor.

.2 For cables within telecommunications room having shield or metallic member, bond shield or metallic member to TGB using #12 AWG green insulated copper conductor.

.3 Bond equipment rack and cabinet located in telecommunications room to TGB using #6 AWG green insulated copper conductor.

3.8 LABELLING

.1 Apply warning labels to telecommunications bonding and grounding conductors.

.2 Apply additional administrative labels to: TIA/EIA-606-B.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)/Telecommunications Industry Association (TIA)

.1 ANSI/TIA-569-C–2012, Telecommunications Pathways and Spaces

.2 Building Industry Consulting Services International (BICSI)

.1 BICSI Telecommunications Distribution Methods Manual 13th Edition

.3 Canadian Standards Association (CSA International)

.1 CSA C22.1-12, Canadian Electrical Code

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 communication raceway systems 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.

.2 Submit Construction/Demolition Waste Management and Disposal in accordance with Section 01 74 21.

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 communication raceway systems 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 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 SYSTEM DESCRIPTION

.1 Empty telecommunications raceways system consists of outlet boxes, cover plates, single gang raise plaster adapter ring, distribution cabinets, conduits, cable trays, pull boxes, sleeves and caps, fish wires, service poles, service fittings, surface raceways, floor boxes.

.2 Overhead main cable tray distribution system and combination J-hook/conduit to device outlet installed in accessible ceiling space.

.3 Voice and data cabling installation is not in contract. Shared Service Canada (SSC) is responsible for the installation, termination and testing of voice and data cabling.

2.2 CABLE TRAYS: BASKET STYLE CABLE TRAY

.1 Shall be a pre-fabricated structure, minimum 300 mm wide by 103mm tall consisting of a Basket bottom within basket two side rails.

.2 Shall be supported as per manufacturer's instruction and applicable codes.

.3 Use proper manufactured fittings; accessories and fittings such as cable drop-out fitting, elbow, reducers, crossovers, tees and risers will be used for any change of direction, height or size of the basket cable tray.

.4 Acceptable Manufacturers: Cablofil, Hubbell, Thomas and Betts

2.3 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

.1 Cable tray shall be supported by Cantilever brackets, Trapeze Brackets, or individual rod suspension. Supports shall be approved types of wall brackets or trapeze hangers. Additional bracing may be required for seismic restraints.

.2 Conduits entering a room shall be appropriately racked on a trapeze support suspended from the structure.

.3 Cable tray shall be supported via Manufactures brackets, or supports manufactured on site using Unistrut or B-line channel, meeting all the manufacturers' requirements for loading.

.4 Conduits should be independently supported, free from any other mechanical system.

.5 Conduit and cable tray support systems shall be securely and adequately installed to preclude movement of conduit and cable tray during pulling operations.

.6 J-hooks are authorized for Communications Distribution installed in T-bar ceiling space.

2.4 CONDUIT, PULL BOXES AND OUTLET BOXES FOR COMMUNICATIONS AND SECURITY SYSTEMS

.1 Metallic Conduit

- .1 Thin Wall EMT, reamed and bushed at both ends.
- .2 Minimum Size for communications is 27mm inside diameter.
- .3 Installed above ceilings, under access floors and in walls only; not acceptable for in floor use.
- .4 Conduits, conduit fittings, hanger and supports: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings, Section 26 05 29 Hangers and Support for Electrical Systems, Section 26 05 33 Raceway and Boxes for Electrical System
- .5 Fish wire: polypropylene type.

.2 Pull Boxes

- .1 Shall be made of code gauge steel and shall have a rust resistant finish.
- .2 Shall be constructed in accordance with Canadian Standards Association.
- .3 Shall be sized in accordance with ANSI/TIA/EIA-569B, Table 12.
- .4 Pull Boxes for Security systems hall not have pre-punched knockouts.
- .5 Junction boxes, cabinets type: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.3 Outlet Boxes for communications systems

- .1 Shall be a minimum size of 100mm x 100mm x 65mm deep.
- .2 Shall have a raised Plaster adapter ring sized for a single gang opening for communications Outlets.
- .3 Shall have raised plaster adapter ring sized for Access Control devices.
- .4 Shall have raised plaster adapter ring sized for Digital Wall clock.
- .5 Shall have raised plaster adapter ring sized for Intrusion Alarm devices.
- .6 Outlet boxes 2-gang type with single gang plaster ring, conduit, and fittings: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

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 Consultant.
- .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 empty raceway system, including underfloor overhead distribution system, pull wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cable tray, service poles, miscellaneous and positioning material to constitute complete system.

.1 Install all systems as per the CEC and manufacturers recommended installation procedures.

.2 Ground and bond all conduits and cable tray in accordance with section 27 05 26 and CEC.

.3 Provide separate conduit/cable tray system for the following systems:

- .1 Intrusion Alarm System
- .2 Audio Video Systems
- .3 Public Address / Audio system
- .4 Sound Masking System
- .5 Video Surveillance and Access Control

.4 Electrical Metallic Tubing (EMT) conduits for all Voice Data Systems, Audio/Video system,. Access Control and Video Surveillance systems minimum size to be 27mm unless specified otherwise.

.5 Electrical Metallic Tubing (EMT) conduits for all Intrusion Alarm and Public Address/Audio systems minimum size to be 21mm unless specified otherwise.

.6 Provide the following separation from Electrical Power systems installed in conduits:

- .1 300mm from circuits of 300Volt and less.
- .2 600mm from circuits 300Volt and higher.
- .3 2 Metres from Circuits between 600V and 15KV.
- .4 3 Metres for circuits above 15KV.
- .5 Electrical or Mechanical systems cannot share the same cable tray or be racked on the same support structure.

.7 Heights of Communications system Outlet Boxes:

- .1 Telecommunications outlets, 400mm Above Finished Floor (AFF) (the same height as adjacent receptacles)
- .2 Wall Mounted Telephones or Intercom, 1220mm AFF.
- .3 Access control Card readers, 1100mm AFF.
- .4 Intrusion alarm keypads, 1400mm AFF
- .5 Barrier Free Buttons, 900mm AFF
- .6 Door Contacts, on leading edge of door frame at top of frame.

3.3 INSTALLATION OF HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS.

.1 Support Cable tray of approved types of wall brackets, trapeze supports. Plumbers perforated straps are not permitted means of supports.

.2 Centre hung cable tray is not acceptable for communications cabling.

.3 Conduits and equipment shall be independently supported, free from any other mechanical system.

.4 Conduit and Cable Tray support systems shall be securely and adequately installed to preclude movement of conduit and cable tray during pulling operations.

.5 Communications outlet boxes shall not be placed back to back with another communications outlet box or any other box.

.6 Maximum Height for installed communications systems is 11ft.

.7 Only communications system can be attached to the trapeze supports of the cable tray.

.8 Power or mechanical controls shall not be attached to communications racking.

3.4 INSTALLATION OF CONDUIT, PULL BOXES AND OUTLET BOXES FOR COMMUNICATIONS SYSTEMS.

.1 Conduit Installation Requirements

- .1 All Communications systems shall be installed in conduit or cable tray unless otherwise indicated.
- .2 The inside radius of a bend in conduit shall be not less than 10 times the internal diameter of the conduit.
- .3 All Conduits shall be identified and labelled at both ends. Tags shall identify start and finish of conduit.
- .4 A Maximum of one communications outlet per 27mm conduit run.
- .5 Back to back or offset outlets shall not be used.
- .6 All Conduits shall originate in the communications room, pull box or cable tray.
- .7 Conduits shall be rigidly and adequately fastened to withstand pulling tensions as per manufacturer's recommendations.
- .8 Conduits must follow building lines.
- .9 90-degree LB, LL, LR, or condulets shall not be used in any instance for communications cabling.
- .10 A pull box shall be installed in conduit runs where:
  - .1 The length of conduit is over 30 metres
  - .2 There are more than two 90-degree bends
- .11 Offsets or kicks are to be considered 90 degree bend for communications
- .12 Conduits protruding through the floor shall be terminated 25-50 mm above the finished floor.
- .13 Riser sleeves protruding through the floor shall be terminated 25-75mm above the finished floor, including sleeve and bonding bushing.

.14 Conduits entering and exiting through the ceiling of a communications Room (TR) shall protrude into the room 25-50mm above the 2400mm level.

.15 All zone conduits entering a TR (unless otherwise stipulated will protrude into the TR from 25-50 mm without a bend.

.16 The maximum fill rate authorized for conduits is 40 percent.

.17 Pull boxes shall not be installed higher than 3353mm above finished floor. Approval of this deviation is on a case by case basis.

.18 Communications conduits shall NEVER be run over:

- .1 Boilers
- .2 Incinerators
- .3 Hot Water lines
- .4 Steam lines
- .5 Electrical rooms and Closets
- .6 Washrooms

.19 All Conduits shall be bonded in accordance with section 27 05 26 and the CEC.

.20 All Conduits shall use the trapeze hanger method to support the conduits, shall use threaded rod not less than 3/8" diameter.

.21 Install pull string in all conduits and cable tray tied at both ends for installation by Voice data system contractor.

.2 PULL BOX INSTALLATION REQUIREMENTS

.1 In all instances pull boxes shall be placed in straight sections of a conduit run and shall NOT be used in lieu of a bend. Corresponding ends of the conduit are to be aligned with each other. Conduit fittings shall not be used in place of pull boxes. Conduits shall always protrude in the direction of pull. Conduits shall not exit the sides bottom or back of the pull box.

.2 All Communications system conduits including Intrusion Alarm, Sound Masking, Public Address and Access control shall follow the requirements of this section.

.3 Pull boxes shall be placed in an exposed location, and readily accessible. Pull boxes shall not be placed in a fixed false ceiling space, unless immediately above a suitably marked and hinged panel. If the pull box is installed above a suspended type ceiling a green indicator dot shall be placed on ceiling t-rail to indicate the location of pull box.

.4 All Boxes shall be adequately secured. They shall not be supported by the conduits entering the box.

.5 Riser cables and Communications outlet cannot share the same conduit system or pull boxes.

.3 OUTLET BOX INSTALLATION REQUIREMENTS

.1 Install communications Outlet boxes for voice data systems same level as adjacent receptacles and flush to the wall wherever possible.

.2 Where communications Outlets are installed in steel stud type systems, provide additional cross bracing and or straps to make the installation completely rigid prior to the application of the wall facing material.

.3 Back to back and offset outlets shall not be used.

.4 Apply appropriate acoustic sealing as necessary on back of communications outlet boxes to ensure the STC rating is maintained.

.5 Ensure conduits are installed not to de-rate the STC rating of the wall.

.6 Ensure Outlet Box is mechanically bonded to the Conduit system.

.7 Conduits must enter the outlet box from the top or bottom.

3.5 CABLE TRAY FOR COMMUNICATIONS SYSTEMS

.1 Cable tray shall be installed above false ceilings or below access floors. Under no circumstances should cable tray be installed above a fixed ceiling. Provide a minimum of two 103mm conduits to transition the fixed ceiling portions Install additional conduits if the fill rating of the cable requires additional conduits.

.2 Cable Trays installed 150mm above a false ceiling with 300mm clear access above. Cable tray shall be installed with separation from sources of EMI and electrical power system as indicated.

.3 Communications Cable Tray shall NEVER be run over:

.1 Boilers
.2 Incinerators
.3 Hot Water lines
.4 Steam lines
.5 Electrical rooms and Closets
.6 Washrooms.

.4 Support Cable Tray to suit loading and recommended support requirements in the Canadian Electrical Code, Part 1, for the applicable class. A support shall be placed within a maximum of 610mm on either side of any connection to a fitting and 1524mm on centre as recommended by the cable tray manufacturer. Cable Tray shall be adequately fastened to withstand pulling tensions as per manufacturer's recommendations.

.5 Remove any burrs, sharp edges, or projections that may damage cables.

.6 Install proper manufactured accessories and fittings such as elbows, reducers, crossovers, tees and risers for any change of direction, height or change of direction of the cable tray. Vented accessories shall be used.

.7 Install cable tray a minimum of 300mm from fluorescent luminaries, Power cables shall cross at right angles to communications cables with the separation distances as indicated.

.8 Install Cable tray either using angle brackets or trapeze, ensure only communications systems can be racked to the bottom of the tray. Electrical power or Mechanical controls shall not be racked or installed using communications equipment supports or hangers.

.9 Install Grounding and Bonding in accordance with section 27 05 26 and CEC.

.10 Ensure other building components, i.e.: mechanical ducts, sprinkler pipes, luminaries, etc do not restrict access to Communications cable tray.

.11 Mark Cable Tray at each transition or connection.

.12 Provide cable water fall down to 2-post rack.

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 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.

3.7 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 RELATED REQUIREMENTS

.1 Not Used

1.2 REFERENCES

.1 Industry Canada - Terminal Attachment Program

.1 CS-03-2010, Compliance Specification.

.2 National Fire Protection Association (NFPA)

.1 NFPA72-2010, National Fire Alarm and Signaling Code.

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 audio system and wireless microphones 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 Manitoba, Canada.

.2 Indicate on drawings:

.1 Riser diagram, block diagram of complete public address system.

.2 Audio system and wireless microphones system design criteria.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit Construction/Demolition Waste Management and Disposal in accordance with Section 01 74 21.

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 audio system and wireless microphones for incorporation into manual.

.3 Include in manual:

.1 Operation instructions.

.2 Description of system operation.

.3 Description of each subsystem operation.

.4 List showing each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Part list showing parts used in equipment by identification numbers that are standard to electronics industry.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Include: Part numbers.

1.6 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 amplifiers, speakers, wireless microphone and wireless microphone transmitters and controllers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction/Demolition Waste Management and Disposal in accordance with Section 01 74 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials as specified in Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Classroom Audio loudspeaker system to incorporate:

.1 The audio room controller shall be programmed to be able to deliver Voice announcement, music or audio input from PC etc for individual classroom Rooms 107A, 107B and 107C. The control panel located in the room shall also be able to select the input and control the volume of the amplifier.

.2 The audio room controller for classroom 107A shall be programmed to be able to send voice announcement, music or audio input from PC etc. and send the output to speakers located in classroom 107A, 107B, 107C and multi-purpose

room. The control panel located in the room shall also be able to select the input and control the volume of the amplifiers.

.3 Audio room controller to be wall mounted in individual classroom to control sound system in the classroom as well as to converge other classroom in to one system.

.4 Audio input to be mounted on the floor box located by the teacher's desk in front of the classrooms. The audio input shall be able to accommodate input from Recorded music from CD player, digital audio - MP3 player, IPOD, computer etc.

.2 Operations:

.1 Paging:

.1 Voice announcements from the microphone overrides broadcast or recorded music reproductions.

.2 Announcement to individual classrooms.

.3 Announcements to all areas.

.2 Music:

.1 Music from CD player and other external source.

.2 Speaker selection made via soft-switches and wall mounted multiplexed assembly.

.3 Amplifiers, wireless microphone receiver and audio input receiver to be rack mounted.

2.2 MATERIALS

.1 Conduits: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings and Section 27 05 28 – Pathways for Communications System.

.2 Communication conductors: as indicated, in accordance with this Section.

2.3 COMPONENTS

.1 Continuous duty cycle.

.2 Modular system design.

.3 Solid state, and suitable for rack mounting.

.4 Maximum operating temperature: 65 degrees C.

.5 Grounding conductor for system components.

2.4 EQUIPMENT RACK

.1 Rack, to accommodate system components, enclosed type, steel construction with internal mounting rails, wire and cable entrances with smooth edges protected by rubber edging, four adjustable rack levelling feet.

.2 Metal outlet raceway with colour coded outlets wired to 120 V, 60 Hz supply controlled by key type locking switch.

.3 Rotating design allows enhanced access to rear equipment connections simplifying wiring. Rotation angle 60°, maximum rollout 635mm.

.4 660mm useable depth, rack frame is housed in a 835mm deep host enclosure.

.5 1956mm Useable height and rack frame height is 2165mm.

.6 Host enclosure can be pre-installed on site while detachable rack frame is integrated with equipment off-site.

.7 Louvres and ventilation apertures in sides and front of the rack complete with forced air cooling system mounted on top of the rack.

.8 Racks to contain but not necessarily limited to following components:

.1 Monitor panel.

.2 Relay assembly.

.3 Page/music selection panel.

.4 Pre-amplifier mixer.

.5 Power amplifiers.

.6 Power supplies.

.7 Installation and service connections to various panels by plug-in type terminal blocks with barriers and screw type terminals.

.8 Acceptable manufacturers: Hammond, Middle Atlantic, Electron Metal

2.5 WIRELESS MICROPHONE AND WIRELESS MICROPHONE RECEIVER

.1 Wireless Microphone: omni-directional, noise cancellation, dynamic type, complete with cradle and battery charger

.2 24-bit/48 kHz digital audio that delivers incredibly clear and accurate reproduction of the source material.

.3 20 Hz – 20 kHz frequency range with flat response.

.4 Greater than 120 dB dynamic range through the analog outputs.

.5 Built-in limiter circuitry prevents digital audio clipping from excessive signal levels.

.6 130 dB dynamic range (typical) using Dante™ digital networked audio.

.7 60 dB of adjustable system gain easily accessible from the receiver front panel.

.8 No transmitter gain adjustments needed - optimized for any input source

.9 Up to 72 MHz overall tuning range (region dependent)

.10 Up to 17 active transmitters in one 6 MHz TV channel (22 on an 8 MHz TV channel).

.11 High Density mode enables up to 47 active transmitters in one 6 MHz TV channel (63 in one 8 MHz TV channel), with no audio quality degradation.

.12 Rock-solid signal stability with no audio artifacts over the entire 100 meter line-of-sight range using standard supplied ½ wave antennas.

.13 Selectable 1, 10, and 20 mW transmitter RF output power.

.14 Optimized scanning automatically finds, prioritizes, and selects the cleanest frequencies available.

.15 Wireless microphone receiver shall be the same manufacturer as the wireless microphone. Shall be complete with ceiling mounted antenna, cable, power supply and wireless microphone battery charger.

2.6 DIGITAL MATRIX MIXER/AMPLIFIER

.1 Modular design.

.2 Power Source: 120 V AC, 60 Hz

.3 Power Consumption: 100 W

.4 Audio Input: Max.

- .1 8 channels, modular construction (modules optional)
- .2 Power amplifier input: 0 dB(*1), 10 kΩ, RCA pin jack

.5 Audio Output

- .1 Preamplifier output 1: 0 dB(*1), 300 Ω, unbalanced, RCA pin jack
- .2 Preamplifier output 2: 0 dB(*1), 600 Ω, balanced, removable terminal block (3 pins)
- .3 Speaker output: Removable terminal block (7 pins) (Direct) 60 W, 4 Ω, unbalanced (Transformer) 60 W, 8 Ω 25 V & 70 V, balanced

.6 Module Slot

- .1 Analog input (slot 1 - 8): -10 dB(*1), 10 kΩ, unbalanced
- .2 Digital input (slot 1 - 4): 24 bit/48 kHz
- .3 MIX output (slot 1 - 8): -14 dB(*1), 330 Ω (CH 1 prefader output), unbalanced
- .4 Digital output (slot 5 - 7): 24 bit/48 kHz
- .5 Power supply (slot 1 - 8): +24 V, -24 V, +6 V DC

.7 Digital Audio Signal Reference Level: -20 dBFS

.8 Power Bandwidth

- .1 (Direct) 20 - 20k Hz, 0.02% THD
- .2 (Transformer) 50 - 20k Hz, 0.5% THD

.9 Frequency Response

- .1 Power amplifier section: 20 - 20k Hz, +0, -1 dB
- .2 Analog input module to speaker output: 20 - 20,000 Hz, +1, -3 dB

.10 Total Harmonic Distortion

- .1 Power amplifier section: 0.008% (22 kHz LPF, 1 kHz, rated power)
- .2 Analog input module to speaker output: 0.008% (22 kHz LPF, 1 kHz, rated power)

.11 S/N Ratio

.1 At Input short, 20 - 20,000 Hz, set to ALL FLAT or OFF setting

.2 Output volume min.: 90 dB (preamplifier output)

.3 Output volume max.: 61 dB

.4 (preamplifier output, Input 1 volume: 0 dB, Other Inputs: OFF)

.5 Power amplifier section: 110 dB

.12 Cross Talk: Over 64 dB (at 20 kHz)

.13 Tone Control

.1 Bass: ±12 dB (at 100 Hz)

.2 Treble: ±12 dB (at 10 kHz)

.14 Parametric Equalizer: 10 bands, Frequency: 20 - 20k Hz, 31 steps, Variable range: ±12 dB, Q: 0.3 - 5

.15 Speaker Equalizer: 15 (compatible with TOA speakers only)

.16 High-pass Filter: -12 dB/oct, Variable frequency range: 20 - 400 Hz, 14 steps

.17 Low-pass Filter: -12 dB/oct, Variable frequency range: 4k - 20k Hz, 8 steps

.18 Compressor: Depth: 1 - 5

.19 Delay: 0 - 40 ms (1 ms steps), maximum 40 ms (CH 1 + CH 2), mixer mode only

.20 Scene/Event Memory: 32

.21 Operation Mode: Matrix mode/Mixer mode (selector switch)

.22 Auxiliary Function: Key lock function

.23 Control Input/Output

.1 RS-232C, D-sub connector (9 P, female)

.2 Control input: 4 inputs, no-voltage make contact input, open voltage: 3.3 V DC,

.3 Short-circuit current: Under 1 mA, removable terminal block (14 pins)

.4 Control output: 4 outputs, open collector output, withstand voltage: 27 V DC, control current: 50 mA, removable terminal block (14 pins)

.5 Remote volume: 2 channels, connect a 10 kΩ/linear taper variable resistor or

.6 Input the DC voltage of 0 to +10 V, removable terminal block (14 pins)

.24 Operating Temperature: -10°C to +40°C

.25 Operating Humidity: 35% to 80% RH (no condensation)

.26 Finish

.1 Panel: Aluminum, hair-line, black

.2 Case: Surface-treated steel plate, black, paint

.27 Dimensions: 420 (W) × 107.6 (H) × 355 (D) mm

.28 Shall be complete with all modules to interface with other amplifiers, wireless microphone receiver and control module, input and output device modules. Provide

audio input complete with faceplate in the classrooms as well as all the wiring back to the equipment cabinet located in telecom room 104.

2.7 POWER AMPLIFIER

.1 Overload and output short circuit protection.

.2 Power output: 60 W stated in RMS power at 1% harmonic distortion

.3 Frequency response 20 to 20,000 Hz, ±1 dB

.4 Signal and noise level: 90 - 108 dB below rated output.

.5 Maximum gain: 75 dB.

.6 Outputs: 70 V balanced or unbalanced line.

.7 Peak power: 60 W.

.8 Controls and indicators:

- .1 Volume control.
- .2 AC power switch.
- .3 Fused primary.
- .4 'On' indicator light.

2.8 AUDIO ROOM CONTROLLER

.1 Remote Control Panel.

- .1 Wall mounted remote control panel having 4 buttons and 1 volume control knob.
- .2 Power Source: 24 VDC
- .3 Consumption: 50 mA or less
- .4 Terminal Blocks: Removable terminal block (10 pins)
- .5 Indicator: 4 function indicators (Green LED), Level indicators (Green LED)
- .6 Connection Cable: Shielded CPEV cable (paired data line and pair power line) or Category 5e twisted pair cable for LAN (CAT5e-STP)
- .7 Operating Section: 4 function button, 1 volume control

2.9 VOLUME CONTROL

- .1 Wall mounted remote control panel having volume control knob.
- .2 Power Source: 24 VDC
- .3 Consumption: 50 mA or less
- .4 Terminal Blocks: Removable terminal block (10 pins)
- .5 Indicator: Level indicator (Green LED)
- .6 Connection Cable: Shielded CPEV cable (paired data line and pair power line) or Category 5e twisted pair cable for LAN (CAT5e-STP)
- .7 Operating Section: 4 function button, 1 volume control

2.10 AUDIO INPUT OVER CAT5E CABLE

.1 Two-pair audio sending modules compatible with manufacturer's twisted pair products. These modules are designed to be mounted in wall boxes, cabinets or other enclosures that allow users to connect audio sources.

.2 Features a white front-panel laminate with gray lettering that matches Decora©-style remote controls.

.3 Shall be complete with transmitting and receiving device module.

.4 Unbalanced -10 dBV Mini Jack Audio Input

.5 Rear-panel RJ45 Input for Connecting Additional -TPS8A Senders

.6 Left (L) Input Feeds Pair B; Right (R) Feeds Pair C

.7 Signal and Power Pair Pass-Through on RJ45 Jacks

.8 Remote Powering through Twisted Pair Cable

.9 Daisy-Chain with Single-Pair Sender

.10 Studio-Quality Precision Active Balanced Circuitry

.11 Decora® Design with All Steel Panel and Rear enclosure.

.12 Inputs (2): 10 kΩ Unbalanced, stereo; Format-A

.13 Input Connection: Mini jack (front panel); RJ45 (rear panel)

.14 Input Level: -10 dBV; +10 dBV Maximum

.15 Format-A Signal Pairs Used (2): B (Left); C (Right)

.16 Gain: 12 dB

.17 Output: RDL TP Format-A

.18 Output Connection: RJ45

.19 Frequency Response: 20 Hz to 50 kHz (+/- 0.5 dB)

.20 THD+N: < 0.1% (20 Hz to 50 kHz); <0.01% (1 kHz)

.21 Noise below +4 dBu: < -85 dB; < -75 dB with up to 10 -TPS8A modules connected

.22 Crosstalk: < 85 dB (1 kHz); < 75 dB (20 Hz to 20 kHz)

.23 Headroom above +4 dBu: > 20 dB

.24 Power Connection: RJ45

.25 Power Requirement: 24 Vdc @ 30 mA

.26 Dimensions: 1.33" (3.37 cm) D; 1.72" (4.37 cm) W; 4.11" (10.44 cm) H

.27 Ambient Operating Environment: 0° C to 55° C

.28 Complete with power supply

2.11 SPEAKERS (TYPE 1)

.1 8" Ceiling speaker complete with speaker baffle, speaker grill and T-bar/drywall kit.

.2 Rated input: 10W, 70V line

.3 Transformer tap: 0.25, 0.5, 1, 1.5, 2, 2.5, 5, 10W

.4 Sensitivity: 97dB

.5 Speaker component: Dual cone type 8”

.6 Frequency response 50 – 16.5 KHz

.7 Magnet size: Dia.80 K (3.15”) × dia.32 (1.26”) × 12 (0.47 “) mm

.8 Magnet Weight 272 g (10 oz)

.9 Flux density 11,900 gauss

.10 Finish Baffle : Steel plate, white; Grille : Surface-treated steel plate net, white

.11 Potentiometer - Type : Screw-driver adjust Wire wound, resistance 50Ω

2.12 COAXIAL CABLES FOR WIRELESS MICROPHONE SYSTEMS

.1 Coaxial antenna wire: centre conductor No. 16 AWG copper, polypropylene foam insulation, medium density polyethylene skin, two longitudinal drain wires for shielding continuity, outer conductor and shield of polyolefin-coated aluminum tape, and outer jacket of polyvinyl chloride, designed for use between wireless microphone receiver and ceiling mounted antenna.

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 public address systems installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.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 equipment in accordance with manufacturer's instructions, and as indicated.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Conduct intelligibility test.

3.4 CLOSEOUT ACTIVITIES

.1 Manufacturer's factory service engineer to instruct:

.1 Maintenance personnel in maintenance of system.

.2 Operating personnel in use of system.

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 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.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by public address and mass notification systems installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM E1374-06 (11) – Standard Guide for Open Office Acoustics and Applicable ASTM Standards

.2 ASTM E1573-09 – Standard Test Method for Evaluating Masking Sound in Open Office Using A-Weighted and One-Third Octave Band Sound Pressure Levels

.3 ASTM E1130-08 – Standard Test Method for Objective Measurement of Speech Privacy in Open Offices Using Articulation Index

.4 ASTM E2638 – Standard Test Method for Objective Measurement of Speech Privacy Provide by Closed Rooms

.5 Acoustical Design of Conventional Open Plan Offices, Canadian Acoustics, vol 27, no. 3, 2003 (NRCC-46274)

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 Sound Masking systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Include single line diagram, sound masking speaker layout of complete Sound Masking system.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

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 Sound Masking systems for incorporation into manual.

.3 Include parts list using component identification numbers standard to electronics industry.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address. Inspect manufacturer's packages upon receipt.

.2 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 Sound Masking systems from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Protect from moisture during shipping, storage and handling.

.5 Handle packages carefully.

.3 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.

.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 Conduits: size as indicated, in accordance with Section 26 05 00 - Common Work Results for Electrical and in accordance with Section 27 05 28 - Pathways for Communications Systems.

.2 Communication conductors: type and size as indicated, in accordance with manufacturer's cable type and sizes, to be CMP or FT6 rated.

2.2 SYSTEM DESCRIPTION

.1 The contractor shall supply and install a complete and operational Sound Masking System for Classroom 107A, Classroom 107B, Classroom 107C and Workstations room 111 as indicated in the plan.

.2 The sound masking speaker shall either be direct field, radiating directly into space or radiating upwards in the ceiling space.

.3 The sound masking system shall automatically adjust based on the room's ambient noise level or timer based system or has wall mounted volume control system.

.4 System Architecture

1. The system shall be of a networked decentralized architecture with addressable masking devices distributed throughout the installation area.

2. The sound masking system shall be arranged into zones from 1 to 6 speakers.

.1 Each zone shall be individually addressable and controllable for both volume and spectrum for fine tuning of the system.

.5 Sound masking generating system

1. The system shall use digital signal processing (DSP) technology for masking sound generation and output adjustment of masking signals.

2. Sound masking generator shall include an automatic calibration process on 340 narrow bands or third-octave bands from 100Hz to 6.3kHz based on DSP technology.

3. The masking sound shall be generated via a truly-random, non-deterministic digital process with no repeat cycle.

4. The system shall provide independently controllable masking zones that efficiently allow the ability to control and monitor the operation of each zone and provide:
   - .1 A third-octave equalizer per zone with minimum 18 bands, ranging from 100Hz to 6 300Hz
   - .2 Possibility to select specific spectrum for each masking zone.
   - .3 Definition of the sound masking spectrum by increment of 0,1 dB in each 1/3 octave band.
   - .4 An independent masking volume control providing minimum 0.1 dBA volume increments and an output range of 35 to 85 dBA @ 1m from the loudspeaker
   - .5 A temporary mute function for the masking output
   - .6 The ability to completely disable the masking output
   - .7 Possibility to provide a masking volume ramp-up function of up to 4 weeks to facilitate the introduction of the system in the buildings that are already occupied.
   - .8 The system shall provide a function to allow a gradual ramp up of masking volume each time power is applied

.6 System control and software

1. The configuration and the adjustment of the system shall be made with a PC or a tablet connected by a wireless connection. The wireless connection is required only during the configuration of the system.

2. The sound masking system shall include graphical software interface that integrates the design, setup, and calibration stages directly on the office layout plan.

3. When adjustment needs to be made on the sound masking system, the operator shall be able to make the changes directly from the area that needs modification. The operator control PC or tablet shall be able to communicate with the system by wireless.

.7 Sound Masking Systems Acoustical Performance

1. The preferred target sound masking frequency spectrum to be used shall be the one shown in Table 1 and in Acoustical Design of Conventional Open Plan Offices, Canadian Acoustics, vol 27, no. 3, 2003 (NRCC-46274) for each zone

   .1 The frequency contour provided shall be maintained at different dBA target levels by equally applying the positive or negative difference, between the nominal 45 dBA level and the target dBA level, to each of the one-third octave frequency band's dB level, so as to equally shift the entire contour. (e.g. A target level of 42 dBA, will required shifting the entire 45 dBA spectrum down equally by 3 dB in each of the 1/3 octave frequency bands)

Table 1: Optimal Sound Masking Spectrum (ref. Bradley, NRCC-46274 report)

– Nominal 45 dBA Contour

1/3 Octave Band Center Frequency	1/3 Octave dB Sound Levels (overall = 45 dBA nominal)
Hz	dB
100	42.5
125	42
160	41.5
200	41.5
250	41
315	40.5
400	39.5
500	38.5
630	37.5
800	37
1,000	35.5
1,250	33.5
1,600	31
2,000	28.5
2,500	26.5
3,150	23.5
4,000	21.5
5,000	19.5

2. Provide Adaptive volume control adjustment Workstations room 111
3. Masking sound levels for each location type shall be as follows:

   .1 45 dBA in open plan areas.
   .2 45 +/- 2 dBA in open areas with the adaptive volume control adjustment option.

.3 42 dBA in enclosed rooms

4. The supplier shall setup the sound masking system to meet acoustical performance requirements when HVAC systems are functioning under what is considered a "normal" mode of operation for occupied periods.
   .1 It is the Departmental Representative's responsibility to ensure HVAC systems are operating as required during sound masking system's scheduled commissioning.
   .2 The supplier shall not be responsible to meet acoustical performance requirements in locations where, existing background noise exceeds sound masking spectrum levels, and/or where building design details or other constraints prevent its proper installation, setup and operation.

5. The spectrum should be verified and adjust to match target spectrum for every 100 to 150 square meters in open area and in 20% of enclosed rooms. The measurement shall be performed at representative locations 1.5m above floor level 1m away from demising partitions and walls or large reflecting surfaces, in concordance with ASTM E1573 measurement procedures.

6. After adjustment, the system shall provide spatial uniformity within the tolerances provide below.
   .1 Overall dBA levels measured within zones and in enclosed rooms shall be within +/- 1 dBA, of the specified target level for the combined mechanical and sound masking level.
   .2 Uniformity in any third-octave band shall vary no more than +/- 2 dBA, from the 1/3 octave band contour levels indicated in Table 1.
   .3 In the situation where building background noise exceeds the target spectrum, special attention should be taken to identify the source.

7. To meet the above requirement, and allow flexible adjustments of the masking level, each 100 to 150 square meters of an open area should have an independent adjustment capability.

8. Upon completion of installation, and final setup the supplier shall provide a report to Departmental Representative of the sound masking systems acoustical performance.

.8 Adaptive volume control adjustment in open areas

1. The adaptive volume control system provides a real-time volume adjustment of the masking sound level based on the level of distracting noise in a zone.
2. The ambient noise shall be measured with sensors installed in the ceiling.
3. The adaptive adjustment system shall be based on the latest DSP technology
4. Sensitivity of the active volume control shall be programmable to adapt masking level with ambient noise increase.
5. Level variations rates shall be adjustable with 0.1dB steps, update every 15s.

6. The minimum and maximum sound masking level and the sensitivity of the active volume control shall be programmable.
7. It should be possible to control the masking sound volume in each zone independently.
8. History of the active volume control shall be recorded on a 7 days period to allow the performance of the system to be analysed.

.9 Timer Performance

1. The system shall provide a timer function allowing masking volume levels to be automatically adjusted according to a programmed schedule
2. The system shall provide a calendar-based programmable timer function. Timer schedules shall be assigned to an individual or group of sound masking zones.

.10 In-Room occupant Control for all the classrooms

1. Provide 1 wall mounted, in-room controls for each classroom giving the user's manual controls over the loudspeaker volume in designated room or zone.
2. Electrical contractor to provide boxes and conduit complete with pull string as indicated in the plan.

.11 Security Performance

1. The system shall provide:
   .1 Password-protected access to the project manager software.
   .2 storage of settings in memory in each networked masking device, which shall be maintained during power outages

2.3. SUBMITTALS

.1 Product Data: Manufacturer's specifications and installation instructions.
.2 System Design: Schematics of the system showing quantity and location of components, related cabling and accessories.
.3 Warranty Documents: Warranty documents covering the system components.

2.4. QUALITY ASSURANCE

.1 System Design: Performed by an approved manufacturer representative.
.2 Installer Qualifications: Approved by manufacturer representative and are trained with the specified components or have demonstrated experience with the installation of similar products to those specified.
.3 System Adjustment: Done by an approved manufacturer representative or trained contractor.

2.5. REGULATORY TESTING AND CERTIFICATIONS

.1 The relevant system components shall conform to:

1. UL 60065 / ULC 60065 – Standard for Audio/Video and Musical Instrument Apparatus for Household, Commercial and Similar General
2. FCC – EN 55103-1&2 – Audio, Video and Entertainment Lighting Control

2.6. WARRANTY AND MAINTENANCE

.1 Provide a written warranty that the system components installed shall be free from defects in parts or assembly for a 5-year period from date of first use (the date of system initialization).

Part 3 Execution

3.1 SYSTEM DESIGN

.1 Design system according to manufacturer's specifications.

3.2 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for intercommunications systems installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of .

.2 Inform of unacceptable conditions immediately upon discovery.

.3 Ensure that facility build out is at a stage suitable for the system installation.

.4 Ensure that facility is constructed according to plans, including wall locations, ceiling types and plenum barriers.

.5 Ensure that the plenum height is appropriate as per manufacturer's recommendations and as per plan.

.6 Ensure power requirements have been provided as per plan.

.7 Ensure sufficient space for centrally located components is available as per plan and manufacturer's specifications.

.8 Ensure any third-party components required to be interfaced with the system have been provided.

.9 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from .

3.3 PERMITS

.1 Obtain necessary permits for installation work.

3.4 INSTALLATION

.1 Install equipment as indicated and in accordance with manufacturer's instructions.

.2 Interconnect system components.

.3 Follow all applicable codes and standards for the area.

.4 Follow manufacturer's recommendations regarding installation.

.5 Follow the system design for location of loudspeakers and wiring.

.6 Record any necessary changes to the system design on the plan.

.7 Ensure that supplementary materials used meet applicable safety standards.

3.5 FIELD QUALITY CONTROL

.1 Ensure that loudspeakers are suspended in a level manner.

.2 Minimize obstructions to loudspeakers, to the extent possible.

.3 Ensure cables are properly supported in the ceiling.

.4 Ensure cables are securely terminated.

.5 Ensure cables are Plenum rated

3.6 SYSTEM CONFIGURATION AND ADJUSTMENT

.1 Follow manufacturer's recommendations for system settings as found in the User Manual.

3.7 DEMONSTRATION AND TRAINING

.1 Demonstrate operational system to the Departmental Representative by walking the space.

.2 Demonstrate functionality of the system to the Departmental Representative.

.3 Provide any training to the Departmental Representative that may be required under the terms of the contract to maintain and/or operate the system or any optional devices (e.g., in room controls)

.4 Provide 2 hour training for users and 2 hour training for maintenance personnel.

3.8 TESTS

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Conduct intelligibility performance test.

3.9 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.

3.10 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by intercommunications and program systems installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Note used

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 Intercommunications systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Include riser diagram, talk paths of complete intercom system.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit Construction/Demolition Waste Management and Disposal in accordance with Section 01 74 21.

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 intercommunications systems for incorporation into manual.

.3 Include parts list using component identification numbers standard to electronics industry.

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 intercommunications systems 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, 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 Conduits: size as indicated, in accordance with Section 26 05 00 - Common Work Results for Electrical and in accordance with Section 27 05 28 - Pathways for Communications Systems.

.2 Communication conductors: type and size as indicated, in accordance manufacturer's recommended cable type and sizes.

2.2 INTERCOM DOOR STATION

.1 Intercom Door Station

.1 Modular type, suitable for indoor or outdoor installation, minimum IP54 rating. The system shall Internet Protocol (IP) based permit the use of push button type of panels.

.2 Panels shall be vandal resistant. Led illumination, stainless steel face plate frames with concealed fasteners.

.3 Door station shall be complete with relay for use with remote door release of electronic door operator.

.4 1/4 in. CCD Color Camera with high-brightness LED and Up/down and left/right manual adjustment for perfect vision.

.5 Pre-amplified speaker unit with trimmers for audio adjustment.

.6 Clean contact NO-NC relay for lock operation.

.7 Operating conditions will be -10 to +50 °C and up to 90% RH Humidity.

.8 Power supply: PoE

.2 Intercom Master Station

.1 Interchangeable front mask to match a variety of interior decor. Hands-free version with touch sensitive buttons, or full touch screen. Each unit shall be of attractive modern design, suitable for flush or wall-mounting.

.2 The Master controller shall be Inter Protocol (IP) based suitable for the installation of Sub-master station using smart phone, tablet and PC.

.3 3.5 inch screen version:

.1 Hands-free version with touch sensitive buttons (capacitive touch), no mechanical buttons

.2 Each unit shall be of attractive modern design, suitable for flush or wall-mounting

.3 Monitor shall be aesthetically flexible with changeable front-mask so to match apartment design (Black and White options required)

.4 Connection of internal monitors will be realized with Cat.5E cable and RJ45 plug (PoE).

.5 3.5 inch High Resolution graphic LCD with User Friendly icons for simple use or 7 inch touch screen LCD.

.6 SD card slot available to increase monitor's memory and upload customized ringtones /melodies.

.7 Dedicated Key and Speech button, for lock release and audio function.

.8 Menu buttons to navigate into the User Menu

.9 Programmable buttons for different services (Intercom Calls to other monitors/apartments, call to CPS, Self Trigger to CCTV camera or Entrance Panels, other functions)

.10 Dedicated button and LED indication for Privacy/Do not Disturb function

.11 All-call audio intercom function between an individual or group of internal stations

.12 Integrated video recording function. Automatic in case of unanswered call

.13 Programmable inputs for Alarms sensors (at least 4) for use as; Panic button, Fire/Smoke detectors or other similar device with the possibility to program these inputs in order to send different type of Alarm signals to CPS

.14 Monitors can provide function as a simple Burglar Alarm control unit, with Arm/Disarm function and programmable Exit/Entry time and Password

.4 Network POE Switch: Use network switch provided by Shared Service Canada/Landlord.

.5 Remote Video Input Module: Remote video input module shall have the following:

.1 Ability to connect to the network via Cat.5E cable and RJ45 plug (PoE).

.2 Able to have 4 analog CCTV cameras connect to it via composite 2 wire connection.

.3 Able to have any internal monitor bring up any of the cameras or sequence of cameras

.4 Allow for unlimited number of video input modules on each system.

.5 Individually addressable through the system.

.6 Software and Apps:

.1 Intercall application (App) - (iOS/Android):

.1 App to be used on any apple iOS or Android mobile device or tablet.

.2 App to be downloaded from the Apple itunes store or the Google Play store.

.3 App to be used as a expansion monitor only.

.4 To be able to provide full functions as a standard monitor such as two way audio and video communication, door release, intercom between internal stations, remote triggers of devices such as relays and cameras on the LAN.

.5 App to be connected through Wifi on the same LAN network as the other intercom devices.

.6 IP address for the app to be determined by DHCP.

.7 Individually addressable through the set up on the mobile device itself.

.2 PC software Monitor- (Loaded on a USB Stick)

.1 Software Monitor used as a master or expansion monitor in the system.

.2 Must be easy to install directly on a PC or MAC via the provided USB stick

.3 USB stick used as the registration encoding device; requires that USB remain on the PC in order for the software to function.

.4 Each Software monitor shall be installed on computers.

.7 Video Output Module:

.1 Module for video output in standard analog format for use with a DVR, or any other video distribution equipment.

.2 Single output in NTSC Video format.

.3 Individually addressable through the system.

.4 Connection of device will be realized with Cat.5E cable and RJ45 plug (PoE).

.5 Product: Video output device 1446, or equal.

.8 VIP to SIP module:

.1 Module allows for the conversion of the proprietary IP Intercom signal to be translated into standard SIP format.

.2 Gives the system the ability to talk to can SIP device, Audio or Video.

.3 Module shall be installed on the same LAN as the rest of the IP intercom system.

.4 Individually addressable through the system.

.5 Connection of device will be realized with Cat.5E cable and RJ45 plug (PoE).

.9 I/O module (relay):

.1 Module to control a normally open or closed relay to be located on the same LAN network as the other Intercom devices

.2 The ability to trigger and control the device from any of the inside or outside devices on the network.

.3 Unlimited I/O modules can be added to the system.

.4 I/O module can be used for door release, gate release, lift/elevator control, or any other dry contact trigger.

.5 Individually addressable through the system.

.6 Connection of device will be realized with Cat.5E cable and RJ45 plug (PoE).

.7 Product: Relay 1443, or equal.

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 intercommunications systems 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 equipment as indicated and in accordance with manufacturer's instructions.

.2 Interconnect system components.

3.3 TESTS

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Conduct intelligibility performance test.

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 intercommunications and program systems installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Not Used.

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 clock systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Diagram of proposed system showing Owner's Network Time Protocol server, communication pathway, and schedule of individual clock locations.

.3 Indicate integration with the Owner's network and servers. Include a line diagram of network relationships. Show system power requirements.

.4 Sample Warranty: Manufacturer's standard form.

.5 Sample System Maintenance Proposal.

1.3 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 clock systems 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, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal Section.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 The synchronized clock system utilizes the Owner's 10/100 Base-T Ethernet. Time signals emanate from the Departmental Representatives Network Time Protocol (NTP) server.

.2 Remotely-hosted system receives diagnostics and firmware upgrades from and backs up to vendor's central server.

.3 Locally-hosted system managed through licensed firmware and software maintenance agreement.

2.2 SYSTEM COMPONENTS

.1 Clocks: IP addressable digital NTP synchronized clocks with automated monitoring, alerting, and reporting firmware. The clock firmware performs self-diagnostics on battery life, time accuracy, and strength of network connection, and sends diagnostics to the gateway server. Clocks maintain internal reference so that failure of the master NTP system will not cause clocks to fail. Clocks will continue indicating accurate time within plus or minus 0.35 seconds in 24-hours.

.1 Clocks systems that rely on low frequency AM or FM signals or power line frequency for synchronization do not meet the requirements of this specification.

.2 NTP Server: Owner’s server to be utilized that synchronizes clocks over the network with signals from the NTP server, stores and forwards system information from the clocks, and communicates with the vendor's central server for firmware upgrades.

2.3 QUALITY ASSURANCE

.1 Manufacturer's Qualifications: Manufacturer of wireless and Ethernet connected synchronized clock systems with a minimum of five years record of satisfactory manufacturing and support of systems comparable to basis of design system.

.2 Electrical Components, Devices, and Accessories: Listed and labeled per NFPA 70.

.3 Regulatory Requirements: System design and installation shall comply with the following:

.1 National Electric Code (NEC).

.2 Underwriters Laboratory (UL) standards for wired devices.

.3 Local codes and regulations.

2.4 COORDINATION

.1 Integrate design of network synchronized clock system with Departmental Representative’s wireless or wired network.

.2 Coordinate installation of cable with Shared Services Canada.

.3 Departmental Representative/SSC to provide IP address for the network clocks.

2.5 POWER OVER ETHERNET CLOCKS:

.1 4-Digit Green 7-Segment LEDs

.2 103mm high numerals

.3 Dimensions: 30cm x 15cm x 5.6cm

.4 Cabinet Brushed Stainless Steel

.5 Weight: 1.7kg

.6 Viewing Distance: 50+ meters

.7 Accuracy: +/- approximately 200 milliseconds

.8 Operating Temperature: 0° to 40° C

.9 Operating Humidity: 95% maximum, non-condensing

.10 Mounting Options: Surface, Pendant, Cantilever, Flush Inset, Double Sided

.11 Certifications: UL 1950, ETL Listed, CE Marked, RoHS Compliant

.12 Acceptable Product: Primex Wireless SNS5X201SS, On-Time ONT4SS (Green Numerals), BRG Precision PENM440G

2.6 POWER OVER ETHERNET NETWORK SWITCH

.1 Utilize Departmental Representative's Power over Ethernet Network switch.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for clock systems installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.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 Locate Digital clock as indicated in the drawing and connect to Departmental Representative's NTP server.

.2 Provide necessary mounting hardware, coordinate any openings and provide any rough in boxes.

.3 Provide category 5e patch cables for patching between patch panel and PoE switch.

.4 Coordinate with Shared Services Canada (SSC) the installation of category 5e cables for all clock locations.

.5 Confirm with Owner the Time Zone settings. Configure and provide test report for clocks.

3.3 SITE TESTS

.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 clock systems installation.

END OF SECTION

Part 1 General

1.1 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 CPVX: Central Station Burglar Alarm Systems.
- .3 CVSG: Mercantile Burglar Alarm Systems.
- .4 CVWX: Proprietary Burglar Alarm Systems.
- .5 DRS:. Door Release System.
- .6 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 of Canada (ULC)
  - .1 CAN/ULC-S301-09, Standard for Signal Receiving Centre Burglar Alarm System and Operations
  - .2 CAN/ULC-S302-M91(R1999), Standard for Installation and Classification of Burglar Alarm Systems for Financial and Commercial Premises, Safes and Vaults.
  - .3 CAN/ULC-S304-06, Signal Receiving Centre and Premise Burglar Alarm Control Units.
  - .4 CAN/ULC-S310-M91(R1999), Installation and Classification of Residential Burglar Alarm Systems.
  - .5 ULC-S318-96, Standard for Power Supplies for Burglar Alarm Systems.
  - .6 ULC-C634-86, Guide for the Investigation of Connectors and Switches for Use with Burglar Alarm Systems.
- .3 Underwriters' Laboratories (UL)
  - .1 UL 294-2009, Access Control System Units.
  - .2 UL 603-08, Power Supplies for Use with Burglar Alarm Systems.
  - .3 UL 681-1999, Installation and Classification of Burglar and Holdup Alarm Systems.
  - .4 UL 827-2008, Central-Station Alarm Services.
  - .5 UL 1023-2009, Household Burglar Alarm System Units.
  - .6 UL 1076-2005, Safety for Proprietary Burglar Alarm Units and Systems.
  - .7 UL 1641-1999, Safety for Installation and Classification of Residential Burglar Alarm Systems.

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 access controls and equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.
- .3 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.

.3 Shop Drawings:

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.
- .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.

.4 Samples:

- .1 Submit for review and acceptance of each unit.
- .2 Samples will be returned for inclusion into work.
- .3 Submit 1 sample of each component proposed for inclusion into system. Components will be returned for incorporation into work.

.5 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 security access system is "Certified alarm system".

.6 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.

.7 Manufacturer's Instructions: submit manufacturer's installation instructions.

.8 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.

.9 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit Construction/Demolition Waste Management and Disposal in accordance with Section 01 74 21.

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 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.

1.4 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 off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect access controls and equipment 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 by manufacturer of crates, padding, packaging materials as specified in Construction Waste Management Plan in

accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 WARRANTY

.1 For Access control equipment and materials the 12 month warranty period.

.2 Manufacturer's Warranty: submit, for Departmental Representative's acceptance, manufacturer's standard warranty document executed by authorized company official.

Part 2 Products

2.1 MATERIALS

.1 Control Panel:

.1 Network Door Controller shall be an open, non-proprietary platform for access management that meets the requirements for advanced enterprise systems as well as smaller installations.

.2 Shall use IP, standard IT equipment and Application Programming Interface (API).

.3 Shall be scalable and future-proof solution that can easily integrate with other systems and components.

.4 Network Door Controller shall have a built-in software for basic access management and is open for third-party software, allowing the unit to be integrated with solutions provided by other manufacturers.

.5 The controller shall be a smart independent device that is installed by each door and data is automatically synchronized between the controllers in the system. It will continue its normal operation and buffer events locally if there is a network failure.

.6 Supports Power over Ethernet, which eliminates the need for separate power cables to do or accessories and other proprietary data cable.

.2 Include: equipment cabinet, equipment panels, system power supply and all the cables.

.3 Provide system cables including multi-conductor control cable and AC power cable as required.

.4 Up to 2 readers per controller (Wiegand, RS485 (OSDP)) with support for Indala Flexcard proximity card format.

.5 Doors: 1–2 doors per controller

.6 Credentials: Up to 15 000 with third-party access management software depending on server capacity

.7 Event history: 30 000 First In, First Out (FIFO) per controller

.8 Access schedules: Unlimited or third-party software dependent

.9 I/O interface Reader I/O: DC output: 2x 12 V DC output max 300 mA; 2x 4 configurable inputs/outputs, (Digital input: 0 to max 40 V DC, Digital output: 0 to max 40 V DC, Open drain, max 100 mA) Reader data: RS485 full duplex, RS485 half duplex, Wiegand Auxiliary: 1x 3.3 V DC output, max 100 mA 2x configurable inputs/output (Digital input: 0 to max 40 V DC, Digital output: 0 to

max 40 V DC, Open drain, max 100 mA) Door connectors: 2x 2 input for door monitors and REX (Digital input: 0 to max 40 V DC)

.10 Password protection, IP address filtering, HTTPSb encryption, IEEE 802.1X network access control, Digest authentication, User access log

.11 Supported protocols IPv4,HTTP,HTTPSb,TLSb,QoSlayer3DiffServ,FTP,SMTP,Bonjour, UPnPTM, SNMPv1/v2c/v3 (MIB-II), DNS, DynDNS, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS

.12 Software Configuration and basic access control management through Internet Explorer, Firefox, Chrome, or Safari Supported languages: English, French, Italian, German and Spanish

.13 Power Power in: 10–30 V DC, max 26 W or Power over Ethernet IEEE 802.3af/802.3at Type 1 Class 3 Power out & relay: 1x 12 V DC, max 500 mA 1x solid state relay 30 V DC, max 700 mA Power out lock: 2x 12 V DC, max 500 mA

.14 Approvals EN 55022 Class B, EN 50130-4, EN 61000-3-2, EN 61000-3-3, EN 55024, EN 61000-6-1, EN 61000-6-2, FCC Part 15 Subpart B Class B, ICES-003 Class B, C-tickAS/NZSCISPR22ClassB,VCCIClassB,IEC/EN/UL60950-1, UL 294, UL 2043, EN 50581

.2 Card readers:

.1 Type: Weigand proximity.

.2 Proximity technology.

.3 Communications: weigand/clock and data

.4 Fitted with LED indicator light.

.5 Reading distance 25 mm.

.6 Compatible with access card model FPCRD-SSSMW-0000.

.7 Card must be compatible with existing building card.

.8 Multi-Layered Security – Ensures data authenticity and privacy through the multilayered security of HID's SIO.

.9 EAL5+ Certified Secure Element Hardware – Provides tamper-proof protection of keys/cryptographic operations.

.10 SIO Data Binding – Inhibits data cloning by binding an object to a specific credential.

.11 Mobile device support using card emulation - Enables HID access control.

.12 SIO Portability – Provides technology independence and portability to other smart card technologies.

.13 Upgradeable Hardware Connection – Allows all Wiegand-based communication readers to expand communication capabilities to OSDP, Hi-O and other bidirectional protocols.

.14 Field Programmable Readers – Provides secure upgrades for migration and extended lifecycle.

.15 Customization and management from a central location – Enables organization to make changes and manage all attached OSDP readers over RS485 wiring.

.16 Simultaneous support for 125kHz HID Prox, Indala, AWID and EM4102.

.17 Allows for support of future technologies.

.18 Secured communications using OSDP with Secure Channel Protocol.

.19 Certification: UL294/cUL (US), FCC Certification (US), IC (Canada), CE (EU), C-tick (Australia, New Zealand), SRRC (China), MIC (Korea)4, NCC (Taiwan)4, iDA (Singapore)4, RoHS , FIPS-201 Transparent FASC-N Reader

.20 Provide 150 proximity cards, cards shall be Indala Flexcard proximity part # FPCRD-SSSMW-0000 with proprietary bit encryption format. Facility code shall be coordinated with Departmental Representative prior to ordering cards.

.3 System Devices:

.1 Door strike: latch monitor, UL approved complete with mounting hardware.

.2 Request to exit motion detector device:

.1 Infrared detection.

.2 Continuous low-voltage operation.

.3 Fitted with indicator light.

.4 Integrated with local audio alarm (electronic buzzer).

.5 Adjustable coverage.

.3 Power supplies:

.1 Continuous low-voltage operation output.

.2 Equipped with secondary protection for each output.

.3 Individual outputs for connection of devices.

.4 AC power failure output.

.5 DC power failure output and low battery output.

.6 Fitted with tamper contact.

.7 Wall mounted cabinet with locked door complete with 2 keys.

.8 Voltage: Shall be able to supply power for both access control panel and electric strike.

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 Consultant.

.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: SECURITY ACCESS

.1 Install security access systems and components in accordance with CAN/ULC-S302 CAN/ULC-S310 .

.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 Consultant.

.1 Provide all necessary tools, ladders and equipment.

.2 Ensure appropriate subcontractors and manufacturer's representatives and security specialists are present for verification.

.3 Ensure that the system is configured through the building Access control system.

.2 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 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 pictorial, video and audio equipment details.

.3 Mechanical inspection:

.1 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 Dust, debris, etc. are cleaned and removed from site.

.2 Equipment is properly labelled.

.3 Equipment identified in system's equipment lists are in-place and properly installed.

.4 Each System ground method are installed in accordance with manufacturer's instructions and this specification.

.3 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 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.

.3 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 sub carrier, and control signals in accordance with this specification.

.4 Safety:

.1 Demonstrate with documentation that access control system meets safety requirements specified in UL 294.

.4 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.

.5 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.

.6 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 and 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 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

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 Remove protective coverings from accessories and components.

.2 Clean housings and system components, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.

.3 Clean components free from dirt and fingerprints.

.3 Waste Management: separate waste materials for reuse and 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 access controls and equipment installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S304-06, Signal Receiving Centre and Premise Burglar Alarm Control Units.

.2 CAN/ULC-S306-03, Intrusion Detection Units.

.3 ULC-S318-96, Standard for Power Supplies for Burglar Alarm Systems.

.4 ULC-C634-M1986, Guide for the Investigation of Connectors and Switches for Use with Burglar Alarm Systems.

.3 Underwriters' Laboratories (UL)

.1 UL 603-08, Power Supplies For Use With Burglar-Alarm Systems.

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 control panels, keypad, sensors and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.

.3 Submit:

.1 Functional description of equipment.

.2 Technical data for devices.

.3 Device location plans and cable lists.

.4 Devices mounting location detail drawings.

.5 Typical devices connection detail drawings.

.3 Shop Drawings:

.1 Shop drawings to indicate project layout, mounting heights and locations, wiring diagrams, detection device coverage patterns, contact operating gaps, etc.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.1 Submit UL Product Safety Certificates.

.2 Submit verification Certificate that service company is ULC/UL List alarm service company.

.3 Submit verification Certificate that intrusion alarm system is Certified Alarm System.

.5 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.

.6 Manufacturer's Instructions: submit manufacturer's installation instructions.

.7 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.

1.3 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.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.

1.4 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 off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect intrusion detection from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 WARRANTY

.1 Manufacturer's Warranty: submit, for Departmental Representative's acceptance, manufacturer's standard warranty document executed by authorized company official.

.1 Include manufacturer/dealer recommendations, information and support services for 1 year.

Part 2 Products

2.1 MATERIALS

.1 Design Criteria:

.1 Design intrusion detection system using only ULC/UL listed products.

.2 Design intrusion detection system using alarm service company specializing in intrusion detection systems.

.3 Design intrusion detection system as a ULC/UL certified alarm system.

.1 Annunciating undesirable, abnormal or dangerous condition.

.2 Prioritizing alarms by alarm type; i.e. panic/duress, intrusion and tamper.

.3 Determining zone where alarm occurred.

.4 Annunciating power failure and power restoration.

.5 Annunciating low battery condition.

.6 Operate continuously for minimum period of 4 hours in the event of a power failure.

.4 Use existing Alarm control panel located in 2nd floor East Electrical room coordinate exact location of alarm panel with Departmental Representative..

.5 Relocate existing keypad, wireless transceiver and extend wiring to new location as indicated in the plan.

.6 Keypad located in the main floor security area shall be kept connected to the alarm panel and operational.

.2 Control Panel: ULC approved, expandable and designed for multiplexed expansion.

.1 Use existing Alarm Panel located in 2nd floor East Electrical room

.3 Detection Accessories:

.1 Passive Infrared Detectors/Microwave (PIR's): ULC approved, digital.

.1 Coverage pattern: minimum 18m, 90 degrees.

.2 Temperature requirement: 0 – 40 degrees Celsius.

.3 Tamper switch.

.4 Mounting: wall and ceiling.

.2 Glass break detector: ULC approved, complete with tamperproof switch and be designed to meet temperature and mounting requirements of project.

.1 Acceptable sensor based on “Tru Dual” Technology, superior combination of acoustic and seismic detection.

.2 Coverage pattern: 7.5m omnidirectional. Range is adjustable; no minimum range.

.3 Alarm Relay: Form C, 125mA max, 25VDC max

.4 Tamper Switch: Combination cover/wall tamper 25mA max, 24VDC max

.5 Alarm Duration: Five seconds (unaffected by alarm LED latching)

.6 ESD Immunity: 10kV discharges of either polarity to exposed surfaces

.7 Power Requirements: 6 - 18VDC, 12mA typical at 12VDC; 22mA max (Latched LED) AC ripple: 4V peak-to-peak at nominal 12VDC

.8 RFI Immunity: 30V/m, 10MHz - 1000MHz

.9 Operating Temperature: -10° to 50° C

.10 Approvals and Listings

.11 FCC and IC verified

.12 CE

.13 C-Tick

.14 UL/ULC Listed.

.3 Door Contacts : ULC approved.

.1 Mounting: concealed.

.2 Mounting locations: door.

.3 Operating gap: 25 mm.

.4 Security level: high security

.5 Type: magnetic balanced.

.6 Colour identical throughout the installation.

.7 Provide separate and independent contacts for intrusion

.8 Sensors shall be installed as close as possible to the leading edge of the door, as a minimum an alarm shall be generated when door movement exceeds 25mm

.9 UL/ULC approved

.4 DURESS PUSH BUTTON

.1 The unit consists of a housing that contains the electrical circuitry and magnetic reed contacts, a cover plate to protect the internal electronics and an actuating lever with an Alnico V magnet installed in a cradle in the lever. When the lever is fully closed, the magnet — in proximity to the reed — triggers the circuit. The alarm occurs when the actuating lever is moved 20° to 45° past the fully closed position (approximately 1" from the fully closed position). On the latching models, an LED on the unit flashes and latches when the lever is opened. It can be reset only at the alarm panel.

.2 Nominal Voltage: 12 V DC @ 6 mA

.3 Current: Max 8 mA

.4 Operational Voltage: 7 V DC to 15 V DC

.5 Temperature Range: 0° to 110°F (-17.8°C to 43.3°C)

.6 Dimensions: 1.77" W x 2.90" L x 0.76" H (4.50 cm W x 7.37 cm L x 1.93 cm H)

.7 Weight: 1.5 oz.

.8 Housing Material: ABS plastic

.9 Form C: Voltage: 30 V

.10 DC max.Current:. 0.25 A max.

.11 Power: 3 W m

.5 Communications: use existing telephone system.

.6 Connectors and switches: to ULC-C634.

.7 Power supplies: to ULC-S318 UL 603.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for intrusion detection installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.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 panels, intrusion detection system and components in accordance with manufacturer's written installation instructions to locations, heights and surfaces shown on reviewed shop drawings.

.2 Install panels, intrusion detection system and components secure to walls, ceilings or other substrates.

.3 Install required boxes in inconspicuous accessible locations.

.4 Conceal conduit and wiring.

3.3 SITE TEST AND INSPECTION

.1 Perform verification inspections and test in the presence of Departmental Representative and Consultant.

.1 Provide necessary tools, ladders and equipment.

.2 Ensure appropriate subcontractors , and manufacturer's representatives and security specialists are present for verification.

.2 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.

.3 Technical verification: purpose to ensure that all systems and devices are properly install and free of defects and damage. Technical verification includes:

.1 Measurements of coverage patterns

.2 Connecting joints and equipment fastening.

.3 Compliance with manufacturer's specification, product literature and installation instructions.

.4 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'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 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 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

3.5 ADJUSTING

.1 Adjust all components for correct function.

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 Remove protective coverings from accessories and components.

.2 Clean housings and system components, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.

.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 intrusion detection installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Underwriters Laboratories of Canada (ULC)

.1 ULC-S317-1996, Installation and Classification of Closed Circuit Video Equipment (CCVE) Systems for Institutional and Commercial Security Systems.

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 video surveillance equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit:

.1 Functional description of equipment.

.2 Technical data sheets of all devices.

.3 Device location plans and cable lists.

.4 Video camera surveillance chart.

.5 Video interconnection detail drawings.

.3 Shop Drawings:

.1 Submit shop drawings to indicate project layout, camera locations, point-to-point diagrams, cable schematics, risers, mounting details and identification labeling scheme.

.4 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Submit 1 sample of each camera selected complete with housing, brackets and mounting hardware.

.4 Camera will be returned for incorporation into work as appropriate.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.1 Submit UL Product safety Certificates.

.2 Submit verification Certificate that service company is "UL List alarm service company".

.3 Submit verification Certificate that monitoring facility is "UL Listed central station".

.4 Submit verification Certificate that video surveillance system is "Certified alarm system".

.6 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.

.7 Manufacturer's Instructions: submit manufacturer's installation instructions.

.8 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.

.9 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.3 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals. Include following:

.1 System configuration and equipment physical layout.

.2 Functional description of equipment.

.3 Manufacturer's Instructions for operation, adjustment and cleaning.

.4 Illustrations and diagrams to supplement procedures.

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 off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect video surveillance materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.5 WARRANTY

.1 Manufacturer's Warranty: submit, for Departmental Representative's acceptance, manufacturer's standard warranty document executed by authorized company official.

Part 2 Products

2.1 DESIGN CRITERIA

.1 Wire and connect video surveillance camera to existing network switch and existing network video recording equipment. Provide all the required cabling.

.2 The existing analog video surveillance for the building is to be upgraded to Internet Protocol based system, but upto this time it is still in the design stage.

.3 Overall control of Video Surveillance provided through software control, which provides complete integration of security components.

.4 Environment: design video components and systems to operate with specified requirements under following ambient temperatures:

.1 Indoor installations:

.1 Temperature: 0 degrees C to 30 degrees C.

.2 Humidity: 10 to 90%.

2.2 CHARACTERISTICS

.1 Internet Protocol (IP) Video Camera:

.1 Lens: Megapixel resolution P-Iris minimum 80° horizontal field of view

.2 Minimum Illumination: Colour- 0.1 lux, B/W- 0.022 lux

.3 Resolution: 1280 x 960 (1MP)

.4 Frame rate: 25/30fps

.5 Video streaming: Multiple, individually configurable streams in H.264/Motion JPEG, Controllable frame rate and bandwidth VBR H.264.

.6 Image sensor: Progressive scan RGB CMOS 1/3" Environment: indoor.

.7 Security: Password protection, IP address filtering, HTTPSb encryption, IEEE 802.1Xb network access control, Digest authentication, User access log, Centralized Certificate Management.

.8 Supported protocols: IPv4/v6, HTTP, HTTPSb, SSL/TLSb, QoS Layer 3 DiffServ, FTP, CIFS/SMB, SMTP, Bonjour, UPnPTM, SNMPv1/v2c/v3 (MIB-II), DNS, DynDNS, NTP, RTSP, RTP, SFTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS, SSH

.9 Analytics: Video motion detection, Active tampering alarm, Audio detection Cross Line Detection, Digital Auto tracking and third-party applications.

.10 Mounting: Dome type ceiling mounted

.11 Lens functions: fixed auto iris.

.12 Additional features: remote back focus capability, backlight compensation, day/night functionality, low light technology, multiple H.264 video steams.

.13 Operational voltage: standard 24 AC, 12 DC, PoE

.14 Video camera to match newly upgraded video surveillance system for the entire building. Coordinate with Departmental Representative.

.2 Recording:

.1 Use existing video surveillance recorder.

2.3 CAMERA POWER SUPPLY

.1 Power supply: custom designed for all cameras requiring 24 VAC power or Power over Ethernet (PoE) located inside equipment cabinet; fused (each input and output); capable of providing correct voltage to overcome real and circulated system power loss for 2 cameras and to provide future expansion of 25%. Permanently mount power supply. PoE mid-span power supply

2.4 JUNCTION BOX

.1 Metal, sized to handle all system conduit interconnections with appropriate expansion.

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 Consultant.

.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 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheet.

.2 Install video surveillance equipment and components in accordance with ULC-S317.

.3 Install cable, boxes, mounting hardware, brackets, video cameras and system components in accordance with manufacturer's written installation instructions.

.4 Install components secure, properly aligned and in locations shown on reviewed shop drawings.

.5 Connect cameras to cabling in accordance with installation instructions.

.6 Install ULC labels where required.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written reports verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product.

.2 Submit 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 Upon completion of Work, after cleaning is carried out.

3.4 SYSTEM STARTUP

.1 Perform verification inspections and test in the presence of Consultant.

.1 Provide all necessary tools, ladders and equipment.

.2 Ensure appropriate subcontractors and security specialists are present for verification.

.2 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.

.3 Technical verification: purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:

.1 Measurements of tension and power.

.2 Connecting joints and equipment fastening.

.3 Measurements of signals (dB, lux, baud rate, etc).

.4 Compliance with manufacturer's specification, product literature and installation instructions.

.4 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 Operation control of camera lens, pan, tilt and zoom.

.4 Switching of camera to any monitor.

.5 Switching of system video recorder to selective monitor.

.6 Set dwell times.

.7 Demonstrate:

.1 Sequence viewing of cameras on each monitor.

.2 Bypass capability.

.3 Display of stored image to cardholder.

3.5 ADJUSTING

.1 Remove protective coverings from cameras and components.

.2 Adjust cameras for correct function.

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 camera housing, system components and lens, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.

.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 video surveillance installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Refer to all sections of the specification for related work.

1.2 REFERENCES

.1 Treasury Board of Canada Secretariat (TBS), Occupational Safety and Health (OSH)

.1 Fire Protection Standard-10.

.2 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S524-06, Standard for the Installation of Fire Alarm Systems.

.2 CAN/ULC-S526-07, Visible Signal Devices for Fire Alarm Systems, Including Accessories.

.3 CAN/ULC-S527-99, Standard for Control Units for Fire Alarm Systems.

.4 CAN/ULC-S528-05, Manual Stations for Fire Alarm Systems, Including Accessories.

.5 CAN/ULC-S529-09, Smoke Detectors for Fire Alarm Systems.

.6 CAN/ULC-S530-91(R1999), Heat Actuated Fire Detectors for Fire Alarm Systems.

.7 CAN/ULC-S531-02, Standard for Smoke Alarms.

.8 CAN/ULC-S537-04, Standard for the Verification of Fire Alarm Systems.

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 fire alarm system devices and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on shop drawings:

.1 Detail assembly and wiring diagrams

.2 Details for devices.

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 fire alarm system for incorporation into manual.

.3 Include:

.1 Technical data - illustrated parts lists with parts catalogue numbers.

.2 Copy of approved shop drawings with corrections completed and marks removed except review stamps.

.3 List of recommended spare parts for system.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

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 off ground 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.

Part 2 Products

2.1 DESCRIPTION

.1 Existing Fire Alarm Panel is Notifier NFS2-3030

.2 System to include:

.1 Initiating/input circuits.

.2 Output circuits.

.3 Auxiliary circuits.

.4 Wiring.

.5 Manual and automatic initiating devices.

.6 Audible and visual signalling devices.

.7 End-of-line resistors.

.3 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.4 Audible signal devices: to CAN/ULC-S524.

.5 Visual signal devices: to CAN/ULC-S526.

.6 Manual pull stations: to CAN/ULC-S528.

.7 Thermal detectors: to CAN/ULC-S530.

.8 Smoke detectors: to CAN/ULC-S529.

.9 Smoke alarms: to CAN/ULC-S531.

.10 Regulatory Requirements:

.1 To TBS Fire Protection Standard.

.2 Subject to Fire Commissioner of Canada (FC) approval.

.3 Subject to FC inspection for final acceptance.

.4 System components: listed by ULC and comply with applicable provisions of NBC, Local, Provincial Building Code and meet requirements of local authority having jurisdiction.

2.2 SYSTEM OPERATION: SINGLE STAGE (EXISTING)

.1 Actuation of any alarm initiating device to:

.1 Cause electronic latch to lock-in alarm state at central control unit and data gathering panel/transponder.

.2 Indicate zone of alarm at central control unit and at remote annunciator display.

.3 For low rise buildings:

.1 Cause audible devices throughout building to sound at 20 strokes per minute.

.2 Cause audible devices in zone of alarm to sound continuously while other audible devices throughout building sound at 20 strokes per minute.

.4 Cause audible signalling devices to sound in alarm tone throughout building.

.2 Acknowledging alarm: indicated at central control unit.

.3 Ensure that it is possible to silence signals by "alarm silence" switch at central control unit, after 60 seconds period of operation.

.4 Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.

.5 Actuation of any supervisory device to:

.1 Cause electronic latch to lock-in supervisory state at central control unit and data gathering panel/transponder.

.2 Indicate respective supervisory zone at central control unit and remote annunciator display.

.3 Cause audible signal at central control unit to sound.

.4 Activate common supervisory sequence.

.6 Trouble on system to:

.1 Indicate circuit in trouble at central control unit.

.2 Activate "system trouble" indication, buzzer and common trouble sequence. Acknowledging trouble condition to silence audible indication; visual indication to remain until trouble is cleared and system is back to normal.

.7 Troubles on system: suppressed during course of alarm.

.8 Trouble condition on any circuit in system not to initiate alarm conditions.

2.3 CONTROL PANEL (EXISTING)

2.4 INITIATING/INPUT CIRCUITS (TO MATCH EXISTING)

2.5 AUXILIARY CIRCUITS (TO MATCH EXISTING)

2.6 WIRING

.1 Twisted copper conductors: rated 300V.

.2 To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.

.3 To signal circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.

.4 To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.

2.7 MANUAL ALARM STATIONS

.1 Manual alarm stations: pull lever, wall mounted semi-flush or surface type, and general alarm key switch for two stage system bilingual English French signage.

2.8 AUTOMATIC ALARM INITIATING DEVICES

.1 Heat detectors, fixed temperature, non- restorable, rated 57 degrees C.

.2 Thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57 degrees C, rate of rise 8.3 degrees C per minute.

.3 Smoke detector: ionization type air duct type with sampling tubes with protective housing.

.1 Twistlock Plug-in type with fixed base.

.2 Wire-in base assembly with integral red alarm LED, and terminals for remote relay alarm LED.

.4 Addressable smoke detector.

.1 Ionization type.

.2 Electronics to communicate detector's status to addressable module/transponder.

.3 Detector address to be set on detector base head in field.

2.9 AUDIBLE SIGNAL DEVICES

.1 Bells: surface mounted, single stroke, polarized, 24 V dc, 150 mm, 98db.

.2 Bells: to match existing type, gongs of special alloy steel, 24 V dc, 150mm, 98db.

2.10 VISUAL ALARM SIGNAL DEVICES

.1 Strobe type: to match existing, red, 24 V dc.

.2 Designed for surface mounting on walls

2.11 END-OF-LINE DEVICES

.1 End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely.

2.12 AS-BUILT RISER DIAGRAM

.1 Provide Fire alarm system riser diagram for the renovation area

2.13 ANCILLARY DEVICES

.1 Remote relay unit to initiate fan shutdown.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for fire alarm 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/SCOPE OF WORK

.1 Install systems in accordance with CAN/ULC-S524.

.2 Install manual alarm stations and connect to alarm circuit wiring.

.3 Locate and install detectors and connect to alarm circuit wiring. Mount detectors more than 1 m from 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.

.4 Connect alarm circuits to main control panel.

.5 Install signal and visual signal devices and connect to signalling circuits.

.6 Connect signalling circuits to main control panel.

.7 Install end-of-line devices at end of alarm and signalling circuits.

.8 Install remote relay units to control fan shut down.

.9 Sprinkler system: wire alarm and supervisory switches and connect to control panel.

.10 Room detection system.

.1 Install detectors. Make necessary connections between room detection panel and main fire alarm panel.

.2 Locate and install audible signals, visual alarms.

.11 Splices are not permitted.

.12 Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, annunciator equipment and CCU, as required by equipment manufacturer.

.13 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.

.14 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.

3.3 FIELD QUALITY CONTROL

.1 Perform testing and verification of all new and relocated devices in accordance with Section 26 05 00 - Common Work Results for Electrical and CAN/ULC-S537.

.2 Note: Existing devices on existing circuits and zones are generally not shown on the drawings. It is the Contractor's responsibility to determine the locations of all existing devices to verify.

.3 Fire alarm system:

.1 Test such device and alarm circuit to ensure manual stations, thermal, smoke detectors, sprinkler system transmit alarm to control panel and actuate first stage alarm general alarm ancillary devices.

.2 Check annunciator panels to ensure zones are shown correctly.

.3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of systems.

.4 Addressable circuits system style DCLA:

.1 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals on each side of single open-circuit fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.2 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.5 Addressable circuits system style DCLB:

.1 Test each conductor on all DCLB addressable links for capability of providing 3 or more subsequent alarm signals on line side of single open-circuit fault condition imposed near electrically most remote device on each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.2 Test each conductor on all DCLB addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near electrically most remote device on each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.4 Provide final PROM program re-burn for system Departmental Representative incorporating program changes made during construction.

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.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by fire alarm system installation.

3.6 CLOSEOUT ACTIVITIES

.1 Provide on-site lectures and demonstration by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

END OF SECTION

Dear Contractor,

Brookfield Global Integrated Solutions would like to thank you for being one of our qualified service providers.

At Brookfield GIS, we advocate an awareness of elements that are considered to be cornerstones of a safe and conscientious work environment and we work progressively for the safety and wellbeing of employees, tenants, contractors and the end users.

As such, we ask that you assist us in keeping in stride with all Health and Safety standards, legislation and best practices. We have attached building specific documentation for your use, to assist you in completing the required safety documents. Please read the documents identified below and sign the attached acknowledgment notification form after reviewing the below documentation.

- 391 York Ave OHS Building Plan
- Facility Site Specific Hazard Assessment
- BGIS Contractor Safety Handbook and acknowledgement notification form

The following documentation is required to be completed by the contractor, and submitted to BGIS at least two weeks prior to commencing work. Please reference the above mentioned OHS building plan and facility hazard assessment, which will assist you in completing the below required documents prior to the start of the project:

- Work Permit (form # HS 289 01)*
- Project Specific Hazard Assessment*

Templates have been attached. Should you require any assistance please don't hesitate to reach out to the Project Manager for support.

*As part of the ongoing effort to maintain the safety and security of site staff, tenants and building occupants, a Work Permit form has been implemented and is to be completed/returned by the Contractor and approved by the site designate 72 hours before commencement of any site work.

The Work Permit is to be submitted in conjunction with your companies Job Safety Plan and Hazard Assessment. Once completed can be returned to West Work Permit Mailbox: WEST-RP1workpermit@brookfieldgis.com.**

Thank you for your continued services and collaboration for a safe work environment.

Kind regards,

BGIS Health & Safety Team

Your subject line to the West -RP1 Work Permit mailbox should read:* ***GOC/MSA # - (building address)*

Brookfield Global Integrated Solutions		FORM	
Form Title	391 York Ave. OHS Plan	**Number:**	HS 287 01 RP1
Author:	HSE Coordinator	**Effective Date:**	04-MAY-2015
Owner:	HSE Manager	**Revision:**	2

Building OHS Plan

Purpose

- To formalize and clarify the health and safety responsibilities of each individual accessing the building for any matter, and through the promotion of health and safety with the ultimate objective of eliminating any opportunity for occupational injury or illness;
- To provide guidance to all work parties on meeting their obligations under our policies and the regulations;
- To provide instruction on building emergency protocols and the manner in which workplace hazards should be identified, reported and controlled; and
- To clearly identify site-specific policy and procedure as it relates to work authorization, work permit requirements, inspection of the workplace, qualification of the worker, and work refusals.

Overview

Brookfield Global Integrated Solutions Canada (Brookfield GIS) has been designated as the Occupational Health and Safety (OHS) Control Authority for this facility. Brookfield GIS's responsibilities at this facility include ensuring the health and safety of all occupants, visitors, service & maintenance contractors, and construction contractors at the facility. **No work activities will occur in this facility without prior authorization from Brookfield GIS**. As OHS Control Authority, Brookfield Global Integrated Solutions has the right and will exercise their right to:

1. Review all work plans prior to the start of any work
2. Reject any work plans that have the potential to disrupt tenant activities, that do not adequately address risk to the property, or that do not adequately address anticipated health and safety exposures.
3. Request to see any licenses, certifications or similar credentials as well as validate those conducting the work have appropriate qualifications and training.
4. Inspect any work in progress to ensure that the work is being carried out safely as planned, in compliance with the regulations and in no way compromises the facility, the occupants, other service & maintenance contractors present at the site, as well as any construction contractors, visitors to the facility or the public.
5. Participate in all health and safety committee meetings.
6. Stop the work at any time if the approved work plan is not being followed, a hazardous condition is discovered or created as a result of the work, or any equipment, device or system being used by a worker is observed to be unsafe in any way.

Access & Orientation

Site Access Protocol:

- Government of Canada RELIABILITY-level clearance **and** completion of the Brookfield GIS Site Orientation are the minimum requirements for workers requiring unescorted access to this site.
- Certain areas of this facility may require a higher level of clearance. Per government security policy, all such areas will have signage identifying SECRET or TOP SECRET clearance requirements.
- Access to any area of this facility is restricted to those having a legitimate business purpose.
- Workers, who have not completed the Brookfield GIS Site Orientation or have not obtained the required Government of Canada security clearance, will not be permitted access to any area of the site without an APPROVED escort.
- An APPROVED escort will be defined as a tenant employee, member of building security or a Brookfield GIS staff member

Obtaining Security Clearance:

- As noted, all workers requiring unescorted access to this site for business purposes will require Government of Canada Reliability-level screening as a minimum.
- Both of the following forms must be completed by each individual requiring access (Unless they already have a valid security clearance through CISD)
  - Personnel Screening Consent and Authorization Form (TBS/SCT 330-23E)
  - Security Clearance Form (TBS/SCT 330-60E)
- Completed forms can be directed to securityscreenings@brookfieldgis.com

Brookfield GIS Site Orientation

The Brookfield GIS Site Orientation module will familiarize the worker with the occupational health and safety requirements of the site and is a mandatory requirement for any worker requiring access. The Brookfield GIS Site Orientation Module orients the worker to the following:

- Site Access Protocol
- The layout of the Site including a map showing parking for contractors and emergency egress routes
- Instructions on how to obtain security clearance
- Hazard Station (location of, responsibility to review the hazards and associated controls prior to the development of the work plan)
- Safety Standards (Requirement to respect the regulations, as well as Brookfield GIS/PWGSC policy)
- Qualifications of the Worker and the Right to Refuse
- Emergency/Hazardous Occurrence/Hazardous Condition Reporting
- First Aid Stations
- Contacts (NSCC, Brookfield GIS Property Manager, Brookfield GIS Health & Safety Coordinator, Security, etc.)
- Building Emergency and Evacuation Procedures
- Brookfield GIS Work Permit Process (Requirement for a Work Permit prior to the start of ANY work activity)
- Requirement for additional permits for High Risk work activities (Confined Space, Lock-Out/Tag-Out, etc.)

- Hazardous Chemicals and Materials (movement, storage, WHMIS labeling, and Material Safety Data Sheets)
- Use of Loading Docks or Entrance/Exit doors for movement of materials
- Elevator use and restrictions
- Responsibility to safely and responsibly remove all waste generated relative to the work being performed

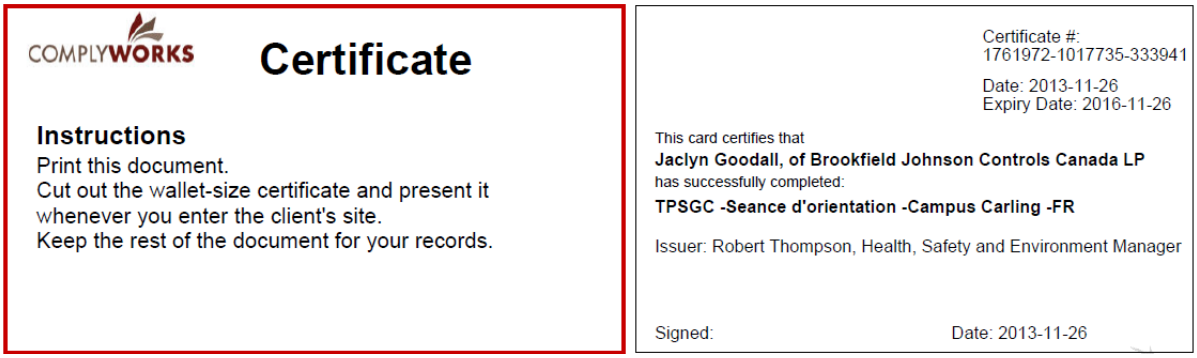
The worker will be required to complete knowledge verification at the conclusion of the Brookfield GIS Site Orientation to ensure that they have understood and retained the information provided.

The worker can obtain this Site Orientation module, through one of three ways:

A. An online version of this module is available through Complyworks and can be completed by the worker prior to their arrival on site. https://cw1.complyworks.com/employer_orientations.php?item=2054
B. A computer terminal is available to the worker at the loading dock entrance of this facility where this same online module through Complyworks can also be accessed.
C. The Brookfield GIS HSE Coordinator assigned to this facility will present this orientation is a classroom style setting at this facility once every two weeks. To obtain further information or to reserve a place in the next scheduled session, contact safety@brookfieldgis.com.

Upon completion of the Site Orientation Module, workers will obtain a wallet card that details the module completed, the date that it was taken, the name of the company, and the worker's full name.

Figure TS-2.1 – Wallet Card


COMPLYWORKS

Certificate

Instructions
Print this document.
Cut out the wallet-size certificate and present it whenever you enter the client's site.
Keep the rest of the document for your records.

Certificate #: 1761972-1017735-333941
Date: 2013-11-26
Expiry Date: 2016-11-26

This card certifies that
Jaclyn Goodall, of Brookfield Johnson Controls Canada LP
has successfully completed:
TPSGC -Seance d'orientation -Campus Carling -FR

Issuer: Robert Thompson, Health, Safety and Environment Manager

Signed: Date: 2013-11-26

Brookfield GIS Contractor Safety Handbook:

All Contractor firms will be required to sign their acknowledgment of the policies and procedures as outlined in the Brookfield GIS Contractor Safety Handbook

Loading Dock Procedure:

- Should access be required to the loading dock outside of the hours identified, additional security coverage must be prearranged through Brookfield Global Integrated Solutions, and the cost of the additional security guard coverage will be at the contractor's expense.

- Only loading docks may be used to bring in construction materials to the site. It is not acceptable for contractors to bring materials in through the other entrances at the site.
- Should material movement be required through another entrance or exit door, prior approval must be obtained from Brookfield Global Integrated Solutions.
- Only one contractor will be permitted to use each loading dock at any given time. This is to ensure the safety of the workers through separation of the work activities via time and space.
- Security must be present to open all overhead doors and loading dock man doors.
- Security is required to remain at the loading dock for the entire duration that the doors are open.
- All materials unloaded at a loading dock must immediately be removed from the loading dock area to an approved staging area.

Additional Security Coverage for Projects/Special Events

- Arrangements for additional security coverage to be coordinated through Brookfield Global Integrated Solutions. Security@brookfieldgis.com.
- A quotation for the extra coverage will then be provided by building security.
- Examples of where additional security coverage might be required include but are not limited to escorts into secure areas, loading dock coverage, perimeter doors that will need to be propped open, etc.

Roles & Responsibilities

All persons in the workplace share the responsibility for ensuring a safe working environment. Employers and Owners alike must take every precaution reasonable for the protection of a worker. Managers and supervisors are accountable for carrying out their responsibilities in accordance with the regulations, and as outlined in this plan.

While Brookfield Global Integrated Solutions will be providing oversight from an OHS Control Authority standpoint, all other parties remain fully responsible for maintaining their own health and safety programs, procedures, and safe work practices as required by the regulations.

Further responsibilities under this Site-Specific Health & Safety Plan are defined here:

Brookfield Global Integrated Solutions Canada (Brookfield GIS)

- In the role of OHS Control Authority, fulfill all of the obligations of the Owner and the Employer as defined under the regulations.
- Maintain Control of the workplace, reviewing and approving all work activities prior to the start of any work.
- Ensure all work activities are properly coordinated and appropriately separated via time and space.
- Maintain the Fire Safety & Evacuation Plan and Emergency Response Procedures (Emergency Action Guide)
- Use the Brookfield GIS Hazard Station to identify all site-specific hazards and associated controls
- Participate in all tenant Health & Safety Committee meetings
- Host regular Contractor Safety Committee Meetings
- Ensure workers have with them: all required personal protective equipment (PPE) and are competent in the use of that PPE; that workers have access to a first aid kit and a fire extinguisher if appropriate, and that MSDS are on hand for any hazardous materials associated with the work.

- Provide clear written instruction (safe work procedures) to the workers, prior to the start of the work.
- Provide an adequate level of supervision for the work and inspect the work and the worksite on a regular frequency.
- Ensure workers have been instructed on Job Hazard Analysis (JHA) and that they will conduct a JHA prior to the start of the work.

PWGSC

- Obtain a Work Permit from Brookfield Global Integrated Solutions as described further in this document.
- Ensure that PWGSC Contractors are aware of their responsibilities as defined herein.

Tenant

- Host health and safety committee meetings as required by the regulations and invite Brookfield GIS to participate in all such meetings.
- Report all Hazardous Occurrences/Hazardous Conditions. Take action to resolve such concerns when they are specifically associated with tenant operations.
- Conduct regular inspections of all areas occupied by the tenant as required by the regulations.
- Obtain a Work Permit from Brookfield Global Integrated Solutions for any and every work activity. .
- Ensure that the tenant's contractors are aware of their responsibilities as defined immediately below

Contractors

- Obtain a Work Permit from Brookfield Global Integrated Solutions as described further in this document.
- Ensure all workers on site have completed the Brookfield Global Integrated Solutions Orientation for this facility.
- Extend an invitation to Brookfield Global Integrated Solutions for all on site safety meetings.
- Ensure workers have with them: all required personal protective equipment (PPE) and are competent in the use of that PPE; that workers have access to a first aid kit and a fire extinguisher if appropriate, and that MSDS are on hand for any hazardous materials associated with the work.
- Provide clear written instruction (safe work procedures) to the workers, prior to the start of the work.
- Provide an adequate level of supervision for the work and inspect the work and the worksite on a regular frequency.
- Ensure workers have been instructed on Job Hazard Analysis (JHA) and that they will conduct a JHA prior to the start of the work.
- Participate in Brookfield GIS-hosted Contractor Safety Committee Meetings (All Resident Service Contractors as well as Project Contractors who will be on-site greater than 30 days)

Individual roles and responsibilities for this site identified in the RACI below.

R = Responsible, A = Accountable, C = Consulted, I = Informed

Table TS-2.2 - RACI

Individual Roles and Responsibilities for this Site	Canada		Brookfield GIS							Other	
	Custodian Representatives	Tenant Representative	Property Manager (Ass/Sr)	HSE Coordinator	Tenant Services - TSC	Maintenance - MTL	Technicians/Engineers	Project Mgmt.	Security	Contractors	Subcontractors
Implementation of Work Permit Process	R	R	A	C	I	R	R	R	I	R	R
Deployment of Brookfield GIS Site Specific Orientation	R	R	A	RC	R	R	R	R	R	R	R
Maintenance of Brookfield GIS Hazard Station/Identification of all hazards and controls			A	R							
Review Brookfield GIS Hazard Station prior to the start of the work	R	R	A	C	I	R	R	R	R	R	R
Inspection of designated/assigned work areas	R	R	A	RCI	CI	R	I	R	R	R	R
Inspection of the work in progress	R	R	A	RCI	R	R	I	R		R	R
Ensure all workers have appropriate competency, qualifications and training prior to assigning the work	R	RC	AR	CI		R		R		R	R
Ensure workers have with them: all required personal protective equipment (PPE) and are competent in the use of that PPE; that workers have access to a first aid kit and a fire extinguisher if appropriate, and that MSDS are on hand for any hazardous materials associated with the work	R	R	A	RCI	R	R	R	R	R	R	R
Participate in Brookfield GIS Contractor Safety Committee Meetings (All Resident Contractors & Project Contractors on-site >30 days)			A	R	I	R	R	R	R	R	R
Report all hazards, hazardous occurrences, workplace injuries or work-related illnesses to Brookfield GIS	R	R	A	R	R	R	R	R	R	R	R
Initiate a STOP WORK if unsafe work is observed or an uncontrolled hazard is discovered	RI	R	A	RCI	R	R	R	R	R	R	R

Safety Policy

The policy is reviewed and approved by OHS Control Authority on an annual basis. The policy expresses the commitment of health and safety and continuous review.

BROOKFIELD JOHSON CONTROLS
HEALTH AND SAFETY POLICY

The safety and well-being of our team members is inherent in the Brookfield Global Integrated Solutions operating philosophy. It is a value embedded in our corporate culture, and a practice reflected in our health and safety program and our business processes. We are the industry leader in workplace management solutions, and our focus on the welfare of our team members has helped to position us there.

Brookfield Global Integrated Solutions is committed to all of its employees and to complying with all applicable health and safety legislation, requirements, codes of practice, internal standards and guidelines subscribed to by ourselves and our clients.

Through audits, team member feedback, accountability and periodic reviews, we are continually striving to improve upon our safety performance. We establish aggressive goals and targets, while providing training and resources to move our organization towards a zero incident rate.

Team members are integral in implementing and maintaining a safe and healthy workplace for ourselves, our contractors, our clients and the public who enter our workplace. We ensure our employees are aware of and understand their rights and responsibilities with respect to health and safety. To this end, we ensure that this policy is communicated to, and understood by, the employees of Brookfield Global Integrated Solutions and our sub-contractors who are involved in the delivery of work on behalf of our clients. Team members provide input and participate in all health and safety related programs and initiatives to ensure that safety and well-being is the blueprint of all our activities. Brookfield Global Integrated Solutions understands the importance of safety and well-being at both a personal and organizational level and Brookfield Global Integrated Solutions fosters this culture through our ongoing initiatives. Together, we will ensure that every day is a safe one.

SAFETY FIRST, it is the way we do business!

Date: July 25, 2014

Gordon I. Hicks
President

Environmental Policy

Brookfield Global Integrated Solutions

ENVIRONMENTAL POLICY

Environmental stewardship is a cornerstone of the Brookfield Global Integrated Solutions' operating philosophy. It is a value embedded in our corporate culture and a practice reflected in our national environmental management system and our business processes. Not only do we manage environmental impacts resulting from self-performed and sub-contractor delivered services, we also manage our clients' impact on the environment in thousands of buildings across Canada. We are the industry leader in workplace management solutions, and our focus on environmental stewardship has helped to position us there.

The communication of this policy is paramount to its understanding and effectiveness.

Therefore we have taken measures to ensure that it is communicated to, and understood by, the employees of Brookfield Global Integrated Solutions and our sub-contractors who are involved in the delivery of work on behalf of our clients.

We are committed to complying with all applicable environmental legislation, requirements, and codes of practice, internal standards and guidelines subscribed to by ourselves and/or our clients. Brookfield Global Integrated Solutions and its employees are also committed to conducting our operations in a manner that minimizes any environmental impacts.

Brookfield Global Integrated Solutions is always aiming for continual improvement in our environmental practices. We set specific performance goals and targets, and provide our team with the resources to achieve these objectives. Our progress related to meeting these targets is reviewed and evaluated regularly, while our overall environmental program, policy and management system are reviewed annually.

Our employees understand the importance of environmental and social responsibility at a personal and organizational level, and we foster this culture through ongoing training and education.

Together, we can make a difference.

Date: July 25, 2014

Gordon I. Hicks
President

Known Site Hazards & Controls

- Contractors must visit the Brookfield GIS hazard station first before starting the work to familiarize themselves with any site-specific hazards and required controls.
- The location of the hazard station is identified directly below. Work Orders will also direct Contractors to the location of the hazard station.
- Contractors will augment controls and adjust their safety plans accordingly relative to any identified hazards.

The Hazard Station for this Site is located at: Basement B11-Adjacent to building Technician's Office

Project Activity

- As the OHS Control Authority, Brookfield GIS will have overall responsibility for coordinating all project and construction activity occurring at this site.
- Furthermore, Brookfield GIS wills serve in the role of Constructor for all Project Activity occurring at this site.
- Project and Construction activities are **NOT** exempt relative to the requirements outlined in this Building OHS Plan.
- Project-Specific OHS Plans will be required for all project activities and require the approval of Brookfield GIS.
- Project-Specific OHS Plans are a supplement to the Building OHS Plan.
- Brookfield GIS will conduct regular inspections of ongoing project work to ensure all work activities are being carried out in a safe and responsible manner, and as per the approved Brookfield GIS Work Permit and approved Project-Specific OHS Plans.
- Any identified scheduling concerns that would prevent Brookfield GIS from separating work activities appropriately via time and space will be immediately and formally raised by the Property or Portfolio Manager to PWGSC and the Tenant Authorities as appropriate.
- All project-related safety meetings will be chaired by the Brookfield GIS Project Management, and will include representatives from Brookfield GIS Property Management and Brookfield GIS HSE.

Work Permit Process

The Work Permit is used by Brookfield GIS in the role of OHS Control Authority so as to remain fully aware of all work activities occurring on site, as well as to appropriately coordinate and separate work activities from a safety standpoint. The Work Permit also allows Brookfield GIS to review the work plans to ensure that all risks, hazards and controls have been considered relative to any planned work activity.

Upon review of submitted Work Permits, Brookfield GIS may also request to see evidence of qualification, training, instrument calibration, etc. so as to ensure that the workers are qualified and properly equipped relative to the task.

Requirements:

- Work Permits are mandatory for all work activities, including project work.

- A copy of the work permit (hardcopy or electronic) must be available at the work site. Workers unable to produce a copy of an approved Work Permit will be required to cease all work activity until it can be produced.
- In relation to project work only, a single permit will be sufficient in relation to all planned work activities and for any given day.
- All non-project related work activity will require a separate permit for every new work activity.
- Project Managers will require a single permit for the project under their management.
- All Work Permits expire at midnight. If work will extend past midnight, a new Work Permit will be required.
- Work Permit authorization can be obtained up to one week in advance of the planned work activity.
- A Work Permit is also required for any after-hours emergency work. An On-call representative of Brookfield Global Integrated Solutions will be available to approve in these circumstances.

How do I obtain a Work Permit?

- Visit www.brookfieldjohnsoncontrols.com and download a copy of the Work Permit form following the "Work Permit" link Submit the completed Work Permit form via email to: WEST-RP1workpermit@brookfieldgis.com
- Upon receipt of the completed Work Permit it will be forwarded to the appropriate Brookfield GIS HSE and Brookfield GIS Property Management delegates for review.
- Upon completion of the review, the Brookfield GIS Property Management delegate will either "Approve" or "Decline" the Work Permit and contact the original requestor.
- In the event that a Work Permit is declined, detail as to why it was declined and a contact will be provided to assist the requestor with follow-up.

Hazardous Occurrence/Hazardous Conditions Reporting

- All Hazardous Occurrences or Hazardous Conditions must be reported to Brookfield GIS Health and Safety for follow-up.
- Immediate hazards or occurrences involving injury should be reported to Brookfield GIS using the 24/7/365 **Brookfield GIS Hazard Line:** 1-877-445-0611
- Non-urgent concerns can be communicated to safety@brookfieldgis.com where they will be assigned an HSE resource for follow-up.
- In all cases Brookfield GIS will follow-up with the reporting party to ensure that concern has been resolved.

Work Refusals

- Brookfield GIS policy is to initiate a Stop Work whenever a potentially dangerous circumstance is identified.
- Notification of a Stop Work will be provided by the Brookfield GIS Property Manager to PWGSC as per standard Incident Process and will be communicated to the Tenant Health & Safety Committee.
- The situation will then be investigated fully by Brookfield GIS, who will work with management and all parties involved ensuring that the identified hazard is controlled to the satisfaction of the party who reported the concern as well as the Health & Safety Committee.

Emergency Procedures

Call 9-1-1 for all life-threatening emergencies
After calling 911, report the incident to Brookfield GIS at 1-877-445-0611,
as well as notifying your immediate supervisor.

Detailed Emergency Response Procedures are included in the Emergency Action Guide located in the Brookfield GIS Hazard Station for this facility. In the event a fire alarm:

- All workers must follow the posted fire safety and evacuation plans located in the elevator lobbies and access to the stairwells.
- Do not use the elevators; proceed to the ground floor using the nearest stairwell.
- If you are mobility impaired, contact building security at 204-942-4472 for assistance.
- Obey all instructions provided by building security and designated floor wardens.

All Project and Construction activity will require a posted project-specific emergency response plan.

Workplace Inspections

Workplace inspections are a key element of any effective health and safety program and internal responsibility system in the identification of potential workplace hazards or unsafe conditions.

The Brookfield GIS HSE Coordinator and Property Manager for this facility will conduct regular workplace inspections of the entire facility as well as regular audits of all work in progress. Although Brookfield GIS in their role as OHS Control authority for this facility will be conducting regular inspections,

- The tenant through their Health & Safety Committee will also be required to conduct monthly inspections of all areas occupied by the tenant as required by the regulations;
- Contractors are expected to provide an adequate level of supervision for the work and inspect the work and the worksite on a regular frequency.

Training & Qualifications

- As identified in the Roles and Responsibilities section of this document, it is the responsibility of each employer to ensure all workers have appropriate competency, qualifications and training prior to assigning the work.
- As noted in the Work Permit Process section of this document, Brookfield GIS reserves the right to request proof of competency and training prior to authorizing the work to proceed.
- All workers accessing the site must first complete the Brookfield Global Integrated Solutions Orientation for this facility prior to the start of any work.

Monitoring, Review, and Records

Metrics associated with hazardous occurrences, hazardous conditions, near misses, minor occurrences, operational incidents and injuries of all types are analyzed and trended by Brookfield GIS HSE. This data is utilized by Brookfield GIS for the purposes of identifying opportunities for program improvement and reporting to PWGSC. Upon request this information will be available to all parties of this Site-Specific Occupational Health Safety Plan.

How can I get Involved?

All workers have the Right to Participate. All workers are encouraged to contact Brookfield Global Integrated Solutions HSE with any questions or concerns, or to make a report of a hazard or unsafe condition.

Contractor Safety Committee meetings will be hosted by Brookfield GIS on a monthly basis. These meetings are mandatory for the Brookfield GIS Property Manager and representatives from all resident contractor firms, as well as any contractor firm's currently conducting project work within the facility that will have duration greater than 30 days. In these meetings, the Property Manager will provide an update on any upcoming site changes, planned projects, projects in progress as will identify any possible safety concerns associated with the coordination of the work. These meetings will also provide a forum for the contractor community to voice any safety concerns as well as foster a culture of mutual collaboration.

Address_____ Contractor Safety Committee Meeting:
DATE / TIME / LOCATION _____
All Are Welcome!

Key Contact Information

Table TS-2.5 –Key Contact Information

Contact		Organization	Phone	Email/Quick Link
Emergency		Municipality	9-1-1	NA
Hazard Occurrence/Unsafe Condition		Brookfield GIS	1-877-445-0611	safety@brookfieldgis.com
Work Permit Request		Brookfield GIS	NA	WEST-RP1workpermit@brookfieldgis.com
Security Clearance Request		Brookfield GIS	NA	securityscreenings@brookfieldgis.com
Site Specific Orientation		Brookfield GIS	NA	https://cw1.complyworks.com/employer_orientations.php?item=2054
General Information – Health & Safety		Brookfield GIS	NA	safety@brookfieldgis.com
Building Security		Commissionaires	204-942-4472	Mobile 204-793-6113
Kari Roy	Property Manager	Brookfield GIS	204-930-9919	Kari.Roy@brookfieldgis.com
Kelly Bishop	HSE Manager	Brookfield GIS	204-509-9763	Kelly.Bishop@brookfieldgis.com
Morgan Minter	HSE Coordinator	Brookfield GIS	204-557-2617	Morgan.Minter@brookfieldgis.com
Jamie Deacon	HSE Coordinator	Brookfield GIS	204-997-2923	Jamie.Deacon@brookfieldgis.com
John Sinclair	Maintenance Lead	Brookfield GIS	204-588-4246	John.Sinclair@brookfieldgis.com

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SITE SPECIFIC HAZARD IDENTIFICATION CHECKLIST

This checklist helps describe site specific health, safety and environmental hazards. This checklist does not replace the need to complete a more detailed project hazard assessment or job hazard assessment. All site specific hazards that are identified, require a hazard control measure.

Site	Stanley Knowles Building			
Site Address	391 York Ave			
Primary Site Contact	Jeremy Anderson			
Site Contact Phone #'s	**Office**		**Mobile**	204-998-3934
Completed By	Jamie Deacon		**Title**	Health and Safety Coordinator
Date Completed: (DD-MMM-YY)	20-Aug-15			

Hazard	**YES**	**NO**	**NA**	**Control/ Comment**
Designated/Hazardous Substances Including Controlled Products			☐	
Exposure to dust, fumes, mists: Indicate location_____	☐	X☐	☐	
Controlled products on site: Indicate location: Several Locations	X☐	☐	☐	MSDS available at Building Technicians office
This Facility is known to contain asbestos or house asbestos containing materials (ACM). (For location check inventory)	X☐	☐	☐	Asbestos Management Plan in place.
Facility is known or suspected to contain Lead (common applications: old paint, old plumbing solder) Indicate location_____	☐	X☐	☐	
Facility is known or suspected to contain Mercury (common applications: thermostats & laboratories) Indicate location_____	☐	X☐	☐	
Risk of exposure to biological hazards (virus, bacteria, fungi) Indicate location_____	☐	X☐	☐	
Radiation exposure at site (X-ray, radio-active) Indicate location_____	☐	X☐	☐	
Facility has known or suspected of having a history of mold contamination Indicate location: Basement red Tape	X☐	☐	☐	Appropriate PPE, follow safe work procedures
Noise levels above 80dBA: Indicate location: Penthouse	X☐	☐	☐	Hearing protection required
Confined Space			☐	

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Hazard	YES	NO	NA	Control/ Comment
This Facility contains Confined Spaces? Locations: Several _____	X☐	☐	☐	C.S Entry Permits; Training, Procedures and Rescue Plan are required prior to entry – Consult BGIS
Warning signs at access points missing and awaiting install: Indicate location(s)_____	☐	X☐	☐	
Electrical Hazards			☐	
Explosion-proof devices required: Indicate location_____	☐	X☐	☐	
Potential exposure to power lines: Indicate Location_____	☐	X☐	☐	
Fire Safety			☐	
Facility stores/contains combustible materials: Indicate location_____	X☐	☐	☐	Flammable materials to be stored in flammable cabinets
Hot work restricted areas on site: Indicate location_____	☐	X☐	☐	
Site Tools, Equipment and Machinery			☐	
Site contains machinery/equipment where guarding is awaiting improvements and is considered inadequate: indicate location_____	☐	X☐	☐	
Site contains Powered Industrial Trucks	☐	X☐	☐	
Housekeeping			☐	
Site contains tripping hazards including exterior	X☐	☐	☐	Maintain awareness of surroundings
Site contains slipping hazards including exterior	X☐	☐	☐	Utilize proper footwear
Low lighting areas: Indicate location_____	☐	X☐	☐	Supplemental lighting
Working at Heights (2M)			☐	
Site contains fixed ladders	X☐	☐	☐	BGIS work at heights permit and fall protection required over 2M
Site contains portable ladders	X☐	☐	☐	BGIS work at heights permit and fall protection required over 2M
Unguarded platforms or Roof top	X☐	☐	☐	BGIS work at heights permit and fall protection required over 2M

Hazard	YES	NO	NA	Control/ Comment
General			☐	
Ability to contact emergency services – Limited cellular reception?	☐	X☐	☐	
Risk of overhead work and falling objects while working at the site: Indicate location_____	☐	X☐	☐	
Risk of exposure to workplace violence and harassment: Indicate location: Public side walk	X☐	☐	☐	No working alone in indicated area
Other:	☐	☐	☐	
Other:	☐	☐	☐	

CONTRACTOR

HEALTH, SAFETY AND ENVIRONMENTAL POLICY HANDBOOK

HS-105-00

Rev 3 – April 1, 2014

Brookfield Johnson Controls

Table of Contents

BROOKFIELD JOHNSON CONTROLS GROUP OF COMPANIES HEALTH AND SAFETY POLICY

The safety and well being of our team members is inherent in Brookfield Johnson Controls group of companies operating philosophy. It is a value embedded in our corporate culture and a practice reflected in our health and safety program and our business processes. We are the industry leader in workplace management solutions and our focus on the welfare of our team members has helped to position us there.

Brookfield Johnson Controls group of companies is committed to all of it's employee's and complying with all applicable health and safety legislation, requirements, codes of practice, internal standards and guidelines subscribed to by ourselves and/or our clients.

Through audits, team member feedback, accountability and periodic reviews, we are continually striving to improve upon our safety performance and our program. We set specific performance goals and targets, implement programs and initiatives and provide communication and resources to keep safety at the forefront and move towards a zero incident rate.

Team members are integral in implementing and maintaining a safe and healthy workplace for ourselves, our contractors and all personnel who enter our workspace. We ensure our employees are aware and understand their rights and their responsibilities with respect to health and safety. To this end, we ensure that this policy is communicated to, and understood by all Brookfield Johnson Controls group of companies employees and the employees of our sub-contractors who are involved in the delivery of work implemented by Brookfield Johnson Controls group of companies, that team members provide input and participate in all health and safety related programs and initiatives and that safety and well being is the fabric of all our activities. Brookfield Johnson Controls group of companies employees understand the importance of safety and well being at a personal and organizational level, and Brookfield Johnson Controls group of companies fosters this culture through our ongoing initiatives. Together, we will ensure that every day is a safe one.

SAFETY FIRST, it is the way we do business!

BROOKFIELD JOHNSON CONTROLS GROUP OF COMPANIES ENVIRONMENTAL POLICY

Environmental stewardship is a cornerstone of Brookfield Johnson Controls group of companies operating philosophy. It is a value embedded in our corporate culture and a practice reflected in our national environmental management system and our business processes. Not only do we manage environmental impacts resulting from self-performed and sub-contractor delivered services, we also manage our clients' impact on the environment in thousands of buildings across Canada. We are the industry leader in workplace management solutions and our Focus on environmental stewardship has helped to position us there.

The communication of this policy is paramount to its understanding and effectiveness. Therefore we have taken measures to ensure that it is communicated to, and understood by all Brookfield Johnson Controls group of companies employees and the employees of our sub-contractors who are involved in the delivery of work implemented by Brookfield Johnson Controls group of companies.

Brookfield Johnson Controls group of companies is committed to complying with all applicable environmental legislation, requirements, codes of practice, internal standards and guidelines subscribed to by ourselves and/or our clients. Brookfield Johnson Controls group of companies and its employees are also committed to conducting our operations in a manner that actively prevents pollution.

Brookfield Johnson Controls group of companies is always aiming for continual improvement in our environmental practices. We set specific performance goals and targets, and provide our team with the resources to achieve these objectives. Our progress related to meeting these targets is reviewed and evaluated regularly, while our overall environmental program, policy and management system are reviewed annually.

Brookfield Johnson Controls group of companies employees understand the importance of environmental and social responsibility at a personal and organizational level, and we will foster this culture through ongoing training and education.

Together, we can make a difference.

Disclaimer - Purpose - Policies

DISCLAIMER

The intent of Brookfield Johnson Controls' Health, Safety & Environment Policy Document for Contractors is to provide a written overview of Brookfield Johnson Controls' minimum policies and procedures with respect to Health, Safety and Environment (HS&E). This handbook does not address all HS&E issues which may arise during completion of work. Nor is this document intended to address or replace the Contractor's duties and requirements with respect to regulatory compliance and best practices, and in conducting work in a manner that creates a safe and healthy environment for its own employees, Brookfield Johnson Controls, building occupants and the public. It is the responsibility of the Contractor to operate in compliance with all applicable legislation and regulations that may pertain to its activities. Compliance with this document does not relieve the Contractor from any liability that may result from the Contractor's actions or from failure to act in accordance with applicable legislation. Where applicable, Brookfield Johnson Controls may provide to the Contractor additional HS&E policies and procedures, relating to specific site or job requirements, which the Contractor shall comply with. This document may be modified at any time at Brookfield Johnson Controls' discretion.

PURPOSE

The purpose of this document is to assist contractors in understanding Brookfield Johnson Controls' minimum HS&E requirements while undertaking work at a Brookfield Johnson Controls controlled space. This document is a general overview of Brookfield Johnson Controls' protocols and should be used in conjunction with the Contractor's own environment, health and safety policies, procedures and programs. Contractors are responsible for controlling workplace activities and for maintaining and promoting a safe and healthy work environment. It is Brookfield Johnson Controls' expectation that the information in this document is communicated to all the Contractor's employees and any of its subcontractors. As a large percentage of contract work is completed at non-Brookfield Johnson Controls supervised locations, we expect Contractors to be conscientious of their HS&E practices and their reflection on Brookfield Johnson Controls. In the event that the Contractor is unable to meet the requirements outlined in this document, the Contractor is to notify Brookfield Johnson Controls immediately. Assistance in meeting the requirements will be reviewed on a case by case basis.

POLICIES

Brookfield Johnson Controls is dedicated to becoming "best in class" with respect to HS&E. Our culture is one in which health, safety and environment are more than words in our value statement, they are integrated into our daily activities and are part of our culture.
Our Health and Safety and Environment Policies are located in Appendix A. These policies are reviewed annually. Brookfield Johnson Controls maintains both health and safety and environmental management systems and is registered to ISO 14001 for certain contracts.
Contractors will:

- Be aware of Brookfield Johnson Controls' HS&E policies
- Review with their designated Brookfield Johnson Controls contact any applicable objectives, targets and environmental programs
- Comply with Brookfield Johnson Controls' HS&E policies
- Upon request provide evidence of competency and/or compliance
- Understand the HS&E impacts related to contractor's activities and be aware of the appropriate operational controls to address any areas of risk.

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Auditing – General Requirements

AUDITING

Brookfield Johnson Controls reserves the right to audit the Contractor for its adherence to the HS&E requirements of the work being performed. An audit may include workplace inspections, visual observations, interviews and document review, including training records, certifications and HS&E related statistics. Action plans, including person responsible and time line, are to be provided to the Brookfield Johnson Controls contact for any observations noted.

GENERAL REQUIREMENTS

Health and Safety Program

All contractors and sub-contractors must have a health and safety program in place. Upon request, contractors must submit to Brookfield Johnson Controls evidence of a comprehensive health and safety program and other specialized plans may be required.

Subcontractors

All Contractors are required to review this manual with all sub-contractors and are responsible for ensuring that all Brookfield Johnson Controls policies and procedures are complied with. Brookfield Johnson Controls reserves the right to request Contractors audit their sub-contractors and forward action plans for any non-conformances.

Facility Access and Security

Contractors are to review facility access and security requirements with their designated Brookfield Johnson Controls contact. The Contractor is to immediately inform their Brookfield Johnson Controls contact of any security or facility access issues.

Working Alone at Remote Sites

Contractors who are working alone at remote sites must have a Work Alone Policy in place.

General Behaviour

All contractors are to conduct themselves in a professional manner. Behaviour which violates Brookfield Johnson Controls' policies or has the potential to endanger the safety and well being of any of the building occupants is grounds for removal from the site.
Inappropriate behaviour includes but is not limited to:

- Use, possession, distribution, offering, sale or being under the influence of alcohol, illicit drugs, illicit drug paraphernalia or non-prescribed drugs for which a prescription is legally required in Canada, while on company business or premises.
- Disorderly or violent conduct
- Theft or intentional damage to property
- Entering restricted areas
- Harassment
- Criminal activities

Training, Licenses and Certifications

Contractors must have all appropriate professional training, licenses and certifications required for the work being performed. Training records and copies of licenses, certifications are to be made available upon request. Contractors are to have their own HS&E program and be able to confirm in writing that the Contractor's employees have received and understood all health, safety and environment training appropriate to the scale of work being undertaken.

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Hazard Identification / Stop Work & Reporting

It is the Contractor's responsibility to be aware of all dangers or hazards associated with the work performed and the work environment and to remove and / or control the hazard or danger prior to commencement of work. To assist the contractor in this regard, Brookfield Johnson Controls is in the process of installing hazard stations at managed properties. Should Contractors have questions regarding site hazards they can contact our 24 hour support line at **1-877-445-0611.** All potential or existing dangers or hazards observed by the Contractor shall be reported to the designated Brookfield Johnson Controls contact. Any danger or hazard observed beyond the control of the Contractor is to be reported to the designated Brookfield Johnson Controls contact immediately and the Contractor is to avoid the hazard or danger until it is eliminated or controlled. The Contractor may not conduct any work that may result in a danger or hazard to people, environment or property. Where an existing danger or hazard is present, or where the Contractor reasonably believes that an imminent danger or hazard is present, the Contractor has the right to stop work so that the danger or hazard is eliminated or safe work practices are incorporated. For the purposes of this policy, a danger or hazard may include, but is not limited to:

- A situation for which the individual is not properly trained or experienced.
- A situation for which the individual is not equipped (i.e. safety or personal protective equipment).
- A situation where the individual believes that proper procedures and work practices are not being followed.
- A hazard that is not typical to the individual's work activities or job.
- A worker unfit for work due to the influence of alcohol or illegal or mind-altering substances.
- A danger that would normally stop work in the affected area.
- A situation where the environment may be adversely affected and regulatory authorities would be involved;
- A situation which may result in equipment / property damage.

Any stop work situations are to be reported immediately to the Brookfield Johnson Controls contact. The designated Brookfield Johnson Controls contact is to be advised of the danger or hazard, the corrective action and when the situation is resolved.

First Aid / Medical Emergencies

All Contractors are responsible to ensure that first aid, emergency medical services and transportation are provided to its employees. Contractors are also required to provide trained first aid personnel, supplies, and equipment as applicable. It is possible that professional medical aid may be available at some locations. Please review potential assistance with your Brookfield Johnson Controls contact. Any access to professional aid does not release the Contractor of ensuring emergency assistance is provided to its employees.

Initial Here _____

Accident / Incident Investigation and Reporting
Contractors are required to report all accidents / incidents, regardless of severity, to their Brookfield Johnson Controls contact on the Brookfield Johnson Controls Incident Injury Report Form. All incidents resulting in serious injury or illness, damage to property or equipment or environmental contamination are to be reported to Brookfield Johnson Controls immediately. All near misses that may have resulted in serious injury or illness, damage to property or equipment or environmental contamination are also to be reported immediately. Contractors must also report immediately to Brookfield Johnson Controls any unplanned or uncontrolled fire, explosion or flood, as well as any collapse or failure of a building or structure. Where the incident resulted in a recordable injury (time loss and / or medical aid sought) or where a regulatory authority must be contacted (e.g., Ministry of the Environment or Ministry of Labor), Brookfield Johnson Controls is to be notified concurrently and a copy of the investigation report is to be forwarded upon completion. It is the Contractor's responsibility to contact the appropriate regulatory authority when it is required due to the nature of the incident. Where reporting of an incident to a regulatory authority is required, the Contractor shall comply in accordance with applicable health and safety legislation in the course of any subsequent investigation or inspection and, where required, the incident scene shall not be disturbed or altered until the site is released by the appropriate regulatory authority.

Emergency Evacuation
In order to ensure personal safety, Contractors are required to be aware of the entire emergency evacuation procedures for the location of work. Review this information with your Brookfield Johnson Controls contact.

Housekeeping
The Contractor is to maintain a clean and orderly work area. Contractors are to clean and remove all non-hazardous solid waste and recyclables at regular intervals throughout the shift and at the end of each shift. Required waste containers are to be provided by the Contractor. Clear access is to be maintained to and in contractor working areas. Access to electrical panels, fire extinguishers, safety showers and eyewash stations, fire hydrants and points of egress are to be kept free and clear of all obstructions unless written approval is obtained from Brookfield Johnson Controls.

Work Area Protection and Hazard Notification
All work areas must be appropriately barricaded and signage where required. Contractors are responsible for providing signs, cones, plastic sheets, guardrails and other materials to create an effective barricade to isolate the work environment from the building occupants and to prevent unauthorized access. Any requirements to block means of egress, fire, life or other safety equipment must first be approved by the Brookfield Johnson Controls contact. Signs and barricades may not be removed until the work is completed or all hazards are eliminated. Where the work being conducted may create a temporary hazard to the building occupants (e.g., wet floor) the Contractor shall ensure the appropriate signage and / or barriers are posted. The signs / barriers may not be removed until the hazard is eliminated. Where work being conducted could affect the health, well being or comfort of the building occupants (e.g., paint fumes) the Contractor shall inform the building occupants through the Brookfield Johnson Controls contract prior to the start of work.

Initial Here _____

Personal Protective Equipment (PPE)
Contractors are responsible for conducting job assessments to determine the appropriate PPE necessary for the work being conducted and are responsible for its provision. Contractors must also be able to demonstrate that the employees have been trained in and conducted proper inspection, maintenance, and safe use of that equipment.

Tools and Equipment
Contractors are responsible to provide their own tools, equipment and vehicles and are required to conduct the work in a safe manner in accordance with all regulatory requirements. Contractors are responsible for the safe operation of any equipment brought on location and must be able to demonstrate that all operators of said tools and equipment are trained and qualified to do so. Contractors are also responsible for the inherent integrity of the tools and equipment itself and must be able to demonstrate that the equipment has been properly maintained and is safe for use.

Brookfield Johnson Controls Owned Tools and Equipment
Unless written authorization is obtained, Contractors may not use Brookfield Johnson Controls owned or leased tools or equipment. In cases of written authorization, Contractors will provide copies of any training records / certifications required to operate the tools and / or equipment. The contactor will also sign the Brookfield Johnson Controls “Loan of Equipment” waiver.

Power Tools
All power tools are to be double insulated or equipped with grounded power cords. Ground Fault Interrupters (GFI) or other similar devices must be used in wet or damp locations. The Contractor’s employees must be properly trained in their use and the tools are to be maintained in a safe operating condition.

Explosive Actuated Tools
Any Contractors using explosive actuated tools must be competent, trained and certified as required. The Contractor is to ensure that all explosive actuated fastening tools are properly inspected before and after each use and that no alterations be carried out to any protective guards. The contractor shall ensure that all requirements regarding safe use, storage and removal process is carried out in accordance with the appropriate legislation. Equipment is to be properly maintained and all Contractors are to be trained in its use and safe operation.

Electrical Safety
It is the Contractor’s responsibility to have a safe electrical program as required. Contractors working on or near live equipment must be qualified to do so. Contractors must not work on low or high voltage unless specifically retained to do so. Energized parts, circuits, panels and other equipment must be properly guarded. Unguarded energized parts must not be left unattended. All electrical devices must be properly grounded or double insulated.

Ladders
All Contractor ladders must be labeled with the Contractor’s name. All ladders are to be maintained in good condition at all times and inspected prior to use. Employees using ladders must do so in a safe and responsible manner. Any defective ladders are to be tagged as such and removed from site.

Initial Here _____

Working at heights
It is the Contractor's responsibility to select the appropriate fall protection measures for the work to be performed. When working at heights, the area below is to be cordoned off as the work area protection requires. Contractors must be able to demonstrate that all equipment has current inspection certificate and is maintained as per regulatory requirements and that all personnel have current and appropriate training.

Scaffolding
All scaffolding is to be erected, maintained and inspected in accordance with all applicable regulations, codes and engineering practices. The Contractor is to ensure competent supervision of any modification process and have written approvals of such modifications. Precautions must also be taken to ensure that each scaffold does not exceed structural or design limits set out by applicable provincial legislation. The Contactor must also provide all scaffolds and safety equipment required for the entire project. Copies of the inspection reports are to be available upon request.

Industrial Powered Vehicles, including Lifting Devices
All Contractors operating industrial powered vehicles must be trained and licensed or certified in the operation of the particular equipment to be used. If the Contractor has received written authorization to use Brookfield Johnson Controls equipment, the "Loan of Equipment" waiver must be signed prior to use and all Brookfield Johnson Controls process and procedures with respect to the equipment must be followed

Motor Vehicles
All Contractors operating motor vehicles are to have and maintain a valid driver's license and a responsible driving record. Contractors must exercise due caution when driving on customer sites.

Material Handling
All Contractors involved in manual material handling should be aware of and trained in proper material handling procedures and are to use material handling equipment where appropriate. Equipment is to be properly maintained and all Contractors are to be trained in its use and safe operation.

Noise
Contractors must work in a manner that does not create a disruption to the normal course of business. Any activity that produces noise that interferes with the business operation must be completed during off-hours. Contractors shall ensure that their employees have proper and adequate noise and hearing protection.

Lighting
Contractors shall ensure that proper and adequate workplace lighting is provided in accordance with applicable legislative and regulatory requirements.

Working in cold and hot environments
Contractors are to have policies and procedures in place to ensure their employees are appropriately protected when working in cold and hot environments.

Initial Here _____

Asbestos Containing Material (ACM)
It is possible that the Contractor may be working in an area where ACM is located. Please review potential ACM locations with your Brookfield Johnson Controls contact prior to commencing work. The presence of various friable and or non friable asbestos containing material (ACM) has been identified or is presumed to be present at all Brookfield Johnson Controls managed facilities constructed prior to 1992. The contractor / service provider shall review prior to their work, the building asbestos survey or asbestos notification letter (attached in appendix A), either or shall be placed in the site hazard station. Buildings without a hazard station, asbestos survey or notification letter are to be regarded as buildings that may contain ACM. Contractors may not intentionally disturb ACM unless specifically retained to do so, in which case Brookfield Johnson Controls' Asbestos Management Program and all Client requirements must be followed. If a Contractor unintentionally disturbs suspected or known ACM, stop work and immediately inform your Brookfield Johnson Controls contact.

Mould
The Contractor is to notify the designated Brookfield Johnson Controls contact if any mould or mildew is observed in the work location. The Contractor must not disturb an area suspected to be contaminated with mould.

Infection Control
All Health Care Centers where the Contractor will be performing construction / maintenance will adhere to the Infection Control and Dust Containment requirements as per Canadian Standards Association CSA Z317.13-07 documentation titled Infection Control During Construction, Renovation or Maintenance of Health Care Facilities (2007).

Halocarbon Management
Contractors that work on systems that contain halocarbons are required to manage those systems in accordance with Brookfield Johnson Controls policy. Brookfield Johnson Controls policy dictates that Federal legislation shall be applied in every circumstance. Contractors are required to report any halocarbon release regardless of the quantity to Brookfield Johnson Controls immediately. All contractors shall adhere to their legislative requirements of having ODS or ODP qualified personnel to maintain the systems. All leak test tags and onsite report logs shall be updated and or provided by the contractor. Only Brookfield Johnson Controls-approved leak-test tags will be utilized.

Site Specific Hazards / Requirements
Any site specific hazards or requirements not covered by this manual should be identified, reviewed, assessed and controlled with the Brookfield Johnson Controls contact immediately.

REQUIREMENTS BROOKFIELD JOHNSON CONTROLS NOTIFICATION / PERMITS

Fire and Life Safety
Contractors are to provide their own fire protection equipment as required, including but not limited to fire extinguishers. Use and storage of flammable and combustible materials must be conducted in accordance with all codes and regulation and their use and storage must be approved by the Brookfield Johnson Controls contact prior to bringing the material on-site. Contractors may not conduct any work that will affect the building's fire life safety systems unless specifically retained to do so and the Brookfield Johnson Controls contact is aware of and approved the timing of the work prior to its commencement. Initial Here _____

Hazardous Materials Management, including compressed gases
Contractors are required to obtain permission prior to bringing hazardous materials to a work location. Quantities brought and maintained at location of work should be minimized and appropriate to the nature and scope of work. Contractors must maintain an updated inventory of hazardous materials on-site; current Material Safety Data Sheets are to be located in proximity to the hazardous materials storage and areas of use and must be accessible to Brookfield Johnson Controls and emergency response personnel. It is the Contractor's responsibility that all hazardous materials are properly handled and stored in accordance with all regulatory and code requirements and all WHMIS labeling requirements are met. It is also the Contractor's responsibility to have an appropriate spill response plan and required equipment in place. The Contractor must be able to demonstrate that its employees have received WHMIS training and are knowledgeable in spill response appropriate to the material at the work location. Any releases or spills that results in a requirement to contact a regulatory authority must be investigated and reported as per the Accident / Incident Investigation and Reporting section.
All Contractors must be able to demonstrate that its employees involved in the transporting of hazardous materials have Transportation of Dangerous Goods training appropriate to their role.
All hazardous waste generated by the Contractor is to be removed through Brookfield Johnson Controls unless written authorization is received.

Lockout / Tag Out
It is the Contractor's responsibility to have a hazardous energy control program in place (Lockout/Tag out) if they are involved in maintaining and / or repairing equipment. This program is to be available to Brookfield Johnson Controls for review upon request. Prior to initiating a lockout / tag out, the Contractor must inform the Brookfield Johnson Controls contact of the location and estimated duration of the equipment lockout / tag out and will conduct a review of all energy sources and the equipment specific written procedure.

Welding / Cutting (Hot Work)
It is the Contractor's responsibility to have a hot work program. The Contractor must inform their Brookfield Johnson Controls contact and have a Hot Work permit issued prior to the start of any hot work. If hot work is being conducted within a building, it must be planned (through scheduling, engineering controls etc), to minimize building occupant's exposure to fumes and other hazards. Precautions must also be undertaken to prevent interference with fire life safety systems. A work and post-work spotter is required where there is a risk of fire or where the fire life safety systems are impaired or off line. The Contractor is responsible for providing all fire protection equipment and personnel.

Confined Space
All Contractors entering a permit restricted confined space must follow Brookfield Johnson Controls' confined space business process and permit requirements. A Contractor may only enter a permit restricted confined space upon review of the specific confined space entry procedure and issuance of a Brookfield Johnson Controls Confined Space Entry and other applicable permits. The Brookfield Johnson Controls contact must be informed prior to an entry. It is the Contractor's responsibility to provide their own safety equipment including PPE, monitoring and rescue equipment.

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Crane, Hoist, and Other Lift Equipment
Contractors will obtain approval from their Brookfield Johnson Controls contact prior to bringing on-site and using cranes, hoists, and other lifting equipment. All operators must be trained and certified in the equipment being used. The equipment is to be maintained as per the manufacturer's recommended maintenance and safety requirements and an up-to-date inspection report certifying the equipment is to be available upon request. A copy of the crane hand signals that will be used are to be posted. The Contractor must ensure that loads never exceed the set limits and that suspended loads are never left unattended.

Worksite Inspections
Brookfield Johnson Controls requires all contractor worksites to be inspected for hazards, when found corrected or isolated as per the applicable provincial / federal legislated regulations. Brookfield Johnson Controls requires that all worksites are to be inspected regardless of size or scope of work. Required frequencies are at the start of a project, when site conditions change, after an accident or at a minimum once per month thereafter. All inspection reports shall be without delay forwarded to the contractor's Brookfield Johnson Controls contact person. In cases where the contractor does not have an Inspection report they can use the Brookfield Johnson Controls (HSE-S02-E Workplace Safety Checklist Audit Form) which can be obtained from the contractor's Brookfield Johnson Controls contact person.

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APPENDIX A

CONTRACTOR / SERVICE PROVIDER ASBESTOS NOTIFICATION

Brookfield Johnson Controls Facility Management Services, Workplace Solutions Inc. RealSuite Inc.
Letter of Notification:

WORKING WITH ASBESTOS CAN BE EXTREMLY DANGEROUS INHALING ASBESTOS FIBRES CAN CAUSE VARIOUS TYPES OF LUNG DISEASE, MESOTHELIOMIA OR CANCER.

Asbestos may be present in the following materials as listed: Cement Pipes, Cement Wallboard, Cement Siding, Asphalt Floor Tile, Vinyl Floor Tile, Vinyl Sheet Flooring, Flooring Backing, Constructions Mastics, Acoustical Plaster, Decorative Plaster, Textured Paints/Coatings, Ceiling Tiles and Lay-in Panels, Spray-Applied Insulation, Blown-in insulation, Fireproofing Materials, Taping compounds (thermal), Packing Materials, High Temperature Gaskets, Laboratory Hoods/Table Tops, Laboratory Gloves, Fire Blankets, Fire Curtains, Elevator Equipment Panels, Elevator Brake Shoes, HVAC Duct Insulation, Boiler Insulation, Breaching Insulation, Flexible Fabric Ductwork, Cooling Towers, Pipe Insulation, Heating and Electrical Ducts, Electrical Panel Partitions, Electrical Cloth, Electric Wiring Insulation, Chalkboards, Roofing Shingles, Roofing Felt, Base Flashing, Thermal Paper Products, Fire Doors, Caulking/Putties, Adhesives, Wallboard, Joint Compounds and Spackling, Vinyl Wall Coverings.

The presences of various friable and or non friable asbestos containing material (ACM) have been identified or are presumed to be present at all Brookfield Johnson Controls managed facilities constructed prior to 1992. The contractor / service provider shall review prior to their work, the building asbestos survey or asbestos notification letter, either or shall be placed in the buildings log book. Buildings without a log book, asbestos survey or notification letter are to be regarded as buildings that may contain ACM. Where applicable Brookfield Johnson Controls will review with the contractor / service provider personnel the locations of known ACMs as noted on the asbestos survey. The Brookfield Johnson Controls Asbestos Management Program applies to all maintenance, repair and renovation work that may disturb asbestos materials. The disturbance of asbestos building materials may only be undertaken by qualified contractors who have received training in asbestos-related precautions and procedures (as per the provincial / federal Occupational Health Safety Act and the governing regulations). As a condition of your contract to provide services and materials to Brookfield Johnson Controls, the contractor / service provider shall not disturb asbestos-containing materials without prior notification to Brookfield Johnson Controls. The contractor / service provider and its workers, while at any location will follow all procedures specified by the Brookfield Johnson Controls Asbestos Management Program.

Thank you for your ongoing support

“SAFETY FIRST, IT’S THE WAY WE DO BUSINESS”

Initial Here _____

Brookfield
Johnson
Controls

Appendix B

Brookfield Johnson Controls Required Project Specific Safety Documents

- **Signed and Initialed BLJC Contractor Handbook**
  - This document must be read and initialed and signed by the contractor's representative and provided to the PM prior to work beginning.
- **Job Hazard Assessment**
  - A job Hazard Assessment must be done prior to work commencing on a site and depending on the project Job Hazard Assessments must be completed when worksite conditions change or a new Hazard is introduced into the worksite.

The contractor is to have, at minimum, the above documentation provided to the Project Manager at the start of a project.

The following documentation must be provided to the PM as soon as possible during the project if applicable.

- **Pre Project Safety Inspection**
  - Where the project involves alterations to the structure of the building a Pre Projection Safety Inspection is to be completed to identify any risks to the tenants of the facility as well as the workers completing the task.
- **Project Safety Plan**
  - If applicable a Project Safety Plan should be completed prior to a project beginning and to be available and reviewed by all personnel on site prior to commencing work.
- **Site Safety Orientations**
  - Where one or more individuals are working on a jobsite a Site Safety Orientation must be done in order for the worker(s) to familiarize themselves with the environment they will be working in. There may be Site Specific Rules that will only apply to that location and all workers must be made aware of these rules.
- **Emergency Response Plan**
  - In case of an emergency there must be a plan in place to respond to the situation. This must be provided to the PM in charge of the project.
- **Toolbox/Safety Meetings**
  - A Toolbox or Safety Meeting must happen at the beginning of a project and should take place periodically throughout the project as well. The minutes of these meetings must be provided to the PM.
- **Work Permits (Lockout/Tag out, Hot Work)**
  - A work permit system must be in place as required.
- **Incident Reports - Near Misses**
  - Any incident or near miss that occurs on a BLJC Project is to be immediately reported to the PM and appropriate documentation including any investigation material provided within 72hours unless client requirements dictate otherwise.

Initial Here _____

CONTRACTOR ACKNOWLEDGEMENT

I _____, the Contractor (or the Contractor Representative), by signing this document acknowledge that I have read and understand the rules and policies outlined in the previous pages. I also acknowledge receipt and acceptance of the Brookfield Johnson Controls "**Contractor Health, Safety and Environmental Policy Handbook**".

_____
Company Name (Please print)

_____
Signature (Contractor / Contractor Representative)

_____
Name (Please print)

_____
Title / Position

_____
Date

Brookfield Global Integrated Solutions			FORM
Title	Project Hazard Assessment and Controls	**Project Name and Number**	
Company Name		**Person Completing**	

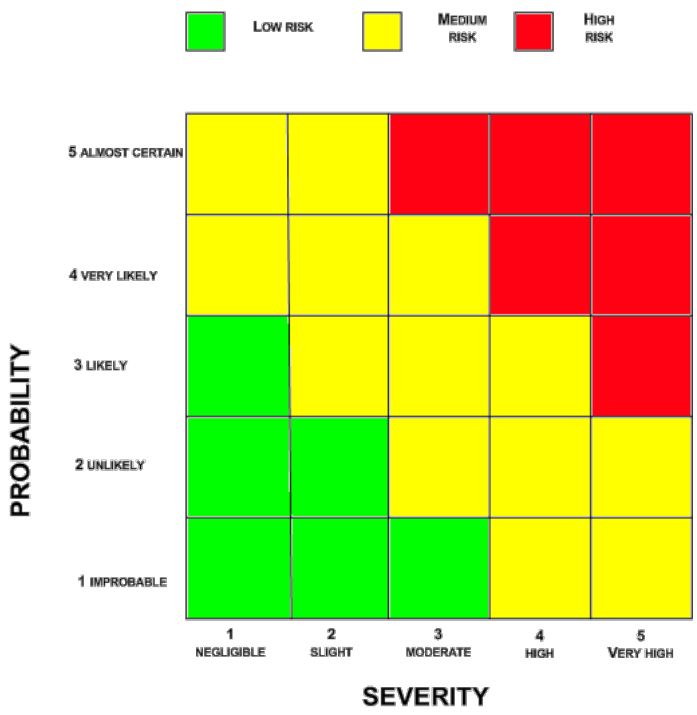
Identification of Hazards and Controls

- Building-related hazards and controls can be reviewed via the Brookfield GIS Site Hazard Station as described in the Building OHS plan.
- Hazards and controls specific to this project have been outlined here. (see table starting next page)

Hazard Assessment and Controls

All identified hazards must be posted at the work site. These must also be communicated to the JHSC or Safety Rep and all workers that may encounter those hazards during the course of their work.

Risk Matrix



Key Risks:
1. Ex. Exposure to Noise
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.

Table TS-2.6 – Hazard Assessment and Controls

Project Component	Risk/Hazard	Control	Priority/ Risk Ranking	Training & Certification Requirements	Status
Example: Start Up	*1. Exposure to high levels of noise from tools, machinery and equipment*	*Mandatory hearing protection for all employees. Signage posted at site entrance indicating hearing protection is required.*	*High*	*Training in use of hearing protection and hearing conservation program in place*	*Implemented*

Project Initiation and Inspection

All work associated with this project will be subject to regular inspection by the Brookfield GIS Senior Project Manager, and the Brookfield GIS Construction Safety Coordinator. While Brookfield GIS maintains oversight in the role of Constructor, contractors remain obligated to provide adequate supervision and continue to conduct their own inspections of the work as required of all employers under the regulations.

Please validate that each item noted is in place and will remain in place for the duration of the project.

Project Initiation & Inspection Checklist

			General Safety
Yes	No	N/A	A Safety Board has been installed at the worker entrance to the project site. Safety board includes all items mandated under the regulations, as well as a copy of the regulations.
Yes	No	N/A	Notice of Project has been posted at the project site (includes project description, emergency telephone numbers, location and address, as well as any known or unique hazards)
Yes	No	N/A	All access points to the construction area have been clearly identified with signage posted. Access Control is in place, and PPE requirements have been posted.
Yes	No	N/A	Pre-Construction and weekly coordination meetings will be hosted by Senior Project Manager (Constructor), and at minimum will be attended by Construction Safety Coordinator, the Property Manager (OHS Control Authority), the HSE Coordinator (representing the interests of the tenants and Brookfield GIS Property Manager) a representative from all major contractors, representatives for each of the tenants.
Yes	No	N/A	Emergency procedures & plans have been posted on the safety board and will be reviewed with team members and contractors as appropriate (at least once at project kickoff and reviewed in each progress meeting to ensure no changes are required)
Yes	No	N/A	There are adequate First Aid Kits and Qualified First Aiders
Yes	No	N/A	Location, schedule and minutes of safety meetings, tool box talks and safety inspections will be posted on the project safety board.
Yes	No	N/A	The Brookfield GIS Work Permit is in place and associated requirements are met.
Yes	No	N/A	All supplemental permits (hot work, confined space entry, lock out/tag out, etc.) have been explained and are in place.
Yes	No	N/A	The location of the on-site Brookfield GIS Hazard Station has been communicated to all workers with instruction to review all hazards and controls prior to the start of any work.
Yes	No	N/A	MSDS for all hazardous materials that will be used on the project have been provided to the BGIS project manager; liquid containers and cylinders are labelled and stored properly, and a Designated Substances Report has been provided to all subcontractors.
Yes	No	N/A	All work involving excessive noise or strong odours will be scheduled to minimize disruption to the tenant and occupant activities.

Yes	No	N/A	Boilers and Pressure vessels will not be touched or interfered with by the project team. Senior Project Manager will interface with qualified representatives of the Property Management team relative to any requirements.
Yes	No	N/A	Project elements that require approval from a regulator or a professional engineer have been identified.
Yes	No	N/A	Arrangements have been made to ensure that all work areas continue to have adequate lighting.
			Contractors and Subcontractors
Yes	No	N/A	All Contractors (and subcontractors) have been verified as having good safety records and remain in good standing with provincial workers compensation board.
Yes	No	N/A	Contractor has a comprehensive safety program meeting at minimum legislated requirements.
Yes	No	N/A	Contractors (and subcontractors) have received orientation to Brookfield GIS safety procedures and reviewed and signed Brookfield GIS Contractor Safety Handbook is on record for every contract company working on the project.
Yes	No	N/A	All contractor and subcontractor workers have completed the Brookfield GIS Site , and Project-Specific Orientation
Yes	No	N/A	All contractors and subcontractors have been informed of the requirement to report all hazardous occurrences, unsafe conditions and incidents to Brookfield GIS, as well as forward copies of any orders and or directives issued by the Authority Having Jurisdiction to Brookfield GIS.
Yes	No	N/A	An adequate level of competent supervision will be provided relative to each contractor or subcontractor.
Yes	No	N/A	Construction material staging and storage requirements/limitations have been communicated to all contractors.
			Fire Prevention
Yes	No	N/A	Fire protection systems will be maintained or a fire watch will be maintained throughout the work.
Yes	No	N/A	Firefighting equipment appropriate to the work will be accessible, and will be maintained at all times in good repair.
Yes	No	N/A	Hot Work permits are available and will be used when required.
			Fall Protection and Confined Space
Yes	No	N/A	All confined spaces (existing or that will be created as a result of the work activity) have been clearly identified with warning signage.
Yes	No	N/A	All workers performing confined space entry are certified and have all necessary equipment, properly calibrated tools, plans and permits.
Yes	No	N/A	All holes or openings have been barricaded or covered securely and marked
Yes	No	N/A	Those working above 2m (6ft) off the ground, within 2m (6ft) of a roof edge, on any sloped roof or within 2m (6ft) of an opening they could fall through are protected by a guardrail, covering or personal fall arrest system. (in tender docs)
Yes	No	N/A	Fall protection equipment will be worn and tied off at all times on any elevated work platforms or scaffolding.
Yes	No	N/A	Personal fall protection devices and equipment will be inspected prior to each use by a competent person and worker fall protection certification will be verified.
			Trenching, Excavation and Tunneling
Yes	No	N/A	A notice of dig and permit number has been issued by the provincial authority if appropriate.
Yes	No	N/A	If no support system will be in use relative to excavation work, documented opinion from a Professional Engineer is available.

Yes	No	N/A	Support System design drawings and specifications are available
Yes	No	N/A	All excavations will be appropriately barricaded.
			Elevating Devices/Hoisting Workers
Yes	No	N/A	Any repair, alteration or modification of an elevating device will be a certified elevating device mechanic. Elevators will be parked with doors open, barricades in place and signage at each floor whenever work is in progress.
Yes	No	N/A	Notification has been made to the provincial authority if required before any hoisting operations takes place if workers will be raised, supported or lowered by a crane.
Yes	No	N/A	Relative the preceding item, design drawings and certification documents are available.
			Housekeeping
Yes	No	N/A	All construction debris will be kept clear from egress, work areas, hallways and stairways.
Yes	No	N/A	Barricades, signage and spill kits are available where necessary. All liquid spills will be barricaded/cleaned-up immediately
Yes	No	N/A	Established walking paths will be kept clear of loose electrical cords, excess equipment, and other trip hazards.
Yes	No	N/A	Appropriate dust control such as hoarding, and dust-capture systems will be used where appropriate.
Yes	No	N/A	Electrical and mechanical rooms will not to be used as storage space and will be kept clear at all times.
			Electrical
Yes	No	N/A	Only authorized/certified electricians will be performing electrical work
Yes	No	N/A	All work parties are trained in lock-out/tag-out procedures
Yes	No	N/A	NO LIVE WORK will be permitted. All equipment will be properly locked out/tagged out prior to the start of the work.
Yes	No	N/A	All temporary lighting will be equipped with guards to prevent contact with the bulb
Yes	No	N/A	Electrical junction boxes will be closed
Yes	No	N/A	Electrical cords will be kept in good repair and will be removed from use if frayed, cut or nicked.
Yes	No	N/A	Any modification to building electrical systems will include updated labeling to the breaker panels.
Yes	No	N/A	All electrical installations will be grounded or double insulated.
			Stairways, Ladders and Scaffolds
Yes	No	N/A	Staircases with more than 4 steps will be equipped with handrails
Yes	No	N/A	If used to access the roof, extension ladders will exceed by at least 1m (3ft) of the roof edge.
Yes	No	N/A	Extension ladders, when in use, will be inclined at a ratio of 4:1
Yes	No	N/A	All ladders and step ladders will be in good repair, and inspected prior to use
Yes	No	N/A	Extension ladders having a risk of sliding or being struck are securely tied off barricaded.
Yes	No	N/A	Ladders will not to be used within 3m (10ft) of electrical power lines
Yes	No	N/A	Scaffolds are in good repair and working surface is fully planked
Yes	No	N/A	Design drawings and load capacity, and engineering sign-off for scaffolding is available where applicable
Yes	No	N/A	Competent person has certified installation of all scaffolds prior to the start of work
			Hand & Power Tools
Yes	No	N/A	All hand and power tools will be inspected prior to use and in good working order

Yes	No	N/A	All safety guards and devices will be in place while the tools are in use
			Vehicle and Mobile Equipment
Yes	No	N/A	All equipment operators are properly authorized, trained and certified
Yes	No	N/A	Construction equipment and vehicles are parked so as to prevent the release of stored energy (bucket/forks down, brake applied, wheels chocked)
Yes	No	N/A	Signallers are used if the operator has an obstructed view in order to protect other vehicles or pedestrians
Yes	No	N/A	Special care is taken when operating heavy equipment near power lines
			Sanitation on construction site
Yes	No	N/A	Toilets and an adequate supply of potable water are provided at the jobsite and location is posted at the job site
Yes	No	N/A	Records of maintenance for portable toilets are posted at the job site

Brookfield
Global Integrated Solutions

Work Permit

Instructions: Complete all Shaded Boxes. Email completed work permit to appropriate mailbox (see below). Await approval from Brookfield Global Integrated Solutions before proceeding with the work.

AUTHORIZED PERMIT MUST BE AVAILABLE IN HARD COPY OR SOFT COPY AT THE LOCATION OF THE WORK

LOCATION OF THE WORK

Province	
City	
Building (Building Name or Address)	
Floor	

DATE & DURATION OF THE WORK

Planned Work Date (dd/mm/yyyy)	
Planned Start Time	
Planned End Time	

WORK INITIATOR

	If "other" please specify
Work Requested By:	BGIS
Work Order # or Project # (If Applicable)	

WORK PLAN

	Specify detail (if applicable)
Will life safety system be impacted or impaired (fire alarm or other)?	No
Will other building systems be impacted or impaired? (HVAC, lighting, elevator, etc.)	No

Provide a brief description of the work (attach job safety plan as appropriate to the task).

RISK ASSESMENT	Yes/No	If "YES" Controls Required
Requires access to a secure area where escort may be needed?		**1,2**
Requires Access to a confined or restricted space?		**1,7,9,10,11**
Requires work from heights?		**1,7,9,10,11**
Requires hot work?		**1,6,7,9,11,12**
Requires live work?		**1,9,10,11**
Life safety systems impacted?		**1,12**
Workers have all licenses, training, and tools needed to perform the task?		**1,10**
Involves loud noises or strong odors?		**1,3**
Requires obstruction of building access or egress?		**1,3,5,7**
Involves electrical or mechanical disruption?		**1,3,4,9**
Asbestos & hazardous materials surveys are available and have been reviewed by those conducting the work?		**1,8,11**
Involves working around or with hazardous chemicals?		**1,11**
Work taking place at a heritage site?		**1,2**

Control

1. Workers to complete BJCC online orientation through comply works
2. Additional Clearance or Authorized Escort Required
3. Tenant Notification or Escort Required
4. Shutdown Notice Required
5. Security Coverage Required
6. Fire Extinguisher & 4 Hour Fire Watch Required after completing work
7. Safety Barriers Required
8. Review of Asbestos Survey / BJCC Hazard Station
9. Additional High Hazard Permit Required (Confined Space, LOTO, etc.)
10. Additional License or certification Required (Confined Space, Fall Arrest etc.)
11. Specialized Personal Protective Equipment Required
12. Notification to Fire Department Required
13. Refer to Conservation Plan

Please note, the Risk Assessment above is not intended to replace a Job Safety Assessment. "Controls" as identified above are intended as prompts for the permit authorizer; The permit holder is responsible for conducting a proper job safety assessment and safety briefing to the workers prior to the commencement of the work and implementing any additional controls that may be required specific to the work task.

PERMIT HOLDER DETAILS

Company Name	
Permit Holder	
Permit Holder Contact Number	
Names of All Workers	

For Site Emergencies Call 911 and Notify BGIS at 1-877-445-0611

BGIS USE ONLY

SAFETY REVIEW

Name of reviewer

Date of review

Approved (Yes/No)

Comments

FACILITIES REVIEW

Name of Reviewer

Date of Review

Approved (Yes/No)

Comments

Reset Form

E-mail permit to:
ON-RP1workpermit@brookfieldjci.com
QC-RP1workpermit@brookfieldjci.com
ATL-RP1workpermit@brookfieldjci.com
WEST-RP1workpermit@brookfieldjci.com
PAC-RP1workpermit@broookfieldjci.com
NCA-RP1workpermit@brookfieldjci.com

Brookfield Johnson Controls

HOT WORK PERMIT

Date _____ Location _____ WO # _____

Job Description _____

Name of person(s) doing Hot Work _____

Permit expires on: Date _____ (MM/DD/YY) Time _____ AM/PM

I confirm the above location has been examined, precautions checked below have been taken to prevent fire and permission is authorized for this work.

_____

Name and Signature - Permit Authorizing Individual (PAI)

Precautions

The PAI must inspect the work area and check off all precautions listed below.

OK N/A

- ☐ ☐ Sprinklers and / or fire hose are in service / operable.
- ☐ ☐ Fire extinguisher is fully charged and readily available at the site.
- ☐ ☐ Cutting, welding equipment are in good working order.
- ☐ ☐ Area Team Leader and personnel have been notified.
- ☐ ☐ Enclosed or confined spaces have been monitored for explosive or flammable gases.
- ☐ ☐ All equipment have been cleaned of all combustible / flammable materials.
- ☐ ☐ Enclosed containers / piping have been purged of flammable vapors.
- ☐ ☐ Adequate air supply has been provided in enclosed or confined space.
- ☐ ☐ **Emergency contact numbers** displayed on backside of the Permit.

Within a radius of 11m or ____m from hot work (if indicated otherwise by PAI):

OK N/A

- ☐ ☐ Work area floors have been swept clean of all combustible materials.
- ☐ ☐ Flammable surfaces have been wetted down or covered with fireproof sheets.
- ☐ ☐ There are no combustible materials or flammable liquids.
- ☐ ☐ Wall and floor openings have been covered or contained by suspending fireproof tarps under work area to collect sparks.

Fire watch person (Usually the person conducting the work):

OK N/A

- ☐ ☐ Present during work, will stay 30 minutes (or as indicated below by PAI) after work is completed.
- ☐ ☐ Supplied with a fire extinguisher or fire hose and knows how to use it and how to sound the alarm.

Time task started: _____ AM/PM Time task finished: _____ AM/PM

Final Check

The job site has been monitored _____ hour(s) after work is completed and was found to be safe and free from fire.

Time of final check: _____ AM/PM

Verified by: _____

(Name and signature – Fire watch person)

Copies: 1. Keep at work site 2. Keep for your file 3. Copy for your manager or customer

Brookfield Global Integrated Solutions		FORM	
Form Title	Building OHS Plan	**Number:**	HS 287-01 RP1
Author:	HSE Manager	**Effective Date:**	May 4, 2015
Owner:	HSE Director	**Revision:**	2

Acknowledgement Notification

Building(s): _____

Service provided: _____

Company name: _____

I acknowledge that I have read and understand the following documents:

- **Brookfield GIS Site Specific Protocol**
- **Brookfield GIS Facility Site Specific Hazard Assessment**
- **Brookfield GIS Contractor Handbook**

I will communicate these documents to all my employees and sub-contractors. I will abide by the rules and regulations stated in these documents. I shall also abide by the Occupational Health & Safety Act, Industrial Regulations 851, as well as all other pertaining regulations and required permits (i.e. window washer Regs.)

Contractor/Service Provider: Contact Number:	
Supervisor's Name: Supervisor's Contact Number:	Tel. No:
Location(s) of Work: Signature:	Date:

If Required:

Sub-Contractor Name:_____

Representative's Name:_____**Cell:**_____

Signature:_____**Date:**_____

Sub-Contractor Name:_____

Representative's Name:_____**Cell:**_____

Signature:_____**Date:**_____