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SPECIFICATION Issued for Construction
12 September 2018

Parks Canada Agency (PCA)
Waterton Lakes National Park
Alpine Stables Reconstruction – Alpine Cottage and Bunkhouse

Project No. R.096286.001

Waterton, Alberta

www.pwgsc-tpsgc.gc.ca

Pages

Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

Division 01 - GENERAL REQUIREMENTS

Division 03 – CONCRETE

Division 04 – MASONRY

Division 06 – WOOD, PLASTICS, AND COMPOSITES

Division 07 – THERMAL AND MOISTURE PROTECTION

Division 08 – OPENINGS

Division 09 – FINISHES

Division 10 – SPECIALTIES

Division 11 – EQUIPMENT

Division 21 - FIRE SUPPRESSION

Division 22 - PLUMBING

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

Division 25 - INTEGRATED AUTOMATION

Division 26 - ELECTRICAL

Division 27 – COMMUNICATIONS

Division 28 – ELECTRONIC SAFETY AND SECURITY

ELECTRICAL APPENDICES

Division 31 – EARTHWORK

LIST OF DRAWING SHEETS

END OF TABLE

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises general construction of two ready-to-move residential buildings, a cottage and a bunkhouse, to be located and finished at Waterton Lakes National Park Alpine Stables site.

1.2 CONTRACT METHOD

.1 Construct Work under single stipulated price contract.

1.3 LAWS, NOTICES, PERMITS AND FEES

.1 Obtain and pay for the building permit, permanent easements and rights of servitude.

.2 Obtain and pay for permits, licenses, and certificates necessary for the performance of the Work that were in force at the date of executing the Agreement.

1.4 SUPPLEMENTARY INFORMATION FOR PROGRESS PAYMENTS

.1 Successful Contractor will be required to submit a detailed breakdown of costs for each elemental section into three funding accountabilities within 5 business days of Contract Award and with every change to the project. The funding accountability will be detailed as directed, and on a form provided by the Departmental Representative, for parts of Work, aggregating total amount of Contract Price, to facilitate evaluation of application for payments. After review by Departmental Representative, cost breakdown will be used as basis for progress payment.

1.5 WORK BY OTHERS

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

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

.3 Work of Project executed during Work of this Contract, and which is specifically excluded from this Contract:

.1 Saddling Barn, Boarding Barn, and site work including weather shelter, fences and corrals, landscaping, and parking lot.

.2 Include provisions for co-ordinating related work.

1.6 CONTRACTOR USE OF PREMISES

.1 Unrestricted use of site until Substantial Performance.

.2 Co-ordinate use of premises under direction of Departmental Representative.

.3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

1.7 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 72 hours' notice for necessary interruption of mechanical or electrical service. Minimize duration of interruptions. Carry out work at times as directed by authorities having jurisdiction with minimum disturbance to residents and businesses.

.3 Provide alternative routes for pedestrian and vehicular traffic. Supply and maintain signage for detours and road closures.

.4 Submit schedule to and obtain approval from Departmental Representative for shutdown or closure of active service or facility including water, sewer, power, and communications services. Adhere to approved schedule and provide notice to affected parties.

.5 Provide adequate bridging over trenches that cross sidewalks or roads to permit normal traffic.

.6 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

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

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

1.8 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 of 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.

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

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

1.3 WORKING TIMES

.1 Operation of construction equipment is permitted only between 8:00 am and 7:00 pm on weekends, and between 8:00 am and 8:00 pm on weekdays to minimize disturbance to residents and businesses.

.1 Application may be made to Departmental Representative for extended work hours under special circumstances.

.2 Construction is not permitted on long weekends and statutory holidays.

.1 Thanksgiving Day 2018

.1 Friday October 5 to Monday October 8

.2 Remembrance Day 2018

.1 Friday November 9 to Monday November 12t

.3 Christmas/Boxing Day 2018

.1 Monday December 24 to Wednesday December 26

.4 New Years 2019

.1 Friday December 28 to Tuesday January 1

.5 Family Day 2019

.1 Friday February 15 to Monday February 18

.6 Good Friday/Easter 2019

.1 Friday April 19 to Monday April 22

1.4 NATIONAL PARK REGULATIONS

.1 Ensure that all work is performed in accordance with ordinances, laws, rules and regulations set out in the Canada National Parks Act.

.2 Ensure personnel comply with National Park Regulations.

.3 Obtain business licenses from Parks Canada Administration Office prior to commencement of work.

.4 Comply with laws and government regulations applicable to work under this contract.

.5 Obtain vehicle passes from Parks Canada Administration Office for business and private vehicles.

.6 Equip all service vehicles and supervisory vehicles with Emergency Spill Kit DOT-E-10102 or equivalent.

1.5 SPECIAL REQUIREMENTS

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

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

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

.4 Ingress and egress of Contractor vehicles at site is limited to existing road and driveway areas to the Alpine Stables site.

.5 Take precautions to protect the endangered Half-moon Hairstreak butterfly habitat located on the east side of the site. Refer to drawings for location.

1.6 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 Schedule and administer project meetings as specified 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 the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.7 Reproduce and distribute copies of minutes within three days after meetings; transmit to Departmental Representative, meeting participants, and affected parties not in attendance.

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

1.2 PRECONSTRUCTION MEETING

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

.2 Departmental Representative, Contractor, major Subcontractors, field inspectors, and supervisors will be in attendance.

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

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

.5 Agenda to include:

.1 Appointment of official representative 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 submittals in accordance with Section 01 33 00 - Submittal Procedures.

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

.5 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, administrative requirements.

.7 Departmental Representative provided products.

.8 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.

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

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

.11 Monthly progress claims, administrative procedures, photographs, hold backs.

.12 Appointment of inspection and testing agencies or firms.

.13 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

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

.2 Contractor, major Subcontractors involved in Work, and Departmental Representative are to be in attendance.

.3 Notify parties minimum three days prior to meetings.

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

.5 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems 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 and expedite as required.

.10 Maintenance of quality standards.

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

.12 Other business.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Activity: Element of Work performed during course of Project. Activity normally has expected duration, 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 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 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 10 working days of Award of Contract, Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

.3 Submit Project Schedule to 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 re-submit 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 Structural framing.
- .6 Siding and Roofing.
- .7 Interior Architecture (Walls, Floors, and Ceiling).
- .8 Plumbing.
- .9 Lighting.
- .10 Electrical.
- .11 Piping.
- .12 Controls.
- .13 Heating, Ventilating, and Air Conditioning.
- .14 Millwork.
- .15 Fire Systems.
- .16 Backfilling.
- .17 Supplied equipment long delivery items.

1.6 PROJECT SCHEDULE REPORTING

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

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impacts, 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 and remedial measures will be discussed and negotiated.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 Provide submittals 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 for 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 are 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 at time of submission, in writing, identifying deviations from requirements of Contract Documents, stating reasons for deviations.

.7 Allow 10 working days for Departmental Representative's review of each submission.

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

.9 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.

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

.11 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 Alberta.

.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 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.

.5 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.

.6 Accompany submissions with transmittal letter, 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.

.7 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.

.8 After Departmental Representative's review, distribute copies.

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

.10 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.

.11 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, indicating 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 performed within 3 years of date of contract award for project.

.12 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.

.13 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.

.14 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative:

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

.15 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.16 Delete information not applicable to project.

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

.18 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.

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

.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 so 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 quality of work and material against which installed Work will be verified.

1.4 MOCK-UPS

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

1.5 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic copy of colour digital photography in jpg format, standard resolution, as directed by Departmental Representative.

.2 Project identification: name and number of project and date of exposure indicated.

.3 Viewpoints and location: As determined by Departmental Representative.

.4 Frequency of photographic documentation: As directed by Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Province of Alberta

.1 Occupational Health and Safety Act, SA 2017, Chapter O-2.1- Updated 2018.

.2 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations

1.2 SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation.

.3 Submit 1 copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative.

.4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.5 Submit copies of incident and accident reports.

.6 Submit WHMIS MSDS - Material Safety Data Sheets to Departmental Representative.

.7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 3 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 3 days after receipt of comments from Departmental Representative.

.8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.

.10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

.1 Emergencies: In event of emergency, call 411.

.2 All other inquiries: Parks Canada Switchboard (403) 859-2224.

1.3 FILING OF NOTICE

.1 File Notice of Project with Provincial authorities prior to beginning of Work.

1.4 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

1.5 MEETINGS

.1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.6 REGULATORY REQUIREMENTS

.1 Perform Work in accordance with Section 01 41 00 - Regulatory Requirements.

1.7 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.8 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.9 COMPLIANCE REQUIREMENTS

.1 Comply with Province of Alberta Occupational Health and Safety Act and its regulations.

.2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 UNFORESEEN HAZARDS

.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.11 WHMIS

.1 Ensure that products used in project comply with Workplace Hazardous Materials Information System (WHMIS) Regulations and Chemical Substances of the OH&S Act and Regulations regarding use, handling, labelling, storage, and disposal of hazardous materials.

.2 Deliver copies of relevant Material Safety Data Sheets (MSDS) to job site and Departmental Representative. MSDS to be acceptable to Labour Canada and Health and Welfare Canada for controlled products that will be used in performance of this work. Locate MSDS in accessible locations for workers and visitors throughout the site, bound and organized in binders.

.3 Train workers required to use or to work in close proximity to controlled products in accordance with OH&S Act and Regulations.

.4 Label controlled products at jobsite in accordance with OH&S and Regulations and WHMIS.

.5 Provide appropriate emergency facilities as specified in the MSDS where workers might be exposed to contact with chemicals, including eye-wash facilities, emergency shower.

.1 Workers are to be trained in use of such emergency equipment.

.6 Provide appropriate personal protective equipment as specified in the MSDS where workers are required to use controlled products.

.1 Properly fit workers for personal protective equipment

.2 Train workers in care, use, and maintenance of personal protective equipment.

.7 No controlled products are to be brought on-site without prior approved MSDS.

.8 MSDS are to remain on site at all times.

1.12 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Departmental Representative.

1.13 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.14 BLASTING

.1 Blasting or other use of explosives is not permitted.

1.15 POWDER ACTUATED DEVICES

.1 Use powder actuated devices only after receipt of written permission from Departmental Representative.

1.16 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Definitions:

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

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

.3 Surveillance Officer: Parks Canada-assigned personnel responsible to monitor compliance with environmental mitigation measures.

1.2 COMPLIANCE REQUIREMENTS

.1 Perform work in accordance with the ordinances and laws set out in the Canada National Parks Act and Regulations.

.2 Read, understand, and comply with Parks Canada Development Permit and all stipulations provided.

.3 Execute Work in compliance with the Canadian Environmental Assessment Act, 2012.

.4 Comply with mitigation measures as defined in Best Management Practices document.

.5 Failure to comply with or observe environmental protection measures, as identified in these specifications and those outlined in the Impact Assessment, may result in work being suspended pending rectification of measures.

1.3 SUBMITTALS

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

.2 Submit Environmental Protection Plan to Departmental Representative for review.

1.4 CONTRACTOR'S EMPLOYEE BRIEFING

.1 Conduct briefing sessions for employees and sub-contractor employees, highlighting requirements of this section, including operation of equipment.

.2 Initial site meeting with Contractor, Departmental Representative, Park Project Manager and Surveillance Officer will take place prior to commencement of construction.

.3 Contract documents have been developed in accordance with Canadian Environmental Assessment Act, 2012 Impact Assessment requirements. Construction methods that are directly affected by CEAA, 2012 Impact

Assessment will be reviewed at initial site meeting. Comply with and ensure construction practices meet mitigation measures outlined in the Impact Assessment. Failure to comply may lead to cessation of work.

1.5 NOTIFICATION

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

.2 After receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.

.1 Take action only after receipt of written approval by Departmental Representative.

.3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.

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

1.6 ENVIRONMENTAL PROTECTION PLAN

.1 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review by Departmental Representative.

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

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

.4 Include in Environmental Protection Plan:

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

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

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

.4 Descriptions of environmental protection personnel training program.

.5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring, and reporting requirements to assure that control measures comply with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

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

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

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

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

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

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

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

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

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

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

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

1.7 EROSION AND SEDIMENTATION CONTROL

.1 Develop and submit Erosion and Sediment Control Plan (ESC) identifying type and location of erosion and sediment controls provided. Include monitoring and reporting requirements to assure that control measures comply with erosion and sediment control plan, Parks Canada requirements, and Federal, Provincial, and Municipal laws and regulations.

.1 ESC Plan is to be developed by a qualified professional.

.2 Refer to Best Management Practices document for ESC Plan minimum requirements.

.2 Obtain permit for dewatering of construction site.

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

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

.5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Parks Canada requirements, and in conformance with the Environmental Contaminants Act and applicable provincial regulations, while observing the Code of Good Practice for Management of Hazardous and Toxic Wastes at Federal Establishments.

.6 Exercise control of erosion caused by wind, using measures in compliance with Best Management Practices document.

1.8 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties as indicated.

.2 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 metres minimum.

.3 Where necessary to work adjacent to existing trees and shrubs, exercise all possible care to avoid injury to vegetation. Where roots or limbs over 25 mm in diameter and bark are damaged during operations, trim damaged portion and immediately inform Departmental Representative for inspection and approval.

.4 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.

.1 Avoid unnecessary traffic, dumping and storage of materials over root zones.

.5 Obtain permits as required from Impact Assessment Office if a tree is to be removed. Contact Impact Assessment Office at (403) 859-5185. Municipal Officer may also give permission for a dead tree to be removed without the consent of Impact Assessment Office. Plant three young trees, from Waterton's native species, for each tree removed.

.6 Minimize stripping of topsoil and vegetation.

.7 Obtain list from Impact Assessment Office for native grasses, shrubs, flowers and trees acceptable for revegetation.

1.9 POLLUTION CONTROL

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

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

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

.1 Provide temporary enclosures where directed by Departmental Representative.

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

1.10 WILDLIFE

.1 Avoid or terminate activities on site that attract or harass wildlife.

.2 Immediately notify Departmental Representative who will notify WLNP Resource Conservation Duty Officers (1-888-WARDENS) of bear activity or encounters on or around site. Report other wildlife encounters within 24 hours.

.3 Take precautions to protect the endangered Half-moon Hairstreak butterfly habitat located on the east side of the site. Refer to drawings for location.

1.11 FIRES

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

1.12 HISTORICAL/ARCHAEOLOGICAL CONTROL

.1 Provide historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on project site: and identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in area are discovered during construction.

.2 Plan: include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.

.3 Give immediate notice to the Departmental Representative if evidence of archaeological finds is encountered during construction and await Departmental Representative’s written instructions before proceeding with work in this area.

.4 Relics, antiquities, items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found on site remain the Department's property. Protect such articles and request directives from Departmental Representative.

.5 Provide 48 hours’ notice to Departmental Representative prior to commencing work that may interfere with or affect an identified historical or archaeological site. Commence work only upon written instructions from Departmental Representative.

Part 2 Products

NOT USED

Part 3 Execution

3.1 CONTRACTOR'S OPERATIONS

.1 Confine operations to work limits as indicated on drawings. No activities of any kind may be carried out beyond work limits without Departmental Representative's written permission.

.2 Do not store or stockpile construction materials in trees bordering or being preserved on site. Do not unreasonably encumber site with products.

.3 Perform equipment maintenance in designated areas or as approved by Departmental Representative and Impact Assessment Office. Use of turnouts, campgrounds, picnic areas, or work camps for equipment oil changes and other servicing is not permitted.

.4 Collect and dispose used oil, filter and grease cartridges, lubrication containers, and other products of equipment maintenance at nearest industrial waste facility.

.5 Provide sufficient sanitary facilities and maintain in a clean condition.

.6 Obtain permit from Impact Assessment Office for storage of fuel or other inflammable liquids. Observe all restrictions and conditions imposed by permit regarding special protection and berming to control spills and tank damage; fire protection considerations; provisions for disposal of fouled material and used petroleum products

.7 Conduct operations to preserve natural features and vegetation in area. Cut and fill slopes to blend with adjoining topography. Do not permit material from fill slopes to slough or roll into surrounding tree cover or to bury plant material designated to be retained.

.8 When, in opinion of Departmental Representative, negligence on part of Contractor results in damage or destruction of vegetation, or other environmental or aesthetic features beyond staked or designated work areas, Contractor shall be responsible, at their expense, for complete restoration of trees including replacement of trees, shrubs, topsoil, grass, and other vegetation to Departmental Representative's satisfaction.

.9 As no non-native vegetation is allowed in Park, thoroughly wash construction equipment for inspection and approval by the Surveillance Officer before entering Waterton Lakes National Park.

3.2 DISPOSAL OF WASTE

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

.2 Store and handle garbage in conformance with National Parks of Canada Garbage Regulations.

.3 Store domestic garbage over the short term in wildlife-proof dumpsters. Put domestic recycling in appropriate facilities. Remove contaminated materials out of the Park.

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

.5 Maintain site in tidy condition, free of waste material, debris and litter.

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

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 REFERENCES AND CODES

.1 Perform Work in accordance with 2015 National Building Code of Canada (NBC) including amendments up to tender closing date, and other codes of provincial or local application; 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 WHMIS

.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 acceptable to Labour Canada and Health and Welfare Canada.

1.3 BUILDING SMOKING ENVIRONMENT

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

1.4 NATIONAL PARKS ACT

.1 Perform Work in accordance with the Canada National Parks Act for projects located within boundaries of a National Park.

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 wherever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections, or approvals whether by Departmental Representative instructions, or by 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 Work and pay cost of examination and correction. If Work is found in accordance with Contract Documents, cost of examination and replacement will be borne by Departmental Representative.

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies may be engaged by Departmental Representative for purpose of inspecting and 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 testing, appointed agency will request additional inspection and 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 retesting and re-inspection.

1.3 ACCESS TO WORK

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

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

1.4 PROCEDURES

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

.2 Submit samples 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, amount of which will be determined by Departmental Representative.

1.6 REPORTS

.1 Submit three hard copies and one electronic copy of inspection and test reports to Departmental Representative.

.2 Provide copies to subcontractor of work being inspected or tested.

1.7 MOCK-UPS

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

.2 Construct in locations acceptable to 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 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.8 EQUIPMENT AND SYSTEMS

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

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

1.2 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.3 DEWATERING

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water as approved by the Surveillance Officer and as stated on the RAP.

1.4 WATER SUPPLY

.1 Provide continuous supply of potable water for construction use.

.2 Provide continuous supply of potable water to homes, businesses, and facilities disrupted by construction activities.

.3 Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.

.4 Costs for temporary water services and considered incidental to the work and no separate or additional payment will be made.

1.5 SANITARY SEWER

.1 Provide continuous sanitary sewer to homes, businesses and facilities disrupted by construction activities.

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

.3 Costs for temporary sanitary sewer services and considered incidental to the work and no separate or additional payment will be made.

1.6 TEMPORARY POWER AND LIGHT

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

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

.3 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.

1.7 FIRE PROTECTION

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

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

1.2 INSTALLATION AND REMOVAL

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

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

.3 Indicate use of supplemental or other staging area.

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

.5 Remove from site all such work after use.

1.3 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.

1.4 CONSTRUCTION PARKING

.1 Parking will be permitted on site provided it does not disrupt performance of Work or normal operations of the National Park. Parking areas must be approved by Departmental Representative

.2 Provide and maintain adequate access to project site.

1.5 SECURITY

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

1.6 OFFICES

.1 If required by Contractor, provide office of sufficient size to accommodate required work activities of Contractor and sub-contractors. Departmental Representative to approve location of trailer.

.2 Deal directly with utility companies for utility hook-ups required for site office.

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

1.7 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

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

1.8 SANITARY FACILITIES

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

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

1.9 PROTECTION AND MAINTENANCE OF TRAFFIC

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

.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.

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

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

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

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

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

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

.9 Provide snow removal during period of Work.

1.10 CLEAN-UP

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

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

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

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

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

.1 Provide temporary controls to execute Work expeditiously.

.2 Remove from site all such work after use.

1.2 ENCLOSURE

.1 Erect temporary site enclosure using new 1.2 m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4 m on centre. Maintain fence in good repair.

.2 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.3 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, and open edges of floors and roofs.

.2 Provide as required by governing authorities.

1.4 WEATHER ENCLOSURES

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

.2 Erect enclosures to allow access for the installation of materials and to allow for work inside enclosure.

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

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

.5 Ensure that upon final construction, and during construction, the work is executed to prevent the entry of water, snow, and air into the interior of the building and to accept the responsibility to correct any deficient work. Bring to the attention of the Departmental Representative, prior to construction, details that may compromise weather tightness.

1.5 DUST TIGHT SCREENS

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

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

.3 Coordinate location and security measures with Departmental Representative on Site.

1.6 ACCESS TO SITE

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

1.7 PUBLIC TRAFFIC FLOW

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

1.8 FIRE ROUTES

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

1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

.2 Be responsible for damage incurred.

1.10 PROTECTION OF BUILDING FINISHES

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

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm locations and installation schedule with Departmental Representative, minimum 3 days prior to installation.

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

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 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 Within text of each specifications section, reference may be made to reference standards. Conform to these reference standards, in whole or in part as specifically requested in specifications.

.2 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.

.3 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY OF PRODUCTS

.1 Products, materials, equipment, and articles incorporated in Work are to 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 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.

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

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

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

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

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

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

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

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

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

.9 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 TRANSPORTATION

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

.2 Transportation cost of products supplied by others will be paid by Departmental Representative. 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 may 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.

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

1.10 REMEDIAL WORK

.1 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. Perform in a manner to neither damage nor put at risk any portion of Work.

.2 For remedial work, employ specialists familiar with materials affected.

1.11 LOCATION OF FIXTURES

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

.2 Inform Departmental Representative of conflicting installation. Install as directed.

1.12 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 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.

1.13 FASTENINGS - EQUIPMENT

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

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

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

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

1.14 PROTECTION OF WORK IN PROGRESS

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Departmental Representative's identification of existing survey control points and property limits.

1.2 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practice in Alberta.

1.3 SURVEY REFERENCE POINTS

.1 Departmental Representative will supply horizontal reference control points benchmark elevations.

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

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

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

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

1.4 SURVEY REQUIREMENTS

.1 Perform survey work required to layout construction.

.2 Set grades and layout work in detail from control points established by Departmental Representative.

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

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

.5 Stake slopes and berms.

.6 Establish pipe invert elevations.

1.5 EXISTING SERVICES

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

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

1.6 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.

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

1.7 RECORDS

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

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

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

1.8 SUBMITTALS

.1 Submit name and address of Surveyor to Departmental Representative.

.2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.

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

.4 Submit as-built survey to Departmental Representative in accordance with Section 01 78 00 – Closeout Submittals.

.1 Provide in electronic form in CAD .dwg format, on CD or DVD.

1.9 SUBSURFACE CONDITIONS

.1 Promptly notify Departmental Representative in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.

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

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 others 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 or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

1.2 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.

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

1.3 EXECUTION

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

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

.3 Uncover Work to install ill-timed Work.

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

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

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

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

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

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

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

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

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

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

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

.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, unless approved by Departmental Representative.

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

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

.5 Provide on-site containers for collection of waste materials and debris. Equip containers with covers to prevent spread of waste by wind, and entry into container by unauthorized persons.

.6 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.7 Dispose of waste materials and debris off site.

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

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

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

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

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

1.2 FINAL CLEANING

.1 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 other than that caused by Departmental Representative or other Contractors.

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

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

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

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

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

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

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

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

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

.14 Remove dirt and other disfiguration from exterior surfaces.

.15 Clean and sweep roofs, gutters, areaways, and sunken wells.

.16 Sweep and wash clean paved areas.

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

.18 Clean roofs, downspouts, and drainage systems.

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

.20 Remove snow and ice from access to building.

END OF SECTION

Part 1 General

1.1 WASTE MANAGEMENT GOALS

.1 Prior to start of Work, conduct meeting with Departmental Representative to review and discuss PWGSC's Waste Management Plan and Goals.

.2 Accomplish maximum control of solid construction waste.

.3 Preserve environment and prevent pollution and environment damage.

1.2 DEFINITIONS

.1 Class III: Non-hazardous waste - construction renovation and demolition waste.

.2 Cost/Revenue Analysis Workplan (CRAW): Based on information from WRW, and intended as financial tracking tool for determining economic status of waste management practices.

.3 Inert Fill: Inert waste - exclusively asphalt and concrete.

.4 Materials Source Separation Program (MSSP): Consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

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

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

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

.8 Reuse: Repeated use of product in same form but not necessarily for same purpose. Reuse includes:

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

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

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

.10 Separate Condition: Refers to waste sorted into individual types.

.11 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.

.12 Waste Audit (WA): Detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.

.13 Waste Management Co-ordinator (WMC): Contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.

.14 Waste Reduction Workplan (WRW): Written report that addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (Schedule A).

1.3 DOCUMENTS

.1 Maintain at job site, one copy of following documents:

- .1 Waste Audit.
- .2 Waste Reduction Workplan.
- .3 Material Source Separation Plan.
- .4 Schedules A, B, and C completed for project.

1.4 SUBMITTALS

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

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

- .1 Submit 2 copies of completed Waste Audit (WA): Schedule A.
- .2 Submit 2 copies of completed Waste Reduction Workplan (WRW): Schedule B.
- .3 Submit 2 copies of Cost/Revenue Analysis Workplan (CRAW): Schedule C.
- .4 Submit 2 copies of Materials Source Separation Program (MSSP) description.

.3 Submit before final payment summary of waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form.

- .1 Failure to submit could result in hold back of final payment.
- .2 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled, co-mingled and separated off-site or disposed.
- .3 For each material reused, sold or recycled from project, include amount and destination.
- .4 For each material land filled or incinerated from project, include amount of material and identity of landfill, incinerator, or transfer station.

1.5 WASTE AUDIT (WA)

.1 Conduct WA prior to project start-up.

.2 Prepare WA: Schedule A.

.3 Record, on WA - Schedule A, extent to which materials or products used consist of recycled or reused materials or products.

1.6 WASTE REDUCTION WORKPLAN (WRW)

.1 Prepare WRW prior to project start-up.

.2 WRW should include but not limited to:

- .1 Destination of materials listed.
- .2 Deconstruction/disassembly techniques and sequencing.
- .3 Schedule for deconstruction/disassembly.
- .4 Location.
- .5 Security.
- .6 Protection.
- .7 Clear labelling of storage areas.
- .8 Details on materials handling and removal procedures.
- .9 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.

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

.4 Describe management of waste.

.5 Identify opportunities for reduction, reuse, and recycling of materials based on information acquired from WA.

.6 Post WRW or summary where workers at site are able to review content.

.7 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.

.8 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.

1.7 COST/REVENUE ANALYSIS WORKPLAN (CRAW)

.1 Prepare CRAW: Schedule C.

1.8 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

.1 Prepare MSSP and have ready for use prior to project start-up.

.2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.

.3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.

.4 Provide containers to deposit reusable and recyclable materials.

.5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.

.6 Locate separated materials in areas that minimize material damage.

.7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.

.1 Transport to approved and authorized recycling facility.

.8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition.

.1 Ship materials to site operating under Certificate of Approval.

.2 Materials must be immediately separated into required categories for reuse or recycling.

1.9 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, store and catalogue salvaged items.

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

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

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

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

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

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

.1 On-site source separation is recommended.

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

.3 Provide waybills for separated materials.

1.10 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

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

.3 Keep records of construction waste including:

.1 Number and size of bins.

.2 Waste type of each bin.

.3 Total tonnage generated.

.4 Tonnage reused or recycled.

.5 Reused or recycled waste destination.

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

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

1.11 USE OF SITE AND FACILITIES

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

.2 Provide temporary security measures approved by Departmental Representative.

1.12 SCHEDULING

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

Part 2 Products

Not used.

Part 3 Execution

3.1 APPLICATION

.1 Perform Work in compliance with WRW.

.2 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.

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

3.3 DIVERSION OF MATERIALS

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

.1 Mark containers or stockpile areas.

.2 Provide instruction on disposal practices.

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

3.4 WASTE AUDIT (WA)

.1 Schedule A - Waste Audit (WA):

(1) Material Category	(2) Material Quantity Unit	(3) Estimated Waste %	(4) Total Quantity of Waste (unit)	(5) Generation Point	(6) % Recycled	(7) % Reused
Wood and Plastics						
Off-cuts						
Warped Pallet Forms						
Plastic Packaging						
Cardboard Packaging						
Other						
Doors and Windows Material Description						
Painted Frames						
Glass						
Wood						
Metal						
Other						

3.5 WASTE REDUCTION WORKPLAN (WRW)

.1 Schedule B:

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

3.6 COST/REVENUE ANALYSIS WORKPLAN (CRAW)

.1 Schedule C - Cost/Revenue Analysis Workplan (CRAW):

(1) Material Description	(2) Total Quantity (unit)	(3) Volume (cumulative)	(4) Weight (cumulative)	(5) Disposal Cost/Credit $(+/-)	(6) Category Sub-Total $(+/-)
Wood					
Wood Stud					
Plywood					
Baseboard - Wood					
Door Trim - Wood					
Cabinet					
Doors and Windows					
Panel Regular					
Slab Regular					
Wood Laminate					
Glazing					
		(7) Cost (-) / Revenue (+)			

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Procedures for Acceptance of Work:

.1 Contractor's Inspection:

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

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

.3 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 Fire Commissioner and Utility companies: Submitted.

.5 Operation of systems: Demonstrated to designated personnel.

.6 Commissioning of mechanical systems: completed in accordance with 01 91 13 - General Commissioning (Cx) Requirements, and final Commissioning Report submitted to Departmental Representative.

.7 Work: Complete and ready for final inspection.

.4 Final Inspection:

.1 When completion tasks have been completed, 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.

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 - Project Meetings to:

.1 Verify Project requirements.

.2 Review warranty requirements.

.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 SUBMITTALS

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

.2 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, three print and three electronic final copies of operating and maintenance manuals in English.

.1 Provide electronic O & M manuals on CD or DVD.

.3 Provide spare parts, maintenance materials, and special tools of same quality and manufacture as products provided in Work.

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

1.3 MECHANICAL AND ELECTRICAL SUBMITTALS

.1 For submittals related to Mechanical work, refer to Section 21 05 01.

.2 For submittals related to Electrical work, refer to Section 26 05 00.

1.4 FORMAT

.1 Organize data as instructional manual.

.2 Binders: Vinyl, hard covered, 3 'D' ring, with spine and face pockets.

.1 When multiple binders are used, correlate data into related consistent groupings.

.3 Text: Manufacturer's printed data, or typewritten data.

1.5 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 Departmental Representative.

.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 Departmental Representative.

.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 reviewed “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 Departmental Representative’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.

1.6 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 as-built documents and samples in field office apart from documents used for construction.

.1 Provide files, racks, and secure storage.

.3 Label as-built documents and file in accordance with Section number listings in List of Contents of this Project Manual.

.1 Label each document "AS-BUILT DOCUMENTS" in neat, large, printed letters.

.4 Maintain as-built documents in clean, dry and legible condition.

.1 Do not use as-built documents for construction purposes.

.5 Keep as-built documents and samples available for inspection by Departmental Representative.

.6 Record as-built information on drawings and in designated copy of Project Manual provided by Departmental Representative.

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

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

.9 Use red felt tip marking pens for recording information.

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

.11 Ensure but do not limit recording of following information on 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.

.12 Incorporate as-built information into CAD drawings.

.13 Submit as-built drawings to Departmental Representative.

.1 Provide in electronic form as CAD .dwg format, on CD or DVD.

.14 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.

1.7 RECORD DOCUMENTS

.1 Prior to Substantial Performance of the Work, provide on CD or DVD the marked-up information from the as-built documents to a master set of drawing files provided by the Departmental Representative:

.2 Mark revised documents as "RECORD DOCUMENTS". Include all revisions.

.3 Indicate changes on the electronic set of record drawings. Provide updated record drawings in .dwg format.

.4 Submit completed record documents to Departmental Representative on CD or DVD.

1.8 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.

.1 Include regulation, control, stopping, shut-down, and emergency instructions.

.2 Include summer, winter, and any special operating instructions.

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

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

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

.8 Include sequence of operation by controls manufacturer.

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

.10 Provide installed control diagrams by controls manufacturer.

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

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

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

.14 Include test and balancing reports as specified in Section 01 91 13 - General Commissioning (Cx) Requirements.

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

1.9 MATERIALS AND FINISHES

.1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.

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

.3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

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

1.10 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; place and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Departmental Representative.

.2 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; place and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Departmental Representative.

.2 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; place and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in Maintenance Manual.

1.11 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 and freezable materials in a heated and ventilated room.

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

1.12 WARRANTIES AND BONDS

.1 Develop warranty management plan to contain information relevant to Warranties.

.2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.

.3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.

.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.

.6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:

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

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

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

.4 Verify that documents are in proper form, contain full information, and are notarized.

.5 Co-execute submittals when required.

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

.7 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

.8 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Departmental Representative.

.9 Include information contained in warranty management plan as follows:

.1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.

.2 Provide list for each warranted equipment, item, feature of construction or system indicating:

.1 Name of item.

.2 Model and serial numbers.

.3 Location where installed.

.4 Name and phone numbers of manufacturers or suppliers.

.5 Names, addresses and telephone numbers of sources of spare parts.

.6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.

.7 Cross-reference to warranty certificates as applicable.

.8 Starting point and duration of warranty period.

.9 Summary of maintenance procedures required to continue warranty in force.

.10 Cross-Reference to specific pertinent Operation and Maintenance manuals.

.11 Organization, names and phone numbers of persons to call for warranty service.

.12 Typical response time and repair time expected for various warranted equipment.

.3 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.

.4 Procedure and status of tagging of equipment covered by extended warranties.

.5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

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

.11 Written verification to follow oral instructions.

.1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.13 WARRANTY TAGS

.1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Leave date of acceptance until project is accepted for occupancy.

.4 Indicate following information on tag:

.1 Type of product/material.

.2 Model number.

.3 Serial number.

.4 Contract number.

.5 Warranty period.

.6 Inspector's signature.

.7 Construction Contractor.

END OF SECTION

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 PV of components, equipment, sub-systems, systems, and integrated systems.

.2 Acronyms:

.1 AFD - Alternate Forms of Delivery, service provider.

.2 BMM - Building Management Manual.

.3 Cx - Commissioning.

.4 EMCS - Energy Monitoring and Control Systems.

.5 O M - Operation and Maintenance.

.6 PI - Product Information.

.7 PV - Performance Verification.

.8 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

.1 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, 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 O M staff.

.2 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 interactively 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.

.3 Design Criteria: as 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 For Cx responsibilities refer to Section 01 91 31 - Commissioning (Cx) Plan.

.3 Cx to be a line item of Contractor's cost breakdown.

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

.5 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which 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 includes transfer of critical knowledge to facility operational personnel.

.6 Consultant will issue Interim Acceptance Certificate when:

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

.2 Equipment, components, systems and integrated systems have been fully commissioned and functional as per design intent within the context of the project requirements.

.3 Final O&M and Training Manual has been received, reviewed and approved by Consultant for suitability.

.4 Completion of Training session with all Operational and Maintenance staff.

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 unfunctional system, including related systems as deemed required by Consultant, 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 Consultant.

.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, systems is 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 Consultant.

.7 Have Cx schedules up-to-date.

.8 Ensure systems have been cleaned thoroughly.

.9 Complete TAB procedures on systems, submit TAB reports to Consultant for review and approval.

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

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

1.6 CONFLICTS

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

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

1.7 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Submit no later than 4 weeks after award of Contract:

.1 Name of Contractor's Cx agent.

.2 Draft Cx documentation.

.3 Preliminary Cx schedule.

.2 Request in writing to Consultant for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.

.3 Submit proposed Cx procedures to Consultant where not specified and obtain written approval at least 8 weeks prior to start of Cx.

.4 Provide additional documentation relating to Cx process required by Consultant.

1.8 COMMISSIONING DOCUMENTATION

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

.2 Consultant to review and approve Cx documentation.

.3 Provide completed and approved Cx documentation to Consultant.

1.9 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16.06 - Construction Progress 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.

1.10 COMMISSIONING MEETINGS

.1 Convene Cx meetings as required.

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

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

.4 At 60% construction completion stage. Consultant 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 Contractor, who will record and distribute minutes.

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

1.11 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.

1.12 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days notice prior to commencement.

.2 Consultant to witness of start-up and testing.

.3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

.1 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems.

.2 Integrity of warranties:

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

1.14 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 CV 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 PV: include repetition of tests after correcting deficiencies.

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

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

.4 Document required tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Consultant. 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 Consultant.

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

.3 If evaluation report concludes that major damage has occurred, Consultant 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.

1.15 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 Consultant 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 PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.

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

1.17 START OF COMMISSIONING

.1 Notify Consultant 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 Consultant for review and approval:

.1 Complete list of instruments proposed to be used.

.2 Listed data including, serial number, current calibration certificate, calibration date, 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, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

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

.3 Follow equipment manufacturer's operating instructions.

1.20 WITNESSING COMMISSIONING

.1 Consultant 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 Consultant within 5 days of test and with Cx report.

1.22 EXTENT OF VERIFICATION

.1 Provide manpower and instrumentation to verify up to 100 % of reported results.

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

.3 Review and repeat commissioning of systems if inconsistencies found.

.4 Perform additional commissioning until results are acceptable to Consultant.

1.23 REPEAT VERIFICATIONS

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

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

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

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

1.24 SUNDRY CHECKS AND ADJUSTMENTS

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

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

1.25 DEFICIENCIES, FAULTS, DEFECTS

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

1.26 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 Consultant.

1.27 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.

1.28 TRAINING

.1 In accordance with Section 01 91 41 - Commissioning (Cx) - Training.

1.29 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

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

1.30 OCCUPANCY

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

1.31 INSTALLED INSTRUMENTATION

.1 Use instruments installed under Contract for TAB and PV if:

.1 Accuracy complies with these specifications.

1.32 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 +/- 5% of specified values.

.2 Instrument accuracy tolerances:

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

.3 Measurement tolerances during verification:

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

1.33 PERFORMANCE TESTING

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 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 Underwriters' Laboratories of Canada (ULC)

.3 CSA -Z320-11 - Building Commissioning Standard

.4 ASHRAE 202-2013 - Commissioning Process for Building and System

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 Facility user and O M personnel have been fully trained in aspects of installed systems.

.3 Optimized life cycle costs.

.4 Complete documentation relating to installed equipment and systems.

.2 Term "Cx" in this section means "Commissioning".

.3 Use this Cx Plan as master planning document for Cx:

.1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.

.2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.

.3 Sets out deliverables relating to O M, process and administration of Cx.

.4 Describes process of verification of how built works meet design requirements within the context of Project Requirements.

.5 Produces a complete functional system prior to issuance of Certificate of Occupancy.

.6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:

.1 Overview of Cx.

.2 General description of elements that make up Cx Plan.

.3 Process and methodology for successful Cx.

.4 Acronyms:

.1 Cx - Commissioning.

.2 BMM - Building Management Manual.

.3 EMCS - Energy Monitoring and Control Systems.

.4 MSDS - Material Safety Data Sheets.

.5 PI - Product Information.

.6 PV - Performance Verification.

.7 TAB - Testing, Adjusting and Balancing.

.8 WHMIS - Workplace Hazardous Materials Information System.

.5 Commissioning terms used in this Section:

.1 Bumping: short term start-up to prove ability to start and prove correct rotation.

.2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.4 DEVELOPMENT OF 100% CX PLAN

.1 Cx Plan 95% completed by the Consultant and transmited to the Contractor.

.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, suppliers' requirements.

.6 Project construction team's and Cx team's requirements.

.3 Submit 100% completed Cx Plan to Consultant and obtain 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 Consultant 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 Consultant 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: confirm Cx processes are developed in the CX Plan by Consultant to deliver a fully operational project.
- .3 Consultant is responsible for:
  - .1 Work closely with members of Cx Team.
  - .2 Monitoring of Cx activities, training, development of Cx documentation.
  - .3 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
  - .4 Organizing Cx.
  - .5 Monitoring operations Cx activities.
  - .6 Witnessing, certifying accuracy of reported results.
  - .7 Witnessing and certifying TAB and other tests.
  - .8 Developing BMM.
  - .9 Ensuring implementation of final Cx Plan.
  - .10 Performing verification of performance of installed systems and equipment.
  - .11 Implementation of Training Plan.
- .4 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with contract documents, including:
  - .1 Testing.
  - .2 TAB.
  - .3 Performance of Cx activities.
  - .4 Delivery of training and Cx documentation.
  - .5 Assigning one person as point of contact with 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 performance verification.

.3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.

.4 Specialist Cx agency:

.1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.

.5 Ensure that Cx participant:

.1 Could complete work within scheduled time frame.

.2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O M personnel, including:

.1 Modify ventilation rates to meet changes in off-gassing.

.2 Changes to heating or cooling loads beyond scope of EMCS.

.3 Changes to EMCS control strategies beyond level of training provided to O M personnel.

.4 Redistribution of electrical services.

.5 Modifications of fire alarm systems.

.6 Modifications to voice communications systems.

.6 Provide names of participants to Consultant 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:

.2 Commission mechanical systems and associated equipment:

.1 HVAC and exhaust systems:

.1 Ceiling fans

.2 HRV's
.3 Furnaces
.4 Hot water tanks.
.5 Exhaust fans.
.6 Plumbing Fixtures
.7 Sump Pumps

.3 Commission electrical systems and equipment:

.1 Electrical Panels
.2 Receptacles
.3 Lighting systems:
.1 Lighting equipment.
.2 Emergency lighting systems, including battery packs.
.3 Exit signs.

1.9 DELIVERABLES RELATING TO O M PERSPECTIVES

.1 General requirements:

.1 Compile English documentation.
.2 Documentation to be computer-compatible format ready for inputting for data management.

.2 Provide deliverables:

.1 Warranties.
.2 Project record documentation.
.3 Inventory of spare parts, special tools and maintenance materials.
.4 Maintenance Management System (MMS) identification system used.
.5 WHMIS information.
.6 MSDS data sheets.
.7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.
.8 As-Built drawings from all disciplines
.9 Preventative maintenance program
.10 Standard operating procedures

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 performance verification tests.

.3 Deliverables: provide:

.1 Cx Specifications.

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

.3 Completed component verification (CV) report forms.

.4 Completed performance verification (PV) report forms.

.5 Results of Performance Verification Tests and Inspections.

.6 Description of Cx activities and documentation.

.7 Training Plans.

.8 Cx Reports.

.9 Prescribed activities during warranty period.

.10 Commissioning issues log

.11 Preventative maintenance program

.12 Standard operating procedures

.13 As-built drawings

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 Consultant satisfaction.

.2 Consultant to use approved check lists.

.2 Pre-Cx activities - MECHANICAL:

.1 HVAC equipment and systems:

.1 "Bump" each item of equipment in its "stand-alone" mode.

.2 At this time, complete pre-start-up checks and complete relevant documentation.

.3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.

.4 Perform TAB on systems. TAB reports to be approved by Consultant.

.2 EMCS:

.1 Demonstrate performance of systems, to be witnessed by Consultant prior to start of 30 day Final Acceptance Test period.

.2 Only additional testing after foregoing have been successfully completed to be "Off-Season Tests".

.3 Pre-Cx activities - ELECTRICAL:

.1 Lighting systems.

.2 Fire alarm systems: test after other safety and security systems are completed. Testing to include a complete verification in accordance with ULC requirements. Consultant has witnessed and certified report, demonstrate devices and zones to Consultant.

1.12 START-UP

.1 Start up components, equipment and systems.

.2 Performance Verification (PV):

.1 Approved Cx Agent to perform.

.1 Repeat when necessary until results are acceptable to Consultant.

.2 Consultant to witness and certify reported results using approved PI and PV forms.

.3 Contractor to complete PV reports and provide to Consultant.

1.13 COMPONENT VERIFICATION (CV) REPORT FORMS

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms.

1.14 PERFORMANCE VERIFICATION (PV) REPORT

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms.

1.15 CX REPORTS

.1 Include completed and certified PV reports in properly formatted Cx Reports.

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

1.16 TRAINING PLANS

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

1.17 FINAL SETTINGS

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 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 COMPONENENT VERIFICATION (CV) FORMS

.1 Include the following data:

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

.2 CV forms to be complete after equipment has been installed and before start-up, to confirm that the installation is complete and according to the specification.

.3 CV report forms include those developed by Contractor records data and information taken prior to start up.

1.3 PERFORMANCE VERIFICATION (PV) 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 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.

1.4 COMMISSIONING FORMS

.1 Refer to Section 01 91 31 CX Plan, for list of system to be commissioned.

.2 Consultant will provide to contractor all required project specific commissioning forms and check sheets in electronic format complete with specification data.

.3 Revise items on the forms and/or check sheet to suit project requirements.

1.5 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

.1 Contractor shall develop appropriate verification forms and submit to Consultant for approval prior to use when additional forms are required, but are not available from Consultant.

.1 Additional commissioning forms to be in same format as sample.

1.6 COMMISSIONING FORMS

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

System: Ceiling Fan Unit Tag: F-

Manufacture: _____ Voltage: _____ Phase: _____

Model #: _____ Serial #: _____

INDICATE ACCEPTANCE
WITH A (□) MARK

ITEM		**COMMENTS**
According to Shop Drawings	( )	
Shipping Blocks & Straps Removed	( )	
Unit is Clean & Free of Debris	( )	
No Physical Damage on Unit	( )	
Unit is Level	( )	
Service Space	( )	
All Labels are Visible	( )	
All Bolts and Screws are Tight	( )	
Fans Rotate Freely	( )	
Disconnect at Unit	( )	
Unit Controls Complete	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: Electrical Panels

ITEM	INDICATE ACCEPTANCE WITH A (□) MARK	**COMMENTS**
Panels According to Shop Drawings	( )	
Circuit Breakers Installed	( )	
Lamacoid Installed	( )	
Panel Name Plate Match Specifications	( )	
Wiring Complete	( )	
Test Sheet Attached	( )	
Panelboard Directory Provided	( )	
All Units Clean & Free of Debris	( )	
No Physical Damage	( )	
All Bolts and Screws are Tight	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: Exit Sign

INDICATE ACCEPTANCE
WITH A (□) MARK

ITEM		**COMMENTS**
Exit Signs According to Shop Drawings	( )	
Test Sheet Attached	( )	
Wiring Complete	( )	
All Units Clean & Free of Debris	( )	
No Physical Damage	( )	
All Bolts and Screws are Tight	( )	
Exit Sign Operates	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: Exhaust Fan Unit Tag: EF-

Manufacture: _____ Voltage: _____ Phase: _____

Model #: _____ Serial #: _____

INDICATE ACCEPTANCE
WITH A (□) MARK

ITEM		**COMMENTS**
According to Shop Drawings	( )	
Shipping Blocks & Straps Removed	( )	
Unit is Clean & Free of Debris	( )	
No Physical Damage on Unit	( )	
Unit is Level	( )	
Service Space	( )	
All Labels are Visible	( )	
All Bolts and Screws are Tight	( )	
Vibration Isolation Complete	( )	
Flexible Duct Connectors Installed	( )	
Fans Rotate Freely	( )	
Disconnect at Unit	( )	
Unit Controls Complete	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: FU Unit Tag: FU-

Manufacture: _____ Voltage: _____ Phase: _____

Model #: _____ Serial #: _____

INDICATE ACCEPTANCE
WITH A (□) MARK

ITEM		**COMMENTS**
According to Shop Drawings	( )	
Shipping Blocks & Straps Removed	( )	
Unit is Clean & Free of Debris	( )	
No Physical Damage on Unit	( )	
Unit is Level	( )	
Service Space	( )	
All Labels are Visible	( )	
All Bolts and Screws are Tight	( )	
Vibration Isolation Complete	( )	
Flexible Duct Connectors Installed	( )	
Fans Rotate Freely	( )	
Disconnect at Unit	( )	
Unit Controls Complete	( )	
Natural Gas Piping complete	( )	
Combustion and Exhaust Piping Complete	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: HRV

Unit Tag: HRV-

Manufacture: _____ Voltage: _____ Phase: _____

Model #: _____ Serial #: _____

INDICATE ACCEPTANCE
WITH A (□) MARK

ITEM		**COMMENTS**
According to Shop Drawings	( )	
Shipping Blocks & Straps Removed	( )	
Unit is Clean & Free of Debris	( )	
No Physical Damage on Unit	( )	
Unit is Level	( )	
Service Space	( )	
All Labels are Visible	( )	
All Bolts and Screws are Tight	( )	
Vibration Isolation Complete	( )	
Flexible Duct Connectors Installed	( )	
Fans Rotate Freely	( )	
Disconnect at Unit	( )	
Unit Controls Complete	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: Hot Water Tank Unit Tag: HWT-

Manufacture: _____ Voltage: _____ Phase: _____

Model #: _____ Serial #: _____

INDICATE ACCEPTANCE
WITH A (□) MARK

ITEM		**COMMENTS**
According to Shop Drawings	( )	
Shipping Blocks & Straps Removed	( )	
Unit is Clean & Free of Debris	( )	
No Physical Damage on Unit	( )	
Unit is Level	( )	
Service Space	( )	
All Labels are Visible	( )	
All Bolts and Screws are Tight	( )	
Piping as per Drawings	( )	
Expansion Tank Installed	( )	
Pressure Relief Valve Installed	( )	
Drains Piped to Floor Drain	( )	
Gauges and Thermometers Installed	( )	
Disconnect at Unit	( )	
Unit Controls Complete	( )	
Venting Installed	( )	
Gas Piping Connected	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: Lighting

ITEM	INDICATE ACCEPTANCE WITH A (□) MARK	**COMMENTS**
Lights According to Shop Drawings	( )	
Wiring Complete	( )	
All Units Clean & Free of Debris	( )	
No Physical Damage	( )	
All Bolts and Screws are Tight	( )	
Lighting Operates	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: Plumbing Fixtures (a separate form for each fixture shall be filled out)

Manufacture: _____ Unit Tag: _____

Model: _____ Location: _____

INDICATE ACCEPTANCE
WITH A (□) MARK

ITEM		**COMMENTS**
According to Shop Drawings	( )	
Shipping Blocks & Straps Removed	( )	
Unit is Clean & Free of Debris	( )	
No Physical Damage on Unit	( )	
Unit is Level	( )	
Correct Height from Floor	( )	
Correct Distance from Walls	( )	
All Bolts and Screws are Tight	( )	
Water Connection Complete	( )	
Drain Connection Complete	( )	
Electrical Connection	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: Receptacles

INDICATE ACCEPTANCE
WITH A (□) MARK

ITEM		**COMMENTS**
Receptacles According to Shop Drawings	( )	
Wiring Complete	( )	
Lamacoid Installed	( )	
Test Sheet Attached	( )	
All Units Clean & Free of Debris	( )	
No Physical Damage	( )	
All Bolts and Screws are Tight	( )	
Receptacles Operate	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: P

Unit Tag: P-

Manufacture: _____ Voltage: _____ Phase: _____

Model #: _____ Serial #: _____

INDICATE ACCEPTANCE
WITH A (□) MARK

ITEM		**COMMENTS**
According to Shop Drawings	( )	
Shipping Blocks & Straps Removed	( )	
Unit is Clean & Free of Debris	( )	
No Physical Damage on Unit	( )	
Unit is Level	( )	
Service Space	( )	
All Labels are Visible	( )	
All Bolts and Screws are Tight	( )	
Vibration Isolation Complete	( )	
Electrical Complete	( )	
Disconnect at Unit	( )	
Unit Controls Complete	( )	
Floats installed	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: Ceiling Fan Unit Tag: F-

Manufacture: _____ Voltage: _____ Phase: _____

Model #: _____ Serial #: _____

INDICATE ACCEPTANCE
WITH A (□) MARK

ITEM		**COMMENTS**
Fan On/Off From Wall Switch	( )	
Timer switch	( )	
No Excessive Vibration	( )	
No Excessive Noise	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: Electrical Panels

INDICATE ACCEPTANCE
WITH A (□) MARK

ITEM		**COMMENTS**
Phase to Phase Megger Test Performed	( )	
Megger Readings Recorded	( )	
Phase to Neutral Megger Test Performed	( )	
Megger Readings Recorded	( )	
Phase to Phase Voltages Measured	( )	
Phase to Neutral Voltages Measured	( )	
All equipment powered	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: Exit Sign

ITEM	INDICATE ACCEPTANCE WITH A (□) MARK	COMMENTS
Verify Device is Operationa	( )	
Arrow Direction as per drawing	( )	
Turn Off Breaker, Exit Light On	( )	
Zone Relays Operational	( )	
All equipment powered	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: Exhaust Fan Unit Tag: EF-

Manufacture: _____ Voltage: _____ Phase: _____

Model #: _____ Serial #: _____

INDICATE ACCEPTANCE
WITH A (□) MARK

ITEM		**COMMENTS**
Fan On/Off From Wall Switch	( )	
Time Switch	( )	
Air Volume Meets Specification	( )	
No Excessive Vibration	( )	
No Excessive Noise	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: FU Unit Tag: FU-

Manufacture: _____ Voltage: _____ Phase: _____

Model #: _____ Serial #: _____

ITEM	INDICATE ACCEPTANCE WITH A (□) MARK	**COMMENTS**
Furnace On/Off from wall controller	( )	
Furnace meets room temperature setpoint	( )	
Room temperature setpoint	____°C	
Furnace responds to different modes from wall controller	( )	
Air Volume Meets Specification	( )	
No Excessive Vibration	( )	
No Excessive Noise	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: HRV Unit Tag: HRV-

Manufacture: _____ Voltage: _____ Phase: _____

Model #: _____ Serial #: _____

INDICATE ACCEPTANCE
WITH A (□) MARK

ITEM		**COMMENTS**
HRV On/Off from wall controller	( )	
Air Volume Meets Specification	( )	
No Excessive Vibration	( )	
No Excessive Noise	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: Hot Water Tank Unit Tag: HWT-

Manufacture: _____ Voltage: _____ Phase: _____

Model #: _____ Serial #: _____

ITEM	INDICATE ACCEPTANCE WITH A (□) MARK	**COMMENTS**
HWT On/Off From Disconnect	( )	
Typical Hot Water Demand Simulated (coordinate with Departmental Representative)	( )	
HWT Temperature	____°C	
HWT Temperature Acceptable	( )	
HWT Temperature at most remote faucet	____°C	
HWT Temperature at most remote faucet Acceptable	( )	
No Excessive Noise	( )	
No Apparent Vent Leaking	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: Lighting

ITEM	INDICATE ACCEPTANCE WITH A (□) MARK	**COMMENTS**
Lighting on/off	( )	
Lighting Switches on/off	( )	
Lighting Switches Installed Correctly	( )	
Lighting Installed Correctly	( )	
All lighting powered	( )	
Lighting Operational	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: Plumbing Fixtures (a separate form for each fixture shall be filled out)

Manufacture: _____ Unit Tag: _____

Model #: _____ Location: _____

ITEM	INDICATE ACCEPTANCE WITH A (□) MARK	**COMMENTS**
Water flows correctly	( )	
No excessive splashing	( )	
Water Drains acceptably from full sink	( )	
No Excessive Noise	( )	
Automatic Sensor Works Properly	( )	
Cold Water Temperature	____°C	
Cold Water Temperature Acceptable	( )	
Hot Water Temperature	____°C	
Hot Water Temperature Acceptable	( )	
Handles operate Smoothly	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: Receptacles

ITEM	INDICATE ACCEPTANCE WITH A (□) MARK	**COMMENTS**
Receptacle Installed Correctly	( )	
GFCI Receptacle Installed Correctly	( )	
Receptacle Polarity Verfied	( )	
Receptacle Polarity Verfied	( )	
Voltages at receptacles verified	( )	
All equipment powered	( )	
Receptacle Operational	( )	
GFCI Receptacle Operational	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

System: P Unit Tag: P-

Manufacture: _____ Voltage: _____ Phase: _____

Model #: _____ Serial #: _____

ITEM	INDICATE ACCEPTANCE WITH A (□) MARK	**COMMENTS**
Pump On/Off from float	( )	
Fill pit with water and confirm pump turns on and removes water	( )	
Fill pit with water and hold float such that pump does not start. Confirm that high water alarm activates	( )	
No leaking in crawlspace	( )	
Water splashes onto splash pad	( )	
Exterior discharge appears appropriate	( )	
No Excessive Vibration	( )	
No Excessive Noise	( )	

REMARKS

Cx Agent Company Name (print): _____

Cx Agent Name (print): _____

Cx Agent Signature: _____

Date: _____

Part 1 General

1.1 SUMMARY

.1 Section Includes:

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

1.2 TRAINEES

.1 Trainees: personnel selected for operating and maintaining this facility.

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

1.3 INSTRUCTORS

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

.1 Start-Up, operation, shut-down of equipment, components and systems.

.2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.

.3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.2 Contractor and equipment manufacturer to provide instruction on:

.1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV 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 Consultant will review and approve 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 project 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 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 O M documentation.

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-A23.1-09/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA O121-2008, Douglas Fir Plywood.

.3 CSA O151-09, Canadian Softwood Plywood.

.4 CSA O153-13, Poplar Plywood.

.5 CSA-O325-07, Construction Sheathing.

.6 CSA O437 Series-93, Standards for OSB and Waferboard.

.7 CSA-O86-14, Engineering Design in Wood.

.8 CSA S269.1-1975, Falsework for Construction Purposes.

.9 CAN/CSA-S269.3-M92, Concrete Formwork, National Standard of Canada

1.2 MEASUREMENT PROCEDURES

.1 No measurement will be made under this Section. Include costs in items of work for which concrete formwork and falsework is required.

1.3 SUBMITTALS

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

.2 Upon request, indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.

.3 Upon request, indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

Part 2 Products

2.1 MATERIALS

.1 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, and CSA-O153.

.2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.

.2 Tubular column forms: round, internally treated with release material.

.1 Spiral pattern may show in hardened concrete, except where column is designated architectural finish, where it shall not show in hardened concrete.

.3 Form ties:

.1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.

.2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.

.4 Form liner:

.1 Plywood: high density overlay.

.5 Form release agent: non-toxic, biodegradable, low VOC.

.6 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene.

.7 Falsework materials: to CSA-S269.1.

Part 3 Execution

3.1 FABRICATION AND ERECTION

.1 Fabricate and erect falsework in accordance with CSA S269.1.

.2 Refer to drawings for concrete members requiring architectural exposed finishes.

.3 Do not place shores and mud sills on frozen ground.

.4 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.5 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.

.6 Align form joints and make watertight. Keep form joints to minimum.

.7 Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.

.8 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.

.9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.10 Construct forms for architectural concrete, and place ties as indicated and as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.11 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.12 Line forms for following surfaces:

.1 Surfaces designated as architectural finish.
.2 Secure lining taut to formwork to prevent folds.
.3 Pull down lining over edges of formwork panels.
.4 Ensure lining is new and not reused material.
.5 Ensure lining is dry and free of oil when concrete is poured.
.6 Application of form release agents on formwork surface is prohibited where drainage lining is used.
.7 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.
.8 Cost of textile lining is included in price of concrete for corresponding portion of Work.

.13 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Notify Consultant 24 hours in advance prior to removing formwork.

.2 Do not remove forms and bracing until concrete has gained sufficient strength to carry its own weight, construction loads, design loads that are liable to be imposed upon it. Verify strength of concrete by compressive test results.

.3 Leave formwork in place for following minimum periods of time after placing concrete:

LOCATION	TEMPERATURE IN °C		
	21-35	15-21	10-15
Walls	2 days	3 days	4 days
Side Forms	2 days	3 days	4 days
Slabs *	7 days	7 days	14 days

* formwork below/supporting these elements shall remain in place for the minimums stated above and then replaced with shoring posts until concrete is 28 days old. Formwork can be removed and replaced with shoring posts earlier, if concrete test cylinders show a strength of 75% of the required 28-day strength.

.4 Reshore structural members where required due to design requirements or construction conditions and as required to permit progressive construction.

.5 Remove formwork progressively and in accordance with Building and Safety Code requirements and so that no shock loads or unbalanced loads are imposed on structure.

.6 Loosen forms carefully. Do not wedge pry bars, hammers, or tools against concrete surfaces.

.7 Store removed forms, for exposed concrete, so surfaces in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.

.8 Re-use formwork subject to requirements of CAN/CSA-A23.1.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-A23.1-09/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CAN/CSA-G30.18-09, Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.

.3 CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.4 CAN/CSA-G164-M92(R2003)(withdrawn), Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.

.5 CSA W186-M1990(R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A82-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

.3 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.2 SUBMITTALS

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

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.

.3 Submit shop drawings including placing of reinforcement and indicate:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

.4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.

.5 Indicate sizes, spacings and locations of chairs, spacers and hangers.

.4 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.

.1 Provide class B tension lap splices unless otherwise indicated.

Part 2 Products

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Departmental Representative.

.2 Reinforcing steel: All reinforcing steel to be CAN/CSA-G30.18M grade 400R deformed bars except column ties and beam stirrups which shall be grade 400W.

.3 Cold drawn annealed steel wire ties: to ASTM A82.

.4 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m^2.

.5 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

.6 Mechanical splices: subject to approval of Departmental Representative.

.7 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 All reinforcing is to be detailed in accordance with the latest edition of the Reinforcing Steel Institute of Canada - Manual of Standard Practice, except otherwise noted

.3 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings.

.4 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.

.5 Ship bundles of bar reinforcement clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.

.2 Upon request inform Departmental Representative of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated below and in accordance with CSA-A23.1/A23.2.

.1 Foundation walls/piers:
Exposure class: F-2 40 mm outside face 20 mm inside face.

.2 Interior Slabs-on-grade:
Exposure class: N 40mm top 20mm bottom

.2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.

.3 Ensure cover to reinforcement is maintained during concrete pour.

3.3 DOWELING PROCEDURES

.1 For bars that are indicated as being dowelled in, drill in and epoxy grout bars as follows:

.1 10M bars, 200 mm
.2 15M bars, 250 mm
.3 20M bars, 350 mm
.4 25M bars, 400 mm

.2 Use only approved adhesive to manufacturer’s instructions. Submit proposed adhesive product to Departmental Representative for the approval prior to commencing construction.

.3 Clean hole thoroughly prior to application of epoxy. Use injection or caulking gun to ensure that the epoxy fills the bottom of the hole prior to embedment of bar.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C260/C250M-10a(2016), Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C330/C330M-17a, Standard Specification for Lightweight Aggregates for Structural Concrete.

.4 ASTM C494/C494M-17, Standard Specification for Chemical Admixtures for Concrete.

.5 ASTM C1017/C1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.6 ASTM D412-16, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

.7 ASTM D624-00(2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.

.8 ASTM D1751-04(2013)e1, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.9 ASTM D1752-04a(2013), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.

.2 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.3 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A283-06(R2016), Qualification Code for Concrete Testing Laboratories.

.3 CAN/CSA-A3000-13, Cementitious Materials.

.4 International Concrete Repair Institute (ICRI)

.1 ICRI Guideline No. 310.2R-2013, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.2 SUBMITTALS

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

.2 Certificates:

.1 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Alberta.

.2 Upon request, provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Alberta.

.3 Concrete pours: submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.

.4 Concrete hauling time: submit for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

1.3 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Upon request submit to Departmental Representative, minimum 4 weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.

.1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.

.3 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for review by Departmental Representative on following items:

.1 Falsework erection.
.2 Hot weather concrete.
.3 Cold weather concrete.
.4 Curing.
.5 Finishes.
.6 Formwork removal.
.7 Joints.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.

.1 Modifications to maximum time limit must be agreed to Departmental Representative and concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by Departmental Representative.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

1.5 MATERIALS

.1 The concrete constituents shall comply with the following standards:

.1 Cement: to CAN/CSA-A3001.

.2 Blended hydraulic cement: to CAN/CSA-A3001.

.3 Water: to CSA-A23.1.

.4 Aggregates: to CAN/CSA-A23.1/A23.2.

.5 Admixtures:

.1 Air entraining admixture: to ASTM C260.

.2 Chemical admixture: to ASTM C494 and ASTM C1017. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

1.6 CONCRETE MIX REQUIREMENTS

.1 Provide the following concrete mix requirements.

Foundation walls/piers:	25 MPa min. at 28 days Class of exposure: F-2 Entrained air/category: 2 (4% to 7%) Aggregate max. 20 mm Curing type: type 2 - additional
Interior slabs-on-grade:	25 MPa min. at 28 days Class of exposure: N Entrained air/category: none Aggregate max. 20 mm Curing type: type 1 - basic

Unless indicated otherwise the contractor shall specify concrete slump appropriate with placement methods and site conditions. The contractor specified slump must be shown on the certification letter and concrete delivery ticket.

1.7 ACCESSORIES

.1 Vapour Barrier: 10 mil polyethylene film to CAN/CGSB-51.34 unless otherwise noted on Drawings.

.2 Grout: Portland Cement based non-shrink, non-metallic composition and shall meet the following requirements:

.1 The grout shall not exhibit bleeding or segregation at pumpable consistency.

.2 Compressive Strength: 25 MPa @ 1 day.

.3 Bond Strength (ASTM C882) 13 MPa @ 28 days.

.4 Positive expansion confirmed by ASTM C827.

.5 The grout shall not produce a vapour barrier.

.3 Non-premixed dry pack grout: composition of non metallic aggregate Type GU cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 25 MPa at 28 days.

.4 Pre-moulded joint fillers:

.1 Bituminous impregnated fiber board: to ASTM D1751.

.2 Sponge rubber: to ASTM D1752, Type I, flexible grade.

Part 2 Execution

2.1 PREPARATION

.1 Obtain Departmental Representative's approval before placing concrete.

.1 Provide minimum 48 hours notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.

.4 Ensure reinforcement and inserts are not disturbed during concrete placement.

.5 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.6 Protect previous Work from staining.

.7 Clean and remove stains prior to application for concrete finishes.

.8 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.9 Do not place load upon new concrete until authorized by Departmental Representative.

2.2 CONSTRUCTION

.1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.

.2 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through beams, column capitals or columns, except where indicated or approved by Departmental Representative.

.2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.

.3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Departmental Representative.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Departmental Representative before placing of concrete.

.5 Check locations and sizes of sleeves and openings shown on drawings.

.3 Anchor bolts:

.1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.

.2 Protect anchor bolt holes from water accumulations, snow and ice build-ups.

.3 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.

.4 Drainage holes and weep holes:

.1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.

.2 Install weep hole tubes and drains as indicated.

.5 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.

.6 Finishing:

.1 Finish concrete in accordance with CSA-A23.1/A23.2.

.1 Concrete tolerance in accordance with CSA-A23.1/A23.2 straightedge method Floor Flatness (FF) = 20 : Floor Levelness (FL) = 15.

.2 Use curing methods compatible with applied finish on concrete surfaces.

.7 Curing:

.1 Cure and protect concrete in accordance with requirements CSA A23.1.

.2 Unless noted otherwise the curing regime shall be consistent with the Class of Exposure. See General Notes on structural drawing for Class of Exposure.

.8 Waterstops:

.1 Install waterstops to provide continuous water seal.

.2 Do not distort or pierce waterstop in way as to hamper performance.

.3 Do not displace reinforcement when installing waterstops.

.4 Use equipment to manufacturer's requirements to field splice waterstops.

.5 Tie waterstops rigidly in place.

.6 Use only straight heat-sealed butt joints in field.

.7 Use factory welded corners and intersections unless otherwise approved by Departmental Representative.

.9 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.

.2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form joints as indicated.

.4 Install joint filler.

.5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

2.3 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by contractor for review in accordance with CSA-A23.1/A23.2.

.1 Ensure testing laboratory is certified in accordance with CSA A283.

.2 Frequency and Number of Tests:

.1 Concrete Tests:

.1 Not less than one strength test per 50 cubic metres of concrete placed and not less than one test for each class of concrete placed on any one day.

.2 Minimum 3 test cylinders required for each sample, for 3, 7 and 28 day compressive testing.

.3 Air measurements will be completed on each of the initial 3 loads of concrete per day of casting to ensure satisfactory control of the air content is established. If adequate control of air content is not established within the first 3 loads of concrete or if a test falls outside the specified limits, the testing frequency shall revert to one test per load until satisfactory control is re-established. Costs for additional testing will be the responsibility of the concrete supplier.

.3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative.

.4 Departmental Representative may request additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.5 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.

.6 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

2.4 VERIFICATION

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established in PART 2 - Products, by Departmental Representative

and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.5 DEFECTIVE CONCRETE

.1 Defective concrete: cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.

.2 Repair or replacement of defective concrete will be determined by the Departmental Representative, based on the specifications and the above guidelines.

.3 Do not patch, fill, touch-up, repair or replace exposed concrete except upon express direction of Departmental Representative for each individual use.

.4 Modify or replace concrete not conforming to lines, detail and elevations indicated on drawings.

.5 Repair or replace concrete not properly placed, resulting in excessive honeycombing and other defects in critical areas of stress.

.6 Notify Departmental Representative of proposed methods of repairing or replacing defective concrete. Methods of repairing or replacing defective concrete shall be acceptable to the Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C39/C39M-14a, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

.2 ASTM C67-14, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

.3 ASTM C192/C192M-16a, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.

.4 ASTM C270-14, Standard Specification for Mortar for Unit Masonry.

.5 ASTM C482-02 (2014), Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste.

.6 ASTM C847-14a, Standard Specification for Metal Lath.

.7 ASTM C979/C979-16, Standard Specification for Pigments for Integrally Colored Concrete.

.8 ASTM C1063-16c, Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.

.9 ASTM C1670-13, Standard Specification for Adhered Manufactured Stone Masonry Veneer (AMSMV) Units.

.10 ASTM C1780-13, Standard Practice for Installation Methods for Adhered Manufactured Stone Masonry Veneer.

.11 ASTM D226/D226M-09, Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

1.2 SUBMITTALS

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

.2 Product Data: Provide manufacturer's printed product literature, specifications and data sheets.

.3 Manufacturer's Instructions: Provide manufacturer's written installation instructions.

.4 Shop Drawings:

.1 Provide drawings stamped and signed by professional engineer registered or licensed in Alberta.

.2 Indicate stone patterns, coursing and arrangement of joints.

.5 Samples: Manufacturer’s samples of masonry units, illustrating shapes, colours, and finishes.

.1 Provide blended grouping of samples indicative of product size range and colour blend.

1.3 QUALITY ASSURANCE

.1 Mock-ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control, supplemented as follows:

.1 Construct mock-up panel of exterior stone construction 1200 x 1800 mm, to illustrate cultured stone bonding and mortar joints.

.2 Delivery, Storage, and Handling:

.1 Deliver, store and handle stone veneer masonry cladding in accordance with manufacturer's recommendations, supplemented as follows:

.1 Stack units on timbers or platforms at least 75 mm above grade.

.2 Place polyethylene or plastic film between wood and other finished surfaces of units when stored for extended periods of time.

.3 Do not use salt or calcium-chloride to remove ice from masonry surfaces.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Solid Building Stone Units: To ASTM C1670, manufactured stone veneer.

.1 Compressive Strength (ASTM C192 and ASTM C39): Minimum 12.4 MPa (1800 psi).

.2 Shear bond (ASTM C482): 345 kPa (50 psi), using Type S mortar.

.3 Freeze/Thaw (ASTM C67): 50 cycles – no disintegration and < 3% mass loss.

.4 Density (ASTM C1670): Maximum 73 kg/m^3 (15 psf).

.5 Colour blend: River rock appearance, as selected by Departmental Representative from manufacturer's standard range.

.2 Trims: Same material as manufactured stone units.

.1 Water table: Formed with sloped top surface and drip edge.

.1 Colour: As selected by Departmental Representative from manufacturer's standard range.

.2 Corner pieces: Matched to manufactured units used in field of installation.

.3 Skimmer stones: Smaller fill stones, matched to manufactured units.

2.2 ACCESSORIES

.1 Weep screeds: Galvanised steel, 0.55 mm (0.0217 inch) thick, G60 galvanising.

.2 Weather resistive barrier: To ASTM D226, No. 15 Type I asphalt saturated felt paper.

.3 Metal lath: To ASTM C847, galvanised expanded metal lath, self-furring, 1.4 kg/m^2 (2.5 lb/yd^2).

.4 Fasteners: To ASTM C1063, galvanised nails, shank diameter minimum 3 mm (1/8 inch).

.5 Joint sealants: Non-staining type, as specified in Section 07 92 00 - Joint Sealants.

2.3 MORTAR

.1 Mortar: To ASTM C270, premixed Type N, Type S or as recommended by masonry manufacturer; integral colour selected by Departmental Representative.

.2 Colour Pigment: To ASTM C979, natural oxide pigment.

.3 Water: Potable, clean and free of deleterious amounts of acids, alkalis, or organic materials.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that site conditions are ready to receive Work.

.2 Inspect materials for fit and finish prior to installation. Do not set unacceptable units.

3.2 PREPARATION

.1 Verify items provided by other sections of work are properly sized and located.

3.3 INSTALLATION

.1 Install cultured stone masonry in accordance with ASTM C1780 and manufacturer’s written instructions.

3.4 COURSING

.1 Place building stone to lines and levels indicated.

.2 Lay units in random bond.

.3 Make vertical and horizontal joints equal and of uniform thickness.

3.5 CLEANING

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

.2 Clean building stone as Work progresses. Allow mortar droppings on masonry to partially dry then remove by means of brushing with stiff fibre brush.

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

3.6 PROTECTION

.1 Protect building stone from damage resulting from subsequent construction operations.

.2 Use protection materials and methods which will not stain or damage building stone units.

.3 Remove protection materials upon Substantial Performance of Work, or when risk of damage is no longer present.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Architectural Manufacturers Association (AAMA)

.1 AAMA 2604-10, Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.

.2 American Society of Mechanical Engineers (ASME)

.1 ASME B18.6.1-1981 (R2016), Wood Screws.

.3 ASTM International

.1 ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealled) by the Hot-Dip Process.

.3 ASTM D3498-03 (2011), Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems.

.4 ASTM F1667-11ae1, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

.4 Canadian General Standards Board (CGSB)

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

.5 Canadian Standards Association (CSA)

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

.2 CAN/CSA O80-Series-08, Wood Preservation.

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

.4 CSA O121-08 (R2013), Douglas Fir Plywood.

.5 CSA O141-05 (R2014), Softwood Lumber.

.6 CSA O151-09 (R2014), Canadian Softwood Plywood.

.7 CSA O325-07 (R2012), Construction Sheathing.

.6 National Lumber Grades Authority (NLGA)

.1 NLGA Standard Grading Rules for Canadian Lumber (2014 edition).

.7 Truss Plate Institute of Canada

.1 Truss Design and Procedures for Light Metal Connected Wood Trusses.

.8 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S102-10, Test for 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 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 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta.

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, S4S, moisture content 19% (S-dry) or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Light-frame trusses in accordance with "Truss Design and Procedures for Light Metal Connected Wood Trusses", Truss Plate Institute of Canada.

.3 Framing and board lumber: in accordance with NBC.

.4 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:

.1 Use S2S or S4S materials.

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

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

.4 Post and timbers sizes: "Standard" or better grade.

.5 Plywood, OSB and wood based composite panels: CSA O325.

.6 Douglas fir plywood (DFP): CSA O121, standard construction.

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

.8 Treated wood products: To CSA O80 Series.

.9 Soffits: Western Red Cedar, tongue and groove, Select #2 Clear and better, V-joint.

.1 Size: Nominal 150 mm (6 inches) wide x 19 mm (3/4 inch) thick.

2.2 ACCESSORIES

.1 Deck railing balusters: Extruded aluminum, round, 19 mm (3/4 inch) diameter, powder-coated black.

.1 Powder coat: To AAMA 2604.

.2 Non-toxic wood treatment: Water soluble.

.1 Acceptable product: LifeTime Wood Treatment by Valhalla Wood Preservatives Ltd., ph. (250) 358-2661.

.3 Insulating sill gasket: Rubberized, moisture resistant 3 mm thick foam strip, 12 mm wide, with self-sticking adhesive on one face, lengths as required.

.4 Vapour barrier: Polyethylene film to CAN/CGSB 51.34, Type 1, 0.25 mm (10 mils) thick.

.5 Air seal: Closed cell polyurethane or polyethylene.

.6 Sealants: In accordance with Section 07 92 00 - Joint Sealants.

.7 General purpose adhesive: CSA O112.9.

.8 Subfloor adhesive: ASTM D3498.

.9 Nails, spikes and staples: ASTM F1667.

.10 Screws: ASME B18.6.1.

.11 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.12 Proprietary fasteners: Toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

.13 Joist hangers: Minimum 1 mm thick sheet steel, galvanized ZF001 coating designation.

.14 Fasteners: Hot dipped galvanized steel to ASTM A123/A123M or ASTM A653/A653M for exterior and treated wood locations, unfinished steel elsewhere.

.15 Panel edge clips ("H clips"): Galvanized steel, sized to plywood sheathing.

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 WOOD TREATMENT – STRUCTURAL CARPENTRY

.1 Use pressure-treated wood for:

- .1 Cant strips and plates on roof.
- .2 Wood on contact with the ground
- .3 Wood bearers of roof mechanical equipment.
- .4 Wood in direct contact with concrete where the concrete is in contact with the ground.
- .5 Wood furring/nailers on outside surface of exterior masonry/concrete walls.
- .6 As indicated on the construction drawings.

.2 Wood treatment:

- .1 Field: Brush apply 2 coats of preservative treatment on all wood in contact with cementitious materials, roofing and flashing. Apply preservative treatment in strict accordance with manufacturer's recommendations. Ensure site sawn lumber or panel ends or edges are similarly treated. Allow preservative to cure prior to placing members.
- .2 Plant: Preservative pressure treated material shall be supplied by a CSA certified treating plant which carriers the CSA stamp certifying that it meets the requirements of CSA O80. Lumber or Panels cut after treatment shall be double brush coated with end cut preservative.

.3 Handling and use of treated material:

- .1 Handle and use treated material in a manner that will avoid damage or field fabrication causing alteration in original treatment.
- .2 Treat in field, cuts and damages to surface of treated material with an appropriate preservative as described in CSA O80. Ensure that damaged areas such as abrasions, nail and spike holes, are thoroughly saturated with field treatment solutions as per CSA O80.

3.3 WOOD TREATMENT – NON-STRUCTURAL CARPENTRY

.1 Treat wood for non-structural exterior installation as indicated, with non-toxic wood treatment according to manufacturer's directions.

3.4 FRAMING

.1 Comply with requirements of NBC 2005 Part 9 supplemented by following paragraphs.

.2 Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

.3 Install members true to line, levels and elevations, square and plumb.

.4 Construct continuous members from pieces of longest practical length.

.5 Construct framing members full length without splices.

.6 Install spanning members with "crown-edge" up.

.7 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.

.1 Surface cutting or sanding to remove such marks is acceptable only in locations where defacement will not be evident after finishing.

.8 Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists. Frame rigidly into joists.

.9 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

.10 Frame, anchor, fasten, tie, and brace members to provide necessary strength and rigidity.

.11 Countersink bolts where necessary to provide clearance for other work.

3.5 FURRING AND BLOCKING

.1 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, audio-visual equipment mounting, electrical equipment mounting boards, architectural hardware, bathroom accessories, fire extinguisher brackets, and other work as required.

.1 Install continuous plywood blocking in stud wall locations as indicated to received shelving and other wall-mounted items.

.2 Install furring to provide rainscreen space behind siding applied horizontally.

.1 Install furring over framing studs.

.2 Align faces of furring to provide flat and even substrate for cementitious siding application.

.3 Install rough bucks, nailers, and linings to rough openings as required to provide backing for frames and other work.

.4 Install wood cants, fascia backing, nailers, curbs, and other wood supports as required and secure using galvanized steel fasteners.

.5 Install sleepers as indicated.

3.6 PANEL TYPE SUBFLOORING

.1 Install subflooring with panel end joints located on solid bearing, staggered at least 800 mm.

.2 Apply subflooring adhesive on wood framing to support panel-type subflooring. Place continuous single bead on each framing member and double bead on framing members supporting panel joints. Comply with adhesive manufacturer's installation instructions.

.3 Fasten subfloor panels using #8 floor screws spaced 150 mm on center along edges and 300 mm on center along intermediate supports.

.1 Drywall screws are not permitted for subfloor installation.

3.7 ROOF SHEATHING

.1 Confirm roof substrate is acceptable for sheathing installation before beginning installation of plywood sheathing.

.2 Install panels with surface grain perpendicular to roof framing. Stagger end joints.

.3 Install H-clips on unsupported edges of plywood sheathing, one clip spaced evenly between roof joists.

.4 Attach plywood sheathing using wood screws, or ring-type or ardox nails.

.1 Space fasteners at maximum 150 mm (6 inches) on center at supported sheathing ends and edges.

.2 Space fasteners at maximum 300 mm (12 inches) on center at intermediate supports.

.5 Install panels with 3 mm (1/8 inch) space between panel ends and edge joints.

3.8 EQUIPMENT/ELECTRICAL MOUNTING BOARDS

.1 Equipment/Electrical mounting board:

.1 Douglas Fir plywood, good one side.

.2 Size: 1220 x 2440 mm x 19 mm (48 x 96 x ¾ inch).

.3 Finish: Intumescent paint finish, refer to Section 09 91 00 – Painting; white or to match wall colour unless otherwise specified; finish on all six surfaces prior to installation to ensure proper sealing.

.4 Fastening: Exposed stainless steel fasteners, at 400 mm (16 inches) o.c. unless otherwise specified.

3.9 CLEANING

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

.2 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.

.4 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 rough carpentry installation.

3.11 SCHEDULES

.1 Roof sheathing:

.1 Plywood, DFP or CSP sheathing 13 mm thick.

.2 Exterior wall sheathing:

.1 Plywood, DFP or CSP sheathing 13 mm thick.

.3 Subflooring:

.1 Plywood, DFP or CSP sheathing 19 mm thick.

.4 Electrical equipment mounting boards:

.1 Plywood, DFP or CSP 19 mm thick.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
- .1 CSA O80, Wood Preservation.
- .2 CAN/CSA-O86, Engineering Design in Wood.
- .3 CAN/CSA-O141, Softwood Lumber.
- .4 CSA S307, Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings.
- .5 CSA S347, Method of Test for Evaluation of Truss Plates Used in Lumber Joints.
- .6 CSA W47.1, Certification of Companies for Fusion Welding of Steel.

.2 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.3 National Lumber Grades Authority (NLGA)
- .1 NLGA-2014, Standard Grading Rules for Canadian Lumber.

.4 National Research Council (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC)
- .1 CCMC-2002, Registry of Product Evaluations.

.5 Truss Plate Institute of Canada (TPIC)
- .1 TPIC - 2014, Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses.

1.2 DESIGN REQUIREMENTS

.1 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for wood truss chords and webs in accordance with engineering properties in CAN/CSA-O86.

.2 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for truss joint designs to test engineering properties in accordance with CSA S347 and listed in CCMC Registry of Product Evaluations.

.3 Design trusses, girders, bracing, bridging, connectors, in accordance with CAN/CSA-O86.1, to safely carry the lie loads, dead loads and equipment loads as noted on the drawings and as imposed by the local conditions.

.4 Limit live load deflection to 1/360th of span.

.5 Provide camber for trusses as indicated.

1.3 QUALITY ASSURANCE

.1 Qualifications:
- .1 Upon request, fabricator for trusses to show evidence of quality control

program such as provided by regional wood truss associations, or equivalent.

.2 Execute the work of this section only by a fabricator who has adequate plant, equipment and skilled tradesmen and is known to have been responsible for satisfactory work similar to that specified during a period of at least five years.

.1 Fabricator for welded steel connections to be certified in accordance with CSA W47.1.

.3 Source Quality Control:

.1 Identify lumber by grade stamp of an agency certified by Canadian Standards Administration Boards.

1.4 SUBMITTALS

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

.2 Product Data:

.1 Upon request, submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with the general conditions of the specification, and bearing stamp of a qualified Professional Engineer registered in the province of Alberta.

.2 Indicate species, sizes and stress grade of lumber used as truss members. Show slopes, span, cambers, and spacing of trusses. Indicate connector types, thicknesses, sizes, locations and design value. Show bearing details including anchorage to beams.

.3 Indicate arrangement of webs for ducts, point loads, etc.

.4 Show location of lateral bracing for compression members.

.5 See General Notes on Structural Drawings for additional requirements.

.4 Design Calculations:

.1 Upon request, submit stress diagrams indicating design loads on each truss member, special loads, allowable stress increase and deflection.

.2 Upon request, submit print-out of computer design with all necessary user manual documents so as to enable review of design.

.5 <u>Truss Supplier shall include in contract price allowance for final inspection and a letter sealed by a professional engineer certifying that trusses are constructed and</u>

erected as per truss supplier's design assumption s and installation requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Storage and Protection:

.1 Store trusses on job site in accordance with manufacturer's instructions. Provide bearing supports and bracings. Prevent bending, warping and overturning of trusses.

Part 2 Products

2.1 MATERIALS

.1 Lumber with maximum moisture content of 19 % at time of fabrication and to following standards:

.1 CAN/CSA-O141.

.2 NLGA (National Lumber Grading Association), Standard Grading Rules for Canadian Lumber.

.2 Fastenings: to CAN/CSA-O86.

2.2 FABRICATION

.1 Fabricate wood trusses in accordance with reviewed shop drawings.

.2 Cut truss members to accurate length, angle and size to assure tight joints for finished trusses.

.3 Assemble truss members in design configuration by securing tightly in jigs or with clamps.

.4 Provide for design camber when positioning truss members.

.5 Connect members using metal or plywood gussets or metal connector plates.

Part 3 Execution

3.1 MANUFACTURER'S INSTUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 EXAMINATION

.1 Verify before delivery of materials on site, that work to receive wood trusses is located correctly at proper levels.

3.3 ERECTION

.1 Erect wood trusses in accordance with reviewed shop drawings.
.2 Handling, installation, erection, bracing and lifting in accordance with manufacturers instructions.
.3 Make adequate provisions for handling and erection stresses.
.4 Exercise care to prevent out-of-plane bending of trusses.
.5 Install temporary horizontal and cross bracing to hold trusses plumb and in safe condition until permanent bracing and decking are installed.
.6 Install permanent bracing in accordance with reviewed shop drawings, prior to application of loads to trusses.
.7 Do not cut or remove any truss material without approval of Departmental Representative.
.8 Trusses with loose connector plates are not acceptable.

3.4 CLEANING

.1 Remove surplus materials, excess materials, rubbish, tools and equipment on completion of installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI A208.1-09, Particleboard.

.2 ANSI A208.2-09, Medium Density Fiberboard (MDF) for Interior Applications.

.2 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)

.1 Architectural Woodwork Standards, 2nd Edition, 2014.

.3 Builders Hardware Manufacturers Association (BHMA)

.1 ANSI/BHMA A156.9-2015, Cabinet Hardware.

.2 ANSI/BHMA A156.11-2014, Cabinet Locks.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 71.20-M88, Adhesive, Contact, Brushable.

.5 Canadian Standards Association (CSA)

.1 CSA B111-74 (R2003), Wire Nails, Spikes and Staples.

.2 CSA O112.10-08 (R2013), Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).

.3 CSA O121-08 (R2013), Douglas Fir Plywood.

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

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

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.7 National Electrical Manufacturers Association (NEMA)

.1 ANSI/NEMA LD3-2005, High-Pressure Decorative Laminates (HPDL).

.8 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber, 2014.

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 and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS for products used in the project.

.3 Shop Drawings:

.1 Indicate details of construction, profiles, jointing, fastening and other related details.

.1 Scales: profiles full size, details half full size.

.2 Indicate materials, thicknesses, finishes and hardware.

.3 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 manufacturer’s samples of high-pressure decorative laminate for pattern and colour selection.

.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 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.

.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 19% 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 Machine stress-rated lumber is acceptable for all purposes.

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

.1 Plywood resin to contain no added urea-formaldehyde.

.4 Particleboard core: To ANSI A208.1, Grade M2 or better.

.1 Thickness swelling: Maximum 5.5%.

.2 Modulus of rupture: Minimum 13.0 N/mm^2 (1885 psi).

.5 MDF (medium density fibreboard) core: 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.

.6 Moisture-resistant MDF: To ANSI A208.2, Grade 155 MR50.

.7 High pressure decorative laminate (HPDL) for horizontal surfaces: To NEMA LD3, Horizontal Grade Standard (HGS), 1.2 ± 0.12 mm thick; colours and patterns as selected by Departmental Representative.

.8 HPDL for vertical surfaces: To NEMA LD3, Vertical Grade Standard (VGS), 0.7 mm ± 0.10 mm thick, colours and patterns as selected by Departmental Representative.

.9 HPDL for postforming work: To NEMA LD3, Horizontal Grade Postforming (HGP), 1.0 ± 0.12 mm thick, colours and patterns as selected by Departmental Representative.

.10 Laminate liner sheet: Grade CLS, 0.5 ± 0.10 mm thick, white colour.

.11 Laminate backing sheet: Grade BKL, minimum 0.5 mm thickness.

.12 Laminate adhesive: Contact adhesive to CAN/CGSB 71.20.

.13 Nails and staples: To CSA B111.

.14 Wood screws: Stainless steel, type and size to suit application.

.15 Splines: Metal.

.16 Sealant: In accordance with Section 07 92 00 - Joint Sealants.

2.2 HARDWARE

.1 General:

.1 Hardware: ANSI/BHMA A156.9.

.2 Finish: Brushed nickel or stainless steel, unless otherwise specified.

.2 Hinges: European style hinges, minimum 110º opening.

.3 Pulls: Metal, contemporary closed end bar pull.

.1 Mounting: 128 mm center-to-center screw attachment.

.2 Overall dimension: 170 mm long; 40 mm projection from mounting surface.

.3 Confirm proposed product with Departmental Representative.

.4 Catches: Type I – 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 coated steel, 30 kg (66 lb) load capacity, soft closing.

.7 Cabinet Locks: ANSI/BHMA A156.11, Grade 1; keyed cylinder, two keys per lock, master keyed, steel with satin finish; complete with strike.

.1 Body: Die cast zinc.

.2 Cylinder: Solid brass, pin tumbler.

.3 Coordinate keying with Departmental Representative.

2.3 MANUFACTURED UNITS

.1 All work to AWMAC Custom grade.

.2 Core: Particleboard or MDF.

.3 Casework:

.1 Construction type: Frameless.

.2 Cabinet and door interface: Flush overlay.

.3 Exposed surfaces: HPDL.

.4 Exposed interior surfaces: HPDL, to match exposed surfaces.

.5 Semi-exposed surfaces: HPDL, to match exposed surfaces.

.6 Edgeband: 3 mm PVC, colour as selected by Departmental Representative.

.1 Adjustable shelves: Apply edgeband to all four sides.

.7 Ladder base: Canadian softwood plywood, 19 mm thick.

.1 Kitchenette: Mount 6 mm moisture-resistant MDF to front face of ladder base, HPDL finish.

.8 Toe kick: HPDL.

.4 Doors/drawers:

.1 Fronts: HPDL.

.2 Semi-exposed surfaces: HPDL.

.3 Concealed surfaces: Melamine.

.4 Edgeband: 3 mm PVC, colour as selected by Departmental Representative.

.5 Laminate countertops:

.1 Horizontal surfaces: HPDL.

.2 Front edges: 3 mm PVC, colour as selected by Departmental Representative.

2.4 FABRICATION

.1 Set nails and countersink screws apply 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 size 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 laminate 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 2400 mm. Keep joints 600 mm from sink cut-outs.

.9 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20°. Do not mitre laminate edges.

.10 Apply laminate backing sheet to reverse side of core of laminate work.

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 Quality Standards of AWMAC.

.2 Install prefinished 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 laminate counter back splash and adjacent wall finish, apply small bead of sealant in accordance with Section 07 92 00 - Joint Sealants.

.7 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.

.8 Fit hardware accurately and securely in accordance with manufacturer's written instructions.

3.3 CLEANING

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

.2 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 Clean millwork outside surfaces, and inside 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 Canadian Standards Association (CSA)

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

.2 National Lumber Grading Authority (NLGA)

.1 NLGA Standard Grading Rules for Canadian Lumber 2014.

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 paneling; include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

.1 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, and related work.

.4 Samples:

.1 Submit duplicate samples of wood panelling, sized 150 mm long x full width, in profile specified.

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 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wood from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Lumber paneling: to NLGA Standard Grading Rules for Canadian Lumber.

.1 Shiplap paneling: Fir or pine, #2 Grade or better, WWPA shiplap ½ lap pattern, 150 mm (6 inch) nominal width, 25 mm (1 inch) nominal thickness.

.2 Fasteners: Nails to CSA B111, stainless steel, sized as required, spiral or ring thread type with textured head.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that conditions of substrate are acceptable 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 Fasten wood paneling in straight, aligned lengths to framing at 600 mm on centre.

.2 Install paneling level and straight.

.3 Stagger butt joints minimum 800 mm and distribute evenly over wall faces.

.4 Cut butt joints at 45 degrees.

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 wood paneling installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C167-09, Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.

.2 ASTM C518-10, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.3 ASTM C1104/C1104M-13, Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.

.4 ASTM C1338-08, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.

.5 ASTM D1621-10, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

.6 ASTM D1622/D1622M-14, Standard Test Method for Apparent Density of Rigid Cellular Plastics.

.7 ASTM D1623-09, Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.

.8 ASTM D2842-12, Standard Test Method for Water Absorption of Rigid Cellular Plastics.

.9 ASTM D6226-10, Standard Test Method for Open Cell Content of Rigid Cellular Plastics.

.10 ASTM E96/E96M-05, Standard Test Methods for Water Vapour Transmission of Materials.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S102-10, Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC S107-10, Methods of Fire Tests of Roof Coverings.

.3 CAN/ULC S114-05, Test for Determination of Non-Combustibility in Building Materials.

.4 CAN/ULC S129-06, Standard Method of Test for Smoulder Resistance of Insulation (Basket Method).

.5 CAN/ULC S604-M91, Standard for Factory Built Type A Chimneys.

.6 CAN/ULC S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.

.7 CAN/ULC S702-09, Standard for Thermal Insulation, Mineral Fibre, for Buildings.

.8 CAN/ULC 705.1-01, Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Material – Specification.

.9 CAN/ULC S705.2-05, Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Application.

.10 CAN/ULC S770-09, Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.

.3 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 VOC's insulation products and adhesives.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.4 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 Spray Foam:

.1 Conform to applicable code for flame and smoke requirements.

.2 CAN/ULC S107: Class A Fire Hazard Classification.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials in manufacturer's original containers clearly labeled with manufacturer's name, product identification, safety information, net weight of contents 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.

.4 Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

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 BATT INSULATION

.1 Batt insulation: To CAN/ULC S702, Type 1; semi-rigid mineral wool batt insulation.

- .1 Non-combustibility (CAN/ULC S114): Pass.
- .2 Surface burning characteristics (CAN/ULC S102):
  - .1 Flame spread: 0.
  - .2 Smoke developed: 0.
- .3 Density (ASTM C167): 32 kg/m^3.
- .4 Thermal resistance minimums (ASTM C518):
  - .1 R14 at 89 mm (3-1/2 inch) thickness.
  - .2 R22 at 140 mm (5-1/2 inch) thickness.

2.2 SPRAY FOAM INSULATION

.1 Polyurethane foam insulation: To CAN/ULC S705.1, two-component spray applied polyurethane, medium density, closed cell foam.

- .1 Density (ASTM D1622): Minimum 30 kg/m^3.
- .2 Long term thermal resistance (CAN/ULC S770): R11.5 @ 50 mm (RSI 2.0 @ 50 mm).
- .3 Water vapour permeance at 50 mm (ASTM E96): Maximum 60 ng/Pa.s.m^2.
- .4 Water absorption percentage by volume (ASTM D2842): Maximum 2.0%.
- .5 Compressive strength (ASTM D1621): Minimum 150 kPa.
- .6 Tensile strength (ASTM D1623): Minimum 200 kPa.
- .7 Fungal resistance (ASTM C1338): No fungal growth.
- .8 Surface burning characteristics (CAN/ULC S102):
  - .1 Flame spread index: Maximum 200.
  - .2 Smoke developed index: Maximum 450.
- .9 Open cell content by volume (ASTM D6226): Maximum 4%.

2.3 RIGID INSULATION

.1 Extruded polystyrene (XPS): To CAN/ULC S701, Type 4, closed cell rigid board.

- .1 Compressive strength (ASTM D1621): Minimum 210 kPa.
- .2 Thermal resistance (ASTM C518): RSI 0.88/25 mm.
- .3 Thickness: As indicated on Drawings.
- .4 Edges: Shiplap.

2.4 ACCESSORIES

.1 Insulation fasteners: Screw and plate style.

.1 Nails: Steel, spiral, galvanised, length sufficient to penetrate substrate 25 mm (1 inch).

.2 Plates: Polypropylene or galvanized steel, minimum 44 mm diameter, low profile.

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, and minimum 50 mm from sidewalls of CAN/ULC S604 type A chimneys.

.5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.6 Offset both vertical and horizontal joints in multiple layer applications.

.7 Do not enclose insulation until it has been 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 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 PREPARATION

.1 Spray foam insulation: Mask and protect adjacent surfaces from over-spray or dusting.

3.5 BATT INSULATION INSTALLATION

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.3 Do not compress insulation excessively to fit voids.

.4 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

3.6 SPRAY APPLIED FOAM INSTALLATION

.1 Install polyurethane foam to CAN/ULC S705.2.

.2 Do not apply spray foam to wet or damp substrate.

.3 Apply by spray method to uniform monolithic density without voids.

.4 Apply to depth indicated on Drawings.

.5 Apply foam to maximum 50 mm thickness per pass. Allow for cooling between application passes, to manufacturer’s recommendations.

3.7 RIGID INSULATION INSTALLATION

.1 Install polystyrene insulation boards with insulation clips and disk, fit boards tight.

.2 Attach with nails in spacing and quantities recommended by rigid insulation manufacturer.

3.8 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

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.

.2 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC S102-10, Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 SUBMITTALS

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

.2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).

1.3 MOCK-UPS

.1 Construct mock-up of sheet vapour barrier installation including one lap joint, one inside corner and at one electrical box. Mock-up may be part of finished work.

.2 Mock-up will be used to judge workmanship, substrate preparation, and material application.

.3 Allow two working days for inspection of mock-up by Departmental Representative before proceeding with vapour barrier work.

.4 When accepted, mock-up will demonstrate minimum standard of quality required for this work.

1.4 DELIVERY, STORAGE AND HANDLING

.1 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 SHEET VAPOUR BARRIER

.1 Polyethylene film: To CAN/CGSB-51.34, 0.15 mm (6 mil) thick.

.1 Flame spread rating: Maximum 150 to CAN/ULC S102.

2.2 ACCESSORIES

.1 Joint sealing tape: Air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.

.2 Sealant: Compatible with vapour retarder materials, recommended by vapour retarder manufacturer and to Section 07 92 00 - Joint Sealants.

.3 Staples: Minimum 6 mm leg.

.4 Moulded box vapour barrier: Factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Ensure services are installed and inspected prior to installation of retarder.

.2 Install sheet vapour retarder on warm side of exterior wall assemblies to form continuous retarder.

.3 Use sheets of largest practical size to minimize joints.

.4 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.2 EXTERIOR SURFACE OPENINGS

.1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

3.3 PERIMETER SEALS

.1 Seal perimeter of sheet vapour barrier as follows:

.1 Apply continuous bead of sealant to substrate at perimeter of sheets.

.2 Lap sheet over sealant and press into sealant bead.

.3 Install staples through lapped sheets at sealant bead into wood substrate.

.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.4 LAP JOINT SEALS

.1 Seal lap joints of sheet vapour barrier as follows:

.1 Attach first sheet to substrate.

.2 Apply continuous bead of sealant over solid backing at joint.

.3 Lap adjoining sheet minimum 150 mm and press into sealant bead.

.4 Install staples through lapped sheets at sealant bead into wood substrate.

.5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.5 ELECTRICAL BOXES

.1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:

.1 Install moulded box vapour barrier.

.2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

3.6 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 REFERENCES

.1 American Association of Textile Chemists and Colorists (AATCC)

.1 AATCC 127-2014, Water Resistance: Hydrostatic Pressure Test.

.2 ASTM International

.1 ASTM C920-14A, Standard Specification for Elastomeric Joint Sealants.

.2 ASTM D882-10, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

.3 ASTM E84-12C, Standard Test Method for Surface Burning Characteristics of Building Materials.

.4 ASTM E96/E96M-05, Water Vapor Transmission of Materials.

.5 ASTM E2178-13, Standard Test Method for Air Permeance of Building Materials.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet. Include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS Material Safety Data Sheets.

.2 Quality Assurance Submittals:

.1 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.

.2 Clean spills and leave area as it was prior to spill.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Remove waste materials.

1.5 AMBIENT CONDITIONS

.1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.

.2 Maintain temperature and humidity recommended by material manufacturers before, during, and after installation.

1.6 SEQUENCING

.1 Sequence work to permit installation of materials in conjunction with related materials and seals.

Part 2 Products

2.1 GENERAL

.1 Provide weather barrier system components from one manufacturer.

2.2 SHEET MATERIALS

.1 Weather Barrier: Spun-bonded polyolefin, non-woven, non-perforated, with vertically-grooved surface.

- .1 Air Penetration (ASTM E2178): Maximum 0.004 cfm/ft^2 at 1.57 psf.
- .2 Water Vapour Transmission (ASTM E96 Method A): 50 perms.
- .3 Water Penetration Resistance (AATCC 127): 210 cm.
- .4 Tensile Strength (ASTM D882, Method A): 30/30 lbs/inch.
- .5 Surface Burning Characteristics (ASTM E84): Class A.
  - .1 Flame Spread: 5.
  - .2 Smoke Development: 25.

.2 Through-wall flashing: Same material as weather barrier, pre-formed for corners and end dams.

.3 Fasteners for weather barrier: Plastic-capped staples, screws, or nails; corrosion resistant.

.4 Sealant: To ASTM C920, elastomeric polymer sealant to maintain weather-tight conditions, acceptable to weather barrier manufacturer.

.5 Tape: As recommended by weather barrier 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 surfaces and conditions are ready to accept work of this section.

.2 Ensure surfaces are clean, dry, sound, smooth, continuous, and in compliance with air barrier manufacturer's requirements.

.3 Report unsatisfactory conditions to Departmental Representative.

.4 Do not start work until deficiencies have been corrected.

3.3 PREPARATION

.1 Ensure substrates are clean of oil or excess dust; open joints filled; and surfaces free of large voids, spalled areas, or sharp protrusions.

.2 Ensure metal closures are free of sharp edges and burrs.

3.4 INSTALLATION

.1 Install weather barrier over substrate in accordance with manufacturer recommendations.

.2 Start weather barrier installation at a building corner, leaving 150-300 mm (6-12 inches) of weather barrier extended beyond corner to overlap.

.3 Install weather barrier horizontally, starting at the lower portion of the wall surface. Maintain weather barrier plumb and level.

.4 Apply weather barrier with grooved surface in vertical direction.

.5 Extend bottom roll edge over sill plate interface 75 mm (3 inches) minimum. Seal weather barrier with sealant or tape. Shingle weather barrier over back edge of thru-wall flashings and seal weather barrier with sealant or tape.

.6 Overlap subsequent layers minimum 150 mm (6 inches) horizontally, in a shingled fashion.

.7 Weather Barrier Attachment:

.1 Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommended fasteners, spaced 300-450 mm (12-18 inches) vertically on center along stud line, and maximum 600 mm (24 inches) on center horizontally.

.8 Seal seams of weather barrier with seam tape at vertical and horizontal overlapping seams.

.9 Seal cuts and tears as recommended by weather barrier manufacturer.

3.5 THRU-WALL FLASHING INSTALLATION

.1 Apply primer to manufacturer’s written instructions.

.2 Install preformed corners and end dams bedded in sealant in appropriate locations along wall.

.3 Starting at a corner, remove release sheet and apply membrane to primed surfaces in lengths of 2.4 m to 3.3 m (8 to 10 feet).

.4 Extend membrane through wall and leave 6 mm (1/4 inch) minimum exposed to form drip edge.

.5 Roll flashing into place. Ensure continuous and direct contact with substrate.

.6 Lap ends and overlap preformed corners 100 mm (4 inches) minimum. Seal all laps with sealant.

3.6 CLEANING

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

3.7 PROTECTION OF WORK

.1 Do not permit adjacent work to damage work of this section.

.2 Protect finished work from climatic conditions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C1186-08 (2016), Standard Specification for Flat Fiber-Cement Sheets.

.2 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act (CEPA), 1999 (R2008).

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S102-10, Standard Method of Test for 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 instructions, printed product literature and data sheets for cementitious materials; 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.

.3 Shop Drawings:

.1 Indicate dimensions, wall openings, head, jamb, sill and mullion detail, materials and finish, anchor details, compliance with design criteria and requirements of related work.

.4 Samples:

.1 Submit duplicate 300 mm x full width samples of wall panels and trim, representative of materials, profiles, finishes, and colours.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.

.2 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 products from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.4 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets (MSDS) acceptable to Labour Canada.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Design composite building panel wall to provide for thermal movement of component materials caused by ambient temperature range of -40° to 35°C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.

.2 Include expansion joints to accommodate movement in wall system and between wall system and building structure, caused by structural movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.

.3 Design members to withstand dead load and wind loads as calculated in accordance with NBC and applicable Municipal and Provincial regulations, to maximum allowable deflection of 1/180 of span.

.4 Provide for positive drainage of condensation occurring within wall construction and water entering at joints, to exterior face of wall in accordance with NRC "Rain Screen Principles".

.5 Provide minimum thermal resistance of RSI 2.97 calculated with design wind loads.

.6 Design wall system to accommodate specified erection tolerances of structure.

.7 Maintain following installation tolerances:

.1 Maximum variation from plane or location shown on approved shop drawings: 10 mm/m of length and up to 20 mm/100 m maximum.

.2 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75 mm.

2.2 MATERIALS

.1 Cementitious Board: to ASTM C1186, Type A, Grade II, engineered for climate conditions of place of installation, thickness as indicated.

.1 Burning characteristics to CAN/ULC S102:

.1 Flame spread: 0.

.2 Smoke developed: 5.

.2 Fasteners: Stainless steel, purpose made.

.3 Furring: Refer to Section 06 10 00 – Rough Carpentry.

.4 Building wrap: Refer to Section 07 27 00 – Weather Barriers.

.5 Flashing: Refer to Section 07 62 00 – Sheet Metal Flashing and Trim.

.6 Sealants: Exterior grade polyurethane joint sealant, permanently flexible, colour matched to siding.

.7 Isolation coating: Alkali resistant.

2.3 FINISH OF PANELS

.1 Colour coating: Factory finish, primed and painted.

.1 Colour: As selected by Departmental Representative.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that conditions of substrate are acceptable 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 - GENERAL

.1 Install cementitious siding and trim in accordance with manufacturer’s written installation instructions.

.2 Protect surface of metals in contact with concrete, mortar, plaster, or other cementitious surface with isolation coating.

.3 Fabricate panels to fit around openings with gaps for expansion and contraction.

.4 Install flashing behind joints, overlapping top course below joint, and extended up past top of course where joint is flashed.

.5 Stagger field joints minimum 812 mm (32 inches).

.6 Seal gaps with joint sealant.

.7 Paint touch-up: Use colour-matched paint as supplied by siding manufacturer.

.1 Apply touch-up paint to cut edges.

.2 Touch-up nicks, scrapes, and nail heads in pre-finished siding.

.3 Touch-up nails after application.

.4 Use touch-up paint sparingly. If large areas require touch-up, replace damaged area with new pre-finished siding.

3.3 INSTALLATION – LAP SIDING

.1 Starting: Install minimum 6 mm (1/4 inch) thick lath starter strip at bottom course of wall. Apply planks horizontally with minimum 32 mm (1-1/4 inches) wide laps at top. Install bottom edge of first plank overlapping starter strip.

.2 Allow minimum vertical clearance between edge of siding and other material as recommended by siding manufacturer.

.3 Align vertical joints of planks over furred-out framing members.

.4 Maintain clearance between siding and adjacent finished grade.

.5 Locate splices at least one stud cavity away from window and door openings.

3.4 INSTALLATION – VERTICAL SIDING

.1 Block framing between studs where siding horizontal joints occur.

.2 Install metal flashing and provide 6 mm (1/4 inch) gap at horizontal panel joints.

.3 Place fasteners no closer than 9.5 mm (3/8 inch) from panel edges and 50 mm (2 inches) from panel corners.

.4 Allow minimum vertical clearance between edge of siding and other material.

.5 Maintain clearance between siding and adjacent finished grade.

3.5 INSTALLATION – TRIM

.1 Install flashing around all wall openings.

.2 Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum 19 mm (3/4 inch) or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.

.3 Place fasteners minimum 19 mm (3/4 inch) and maximum 50 mm (2 inches) from side edge of trim board and minimum 25 mm (1 inch) from end. Fasten maximum 400 mm (16 inches) on center.

.4 Maintain clearance between trim and adjacent finished grade.

.5 Outside corner board: Attach trim with corrosion resistant finish nail 13 mm (1/2 inch) from edge, spaced 400 mm (16 inches) apart, weather cut each end spaced minimum 300 mm (12 inches) apart.

.6 Allow 3 mm (1/8 inch) gap at trim and siding transitions.

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: 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 cementitious siding installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Alberta Roofing Contractors Association (ARCA)

.1 ARCA Standards Manual, current edition.

.2 ASTM International

.1 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM D523-14, Standard Test Method for Specular Gloss.

.3 ASTM D822/D822M-13, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.4 ASTM D903-98(2010), Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

.5 ASTM D1970/D1970M-14, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

.6 ASTM D5601-94, Standard Test Method for Tearing Resistance of Roofing and Waterproofing Materials and Membranes.

.7 ASTM D5602/D5602M-11, Standard Test Method for Static Puncture Resistance of Roofing Membrane Specimens.

.8 ASTM E96/E96M-15, Standard Test Methods for Water Vapor Transmission of Materials.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-37.29-M89, Rubber-Asphalt Sealing Compound.

1.2 SUBMITTALS

.1 Submit in accordance with Section 01 00 50 - General Instructions.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for sheet metal roofing and underlayment; include product characteristics, performance criteria, physical size, finishes, and limitations.

.3 Shop Drawings:

.1 Submit shop drawings sealed by structural engineer licensed in Alberta.

.2 Show arrangements of sheets and joints, types and locations of fasteners, and relationship of panels to structural frame.

.3 Indicate fastening requirements of metal panels to supporting substrate.

.4 Samples:

.1 Submit duplicate 50 x 50 mm samples of sheet metal material, illustrating metal thickness and finish.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance 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 sheet metal roofing from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: To ASTM A653/A653M with minimum Z275 coating designation, commercial quality, smooth surface, prefinished,

.1 Base metal thickness 0.607 mm (24 gauge).

.2 Provide sheet metal material with factory-laminated anti-condensation felt liner on bottom side.

.3 Pre-finish steel with factory applied silicone modified polyester.

.1 Specular gloss: 30 units +/- 5 in accordance with ASTM D523.

.2 Coating thickness: Minimum 25 micrometres.

.3 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:

.1 Outdoor exposure period 1000 hours.

.2 Humidity resistance exposure period 1000 hours.

.4 Colour: As selected by Departmental Representative from manufacturer's standard range.

2.2 DECK

.1 Plywood: Refer to Section 06 10 00 – Rough Carpentry.

2.3 ACCESSORIES

.1 Trims: Same material as sheet metal roofing, pre-formed gable caps, starter trim, and ridge cap.

.2 Underlayment: Self-adhered SBS rubber modified laminated to slip-resistant woven polyethylene film on top surface, release film on bottom surface.

.1 Thickness: 1.0 mm.

.2 Maximum load (ASTM D1970): MD 11.3 kN/m; XD 15.4 kN/m.

.3 Elongation at break (ASTM D1970): MD 52%; XD 24%.

.4 Static puncture (ASTM D5602): 400 N.

.5 Peel strength (ASTM D903): 3000 N/m.

.6 Tear resistance (ASTM D5601): MD 375 N; XD 400 N.

.7 Cold bending (ASTM D1970): -30°C.

.8 Water vapour permeance (ASTM D1970): < 0.09 ng/Pa·s·m^2.

.9 Water transmission (ASTM E96): No wetness.

.10 Nail sealability (ASTM D1970): Pass.

.3 Isolation coating: Alkali resistant bituminous paint.

.4 Sealant: Asbestos-free sealant, tape or gun applied, compatible with systems materials, recommended by system manufacturer.

.5 Fasteners: To ASME B18.6.3, same material as sheet steel, corrosion-resistant, with heads finished in same colour as roof panels; pull-out resistance to approval of engineer of record; length sufficient to extend minimum 13 mm (1/2 inch) beyond underside of roof sheathing.

.1 Washers: Neoprene or EPDM.

.6 Touch-up paint: As recommended by sheet metal roofing manufacturer.

2.4 FABRICATION

.1 Form sheet metal to profile indicated.

.2 Form individual pieces in full lengths to match roof length, without transverse seams.

.3 Hem exposed edges on underside 12 mm, mitre and seal.

.4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.5 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.

.6 Protect metals against oxidization by back painting with isolation coating where indicated.

Part 3 Execution

3.1 EXAMINATION

.1 Verify conditions of substrate are acceptable for sheet metal roofing 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 Perform work in accordance with Alberta Roofing Contractors Association Standards Manual.

.2 Include underlayment to manufacturer's instructions and recommendations.

.1 Secure in place and lap joints in direction of waterflow.

.1 Horizontal laps: Minimum 75 mm (3 inches).

.2 Vertical laps: Minimum 150 mm (6 inches).

.2 Seal laps with roofing cement, EPDM, or butyl sealant.

.3 Flash roof penetrations with material matching roof panels and make watertight.

.4 Form seams in shingled fashion and make watertight.

3.3 SHEET METAL ROOFING

.1 Form pre-finished steel to profile indicated.

.2 Apply sheet metal roofing beginning at eaves, and at gable end downwind from prevailing wind. Loose lock pans to edge strips at eaves and gable rakes.

.3 Mechanically attach sheet metal panels using screws attached in spacing and quantities indicated on engineer-stamped shop drawings.

.4 Seal joints and laps with butyl sealant.

.5 Install panels flat, straight, and square.

3.4 CLEANING

.1 Progress Cleaning:

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

.2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: Remove waste materials.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by sheet metal roofing installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM D523-14, Standard Test Method for Specular Gloss.

.3 ASTM D822/D822M-13, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 37.5-M89, Cutback Asphalt Plastic Cement.

.2 CAN/CGSB 93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.

.3 Canadian Standards Association (CSA)

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

.2 CSA HA Series-M1980, Standards for Aluminum and Aluminum Alloys.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 Architectural Sheet Metal Manual, 2012.

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 for sheet metal flashing systems materials, specifications, and datasheets; and include product characteristics, performance criteria, physical size, finishes, and limitations.

.3 Samples: Submit duplicate 50 x 50 mm samples of each type of sheet metal material, illustrating finishes and colours.

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.

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: ASTM A653/A653M, 0.60 mm (24 gauge) base metal thickness, commercial quality, with G90/Z275 designation zinc coating.

.2 Aluminum sheet: Utility quality to CSA HA Series.

.1 Thickness: Minimum 0.81 mm (0.032 inch) for all items except:

.1 Continuous cleats: 1.27 mm (0.050 inch).

.2 Roof edge strips: 1.27 mm (0.050 inch).

.3 Fascias over 125 mm (5 inches) high: 1.27 mm (0.050 inch).

.3 Pre-finish sheet metal with factory applied silicone modified polyester.

.1 Specular gloss: 30 units +/- 5 in accordance with ASTM D523.

.2 Coating thickness: Minimum 25 micrometres.

.3 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:

.1 Outdoor exposure period 1000 hours.

.2 Humidity resistance exposure period 1000 hours.

.4 Colour: As selected by Departmental Representative from manufacturer's standard range.

2.2 ACCESSORIES

.1 Isolation coating: Alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB 37.5.

.3 Underlay for metal flashing: No. 15 perforated asphalt felt to CSA A123.3.

.4 Sealants: Refer also to Section 07 92 00.

.1 Sealing Tape: Polyisobutylene compound sealing tape with 100% solids and pressure sensitive release-paper backing. Provide non-toxic, non-staining permanent elastic tape.

.2 Elastomeric Sealant: Elastomeric polyurethane polymer sealant to ASTM C920, as required for watertight installation.

.3 Butyl Sealant: Single-component, solvent-release butyl rubber sealant to ASTM C1311, for use in joints with limited movement.

.4 Epoxy Seam Sealer: Aluminum seam-cementing compound, 2-part, non-corrosive, as recommended by manufacturer for exterior non-moving joints.

.5 Bituminous Coating: Cold-applied asphalt mastic, compounded for 0.4 mm (15-mil) dry film thickness per coat.

.5 Eavestrough hangers: Purpose-made for attachment of K-style gutters, aluminum, 1.5 mm (0.060 inch) minimum thickness, screw attachment, channeled or ribbed body.

.6 Eavestrough leaf guards: Aluminum, 0.43 mm thick, perforated, integral installation to eavestrough, complete with self-sealing screws with rubber gaskets.

.1 Perforations: 2.8 mm (7/64 inch) diameter.

.7 Fasteners: Same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.

.8 Washers: Same material as sheet metal, 1 mm thick with rubber packings.

.9 Touch-up paint: as recommended by prefinished material manufacturer.

2.3 FABRICATION

.1 Fabricate metal flashings and other sheet metal work as indicated.

.2 Form pieces in 2400 mm maximum lengths.

.1 Make allowance for expansion at joints.

.3 Hem exposed edges on underside 12 mm.

.1 Mitre and seal corners with sealant.

.4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.4 METAL FLASHINGS

.1 Form flashings, copings, and fascias to profiles indicated of minimum 0.60 mm thick galvanized prefinished steel.

2.5 EAVESTROUGHS AND DOWNSPOUTS

.1 Form eavestroughs and downspouts from prefinished aluminum sheet metal.

.1 Eavestroughs: K-style, 152 mm (6 inches) width.

.2 Downspouts: Rectangular, 100 x 125 mm (4 x 5 inches), corrugated.

.2 Provide integral leaf guards.

.3 Provide goosenecks, outlets, strainer baskets, and necessary fastenings.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

.3 Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

.1 Install starter and edge strips, and cleats before starting sheet metal installation.

3.3 INSTALLATION

.1 Install sheet metal work in accordance with SMACNA Architectural Sheet Metal Manual.

.2 Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

.3 Fit flashings tightly in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

.4 Lock end joints and caulk with sealant.

.5 Insert metal flashing under cap flashing to form weather tight junction.

.6 Caulk flashing at cap flashing with sealant.

.7 Install pans, where shown around items projecting through roof membrane.

3.4 EAVESTROUGHS AND DOWNSPOUTS

.1 Install eavestroughs and secure to building at 450 mm on centre, with purpose-made eavestrough hangers.

- .1 Slope eavestroughs evenly to downspouts.
- .2 Provide endcaps at gutter ends.
- .3 Seal joints watertight.

.2 Install downspouts and provide goosenecks back to wall.

- .1 Install downspouts, provide elbows and offsets, and secure downspouts to wall construction using downspout supports spaced maximum 1800 mm (6 feet) on center.
- .2 Maximum distance of downspout support from top or bottom of downspout: 600 mm (24 inches).
- .3 Provide 45° elbows at bottom of downspouts to direct water away from wall surface or foundation.
- .4 Seal joints watertight.

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.

.3 Leave work areas clean, free from grease, finger marks, and stains.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C612-10 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.2 ASTM E1966-07 (2011) - Standard Test Method for Fire-Resistive Joint Systems.

.3 ASTM E2174-14 – Standard Practice for On-Site Inspection of Installed Firestops.

.4 ASTM G21-15 - Determining Resistance of Synthetic Polymeric Materials to Fungi.

.2 Firestop Contractors International Association (FCIA)

.1 FCIA Firestop Industry Manual of Practice, 5th Edition.

.3 FM Global (FM)

.1 FM Approvals 4991 – Approval of Firestop Contractors.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 National Fire Protection Association (NFPA)

.1 NFPA 101 – Life Safety Code, 2012 Edition.

.6 UL (formerly Underwriters Laboratories)

.1 UL 1479 – Standard for Fire Tests of Through-Penetration Firestops.

.2 UL 2079 – Standard for Tests for Fire Resistance of Building Joint Systems.

.7 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S101-14 – Standard Methods of Fire Endurance Tests of Building Construction and Materials.

.2 CAN/ULC S102-10 – Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.3 CAN/ULC S115-11 - 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 noncombustible construction or have "0" annular space in buildings of combustible construction.

.1 Words "tightly fitted" should 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 PERFORMANCE REQUIREMENTS

.1 Materials, accessories, and application procedures: Listed by ULC, cUL, or tested in accordance with CAN/ULC S115 to comply with applicable building code requirements.

.2 Firestopping materials: To CAN/ULC S101, to achieve fire rating as noted on Drawings and ULC Design Number shown.

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 datasheets. Include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings:

.1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings, and method of installation.

.2 Ensure construction details accurately reflect actual job conditions.

.4 System Design Listings, including illustrations from a qualified testing and inspection agency as applicable for each firestop configuration.

.5 Quality Assurance Submittals: Submit following in accordance with Section 01 45 00 - Quality Control.

.1 Certificates: Signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Manufacturer's Instructions: Including special handling criteria, installation sequence, and cleaning procedures.

.6 Project Record Documentation: Supply documentation for each single application addressed. Identify each penetration and joint location on entire project. Provide at completion of project.

.1 Include the following for through-penetrations:

.1 Sequential location number.

.2 Project name.

.3 Installation date.

.4 Detailed description of penetration location.

.5 Tested System or Engineered Judgment Number.

.6 Type of assembly penetrated.

.7 Detailed description of size and type of penetrating item.

.8 Size of opening.

.9 Number of sides of assemblies addressed.

.10 Hour rating achieved.

.11 Installer's name.

.2 Include the following for construction joints:

.1 Sequential location number.

.2 Project name.

.3 Installation date.

.4 Detailed description of construction joint location.

.5 Tested System or Engineered Judgment Number.

.6 Type of construction joint.

.7 Width of joint.

.8 Lineal footage of joint.

.9 Number of sides of assemblies addressed.

.10 Hour rating achieved.

.11 Installer's name.

1.5 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacture of Products specified in this Section, with minimum 3 years of documented experience, and FCIA Manufacturer Membership in good standing for minimum 2 years.

.2 Contractor: Company specializing in performing the work of this section, with minimum 3 years of documented experience, and with at least one of the following qualifications:

.1 Approved in accordance with FM Standard 4991.

.2 FCIA Member in good standing.

.3 UL Approved Contractor.

.4 Licensed by the local authority having jurisdiction.

.5 Documented successful completion of at least five comparably scaled projects.

.3 Single Source Responsibility: Obtain firestop systems for each type of penetration and construction situation from a single primary firestop systems manufacturer.

.4 Regulatory Requirements:

.1 Conform to applicable code for fire resistance ratings and surface burning characteristics.

.2 Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

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 the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, and ULC or cUL labels.

.3 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.4 Replace defective or damaged materials with new.

.5 Waste Management and Disposal:

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

1.7 SITE CONDITIONS

.1 Apply materials within temperature range recommended by manufacturer.

.2 Maintain recommended temperature before, during, and for 72 hours after installation of materials.

1.8 SEQUENCING AND SCHEDULING

.1 Schedule installation of cast-in-place firestop devices after completion of floor formwork, metal form deck, or composite deck, but before placement of concrete.

.2 Schedule installation of drop-in firestop devices after placement of concrete but before installation of pipe penetration.

.3 Schedule installation of other firestopping materials after completion of penetrating item installation, but prior to covering or concealing of openings.

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 Ensure firestopping system components are fully compatible with each other, with substrates, and with items penetrating the firestopping.

.3 Mould and mildew resistance to ASTM G21: 0 (Zero).

.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 Insulation: Mineral wool fibre semi-rigid insulation to ASTM C612 – Type IVA, UL 2079, and ASTM E1966; minimum density 64 kg/m^3 (4 lbs/ft^3).

.10 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.

.11 Sealants for vertical joints: Non-sagging.

.12 Installation Accessories: Clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

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 existing conditions before starting work.

.2 Verify opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping are ready to receive the work of this Section.

.3 Proceed with installation only when unsatisfactory conditions have been corrected.

3.3 PREPARATION

.1 Ensure substrates and surfaces are clean, dry, and frost free.

.2 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.

.3 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.4 Maintain insulation around pipes and ducts penetrating fire separation, without interruption to vapour barrier.

.5 Mask and use drop cloths where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.4 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.

3.5 LABELLING

.1 Provide and install identification labels for each individual penetration with firestopping.

.1 Install labels in readily visible location, on both sides of penetrated assembly, with permanently bonding adhesive.

.2 Label to include:

.1 Warning indicating that system is firestopping installation to be left undisturbed.

.2 Installing Contractor name and contact information.

.3 System designation of testing organization.

.4 Installation date.

.5 Manufacturer.

3.6 FIELD QUALITY CONTROL

.1 Section 01 45 00: Quality Control.

.2 Inspections: Notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

3.7 CLEANING

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

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Architectural Aluminum Manufacturers Association (AAMA)

.1 AAMA 812-04 (2012), Voluntary Practice for Assessment of Single Component Aerosol Expanding Polyurethane Foams for Sealing Rough Openings of Fenestration Installations.

.2 ASTM International

.1 ASTM C719-14, Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement (Hockman Cycle).

.2 ASTM C834-05, Standard Specification for 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 C1016-14, Determination of Water Absorption of Sealant Backing (Joint Filler) Material.

.6 ASTM C1193-13, Standard Guide for Use of Sealants.

.7 ASTM C1311-02, Standard Specification for Solvent Release Sealants.

.8 ASTM C1330-02 (2013), Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

.9 ASTM D1623-09, Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.

.10 ASTM D5249-10(2016), Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints.

.11 ASTM E814-13a, Standard Test Method for Fire Tests of Penetration Firestop Systems.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.2 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.

.3 CAN/CGSB 19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

.4 CAN/CGSB 19.21-M87, Sealing and Bedding Compound, Acoustical.

.5 CAN/CGSB 19.24-M90, Multi-component, Chemical Curing Sealing Compound.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

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 joint sealants. Include product characteristics, performance criteria, physical size, finish and limitations.

.2 Manufacturer's product to describe:

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Manufacturer's Instructions: Submit instructions to include installation instructions for each product used.

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 incorporation into manual.

1.4 QUALITY ASSURANCE

.1 Compatibility: Verify sealants used are compatible with their respective joint substrates.

.2 Provide sealants with appropriate expansion and contraction properties for the joints being sealed.

.3 Perform sealant application work to ASTM C1193.

.4 Perform structural sealant application work to ASTM C1401.

.5 Perform acoustic sealant application work to ASTM C919.

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 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.

1.6 SITE CONDITIONS

.1 Ambient Conditions:

.1 Proceed with installation of joint sealants only when:

.1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4°C.

.2 Joint substrates are dry.

.3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Joint-Width Conditions:

.1 Proceed with installation of joint sealants only where joint widths are within range allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 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 by use of approved portable supply and exhaust fans.

Part 2 Products

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas that off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

.3 Where sealants are qualified with primers, use only these primers.

.4 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: Control joints in concrete floors (when no hard finish is specified), exterior joints, expansion joints, perimeter windows.

.5 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: Expansion and control joints, perimeter caulking of windows and doors.

.6 Spray foam sealant: Spray applied polyurethane, closed cell, low pressure build foam, complying with AAMA 812.

.7 Latex Sealant: To CAN/CGSB 19.17; and ASTM C834; single component, acrylic latex or siliconized acrylic latex.

.1 Typical uses: General purpose, back bedding glazing compound, window frame perimeters.

.8 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.

.9 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.

.10 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, janitor's sinks, and other wet areas.

.11 Butyl: To CGSB 19-GP-14M and ASTM C1311, single component, butyl rubber sealant.

.1 Typical uses: gutter and flashing sealing, roof vents, between base plates and slabs.

.12 Preformed compressible and non-compressible back-up materials:

.1 Polyethylene foam: Extruded closed cell round foam backer rod, to ASTM C1330 Type C.

.1 Size: oversize 30 to 50%.

.2 Neoprene or butyl rubber:

.1 Round solid rod, Shore A hardness 70.

.3 High density foam:

.1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m^3 density, or neoprene foam backer, size as recommended by manufacturer.

.4 Bond breaker tape:

.1 Polyethylene bond breaker tape that will not bond to sealant.

.13 Primer: As recommended by sealant manufacturer, where required, for adhesion of sealant to substrate.

2.2 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 substrates are acceptable for joint sealants 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 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.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime joint substrates as recommended by sealant manufacturer immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

.1 Mix materials in accordance with sealant manufacturer's instructions.

3.6 APPLICATION

.1 Sealant:

- .1 Mask edges of joint where irregular surface or sensitive joint border exists, to provide neat joint.
- .2 Apply sealant in continuous beads.
- .3 Apply sealant using gun with proper size nozzle.
- .4 Use sufficient pressure to fill voids and joints solid.
- .5 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .6 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .7 Remove excess compound promptly as work progresses and upon completion.

.2 Curing:

- .1 Cure sealants in accordance with sealant manufacturer's instructions.
- .2 Do not cover up sealants until proper curing has taken place.

3.7 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.

3.8 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by joint sealants installation.

END OF SECTION

ALPINE COTTAGE (AP):

DOOR						FRAME				Hardware Set	Keynotes
Number	Nominal Size	Type *	Material	Finish	Glass	Type *	Material	Finish	Glass		
D01AP	810 x 1980	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	1	Bedroom 01
D02AP	950 x 1980	ID 2	WD	STN	NO	-	-	-	NO	2	Laundry 02 - Sliding
D03AP	915 x 1980	ED 1	INS MTL	PTD	YES	EF 1	MTL	PTD	NO	4	West Exterior
D05AP	810 x 1980	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	3	Washroom 05
D06AP	810 x 1980	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	1	Bedroom 06
D07AP	810 x 1980	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	1	Bunk 07
D08.1AP	810 x 1980	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	1	Corridor 08
D08.2AP	810 x 1980	ED 1	INS MTL	PTD	YES	EF 1	MTL	PTD	NO	5	North Exterior
D09AP	810 x 1980	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	1	Bunk 09
D10AP	810 x 1980	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	3	Washroom 10
D11AP	810 x 1980	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	1	Bedroom 11
D13AP	915 x 1980	ED 1	INS MTL	PTD	YES	EF 2	MTL	PTD	YES	6	East Exterior - Sidelight
D13.1AP	2x (610 x 1980)	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	7	Entrance 13 Closet
D14AP	2x (810 x 1980)	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	8	Utility 14
D15AP	810 x 1980	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	3	Washroom 15
D16AP	810 x 1980	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	1	Bedroom 16
D17AP	810 x 1980	ED 1	INS MTL	PTD	YES	EF 1	MTL	PTD	NO	5	South Exterior

LEGEND

INS	Insulated	STN	Stained
MTL	Metal		
PTD	Painted		
WD	Wood with solid core	*Refer to elevations for door and frame types	

BUNKHOUSE:

DOOR						FRAME				Hardware Set	Keynotes
Number	Nominal Size	Type *	Material	Finish	Glass	Type *	Material	Finish	Glass		
D01BH	810 x 1980	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	1	Bunk 01
D02BH	810 x 1980	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	3	Washroom 02
D03BH	810 x 1980	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	3	Washroom 03
D04BH	810 x 1980	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	1	Bunk 04
D05BH	810 x 1980	ID 1	WD	STN	NO	IF 1	WD	PTD	NO	1	Bunk 05
D06BH	810 x 1980	ED 1	INS MTL	PTD	YES	EF 1	MTL	PTD	NO	5	North Exterior
D08BH	950 x 1980	ID 2	WD	STN	NO	-	-	-	NO	2	Utility 08 - Sliding
D10BH	810 x 1980	ED 1	INS MTL	PTD	YES	EF 1	MTL	PTD	NO	5	South Exterior

LEGEND

INS	Insulated	STN	Stained
MTL	Metal		
PTD	Painted		
WD	Wood with solid core	*Refer to elevations for door and frame types	

Part 1 General

1.1 REFERENCES

.1 ASTM International (ASTM)

.1 ASTM A653/A653M-08, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA)

.1 CAN/CSA A440.4-07, Window, Door, and Skylight Installation.

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

.3 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 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.2 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.

1.3 SUBMITTALS

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

.2 Shop drawings:

.1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazing, arrangement of hardware, fire ratings, and finishes.

.2 Indicate each type of frame material, core thickness, reinforcements, glazing stops, location of anchors, and exposed fastenings and finishes.

.3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver, handle, and store doors and frames at the job site in such manner as to prevent damage.

.3 Store doors and frames under cover with doors stored in a vertical position on blocking, clear of floor, and with blocking between doors to permit air circulation.

.4 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 Hot dipped galvanized steel sheet: To ASTM A653/A653M, CS Type B.

.1 Galvanizing thickness: Z120 (G40).

2.2 DOOR CORE MATERIALS

.1 Polyurethane: To CAN/ULC S704, rigid, modified polyisocyanurate, closed cell board. Density 32 kg/m^3.

2.3 ADHESIVES

.1 Polyurethane cores: Heat resistant, epoxy resin based, low viscosity, contact cement.

.2 Lock-seam doors: Fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 PRIMER

.1 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 and Weatherstripping: Specified in Section 08 71 00.

.2 Door silencers: Single stud rubber/neoprene type.

.3 Exterior top caps: Rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.4 Metallic paste filler: To manufacturer's standard.

.5 Sealant: Refer to Section 07 92 00 – Joint Sealing.

.6 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.

.7 Finish painting: Refer to Section 09 91 00 – Painting.

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 Exterior frames: 1.6 mm welded, thermally broken type construction.

.4 Blank, reinforce, drill and tap frames for mortised, templated hardware, using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.5 Protect mortised cut-outs with steel guard boxes.

.6 Prepare frame for door silencers, 3 for single door, 2 at head for double door.

.7 Manufacturer's nameplates on frames and screens are not permitted.

.8 Conceal fastenings except where exposed fastenings are indicated.

.9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.10 Insulate exterior frame components with low-pressure expanding polyurethane insulation.

2.8 FRAME ANCHORAGE

.1 Shim and anchor new doors in accordance with CAN/CSA A440.4.

.2 Provide appropriate anchorage to floor and wall construction.

.3 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.4 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.

2.9 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails, and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in 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 Exterior doors: Insulated core, steel construction.

.3 Fabricate doors with longitudinal edges lock-seamed, adhesive assisted.

.1 Seams: Visible.

.4 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.5 Prepare doors for recessed mounting of automatic door bottoms where scheduled in Section 08 71 00 – Door Hardware.

.6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.7 Reinforce doors where required, for surface mounted hardware. Provide flush PVC top caps to exterior doors.

.8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.9 Manufacturer's nameplates on doors are not permitted.

2.11 DOORS: CORE CONSTRUCTION

.1 Form face sheets for exterior doors from 1.3 mm sheet steel with polyurethane core laminated under pressure to face sheets.

2.12 THERMALLY BROKEN FRAMES

.1 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.

.1 Thermal break: Rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install doors and frames to CSDMA Installation Guide.

3.2 FRAME INSTALLATION

.1 Set frames plumb, square, level, and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continuity of air barrier and vapour retarder.

3.3 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 as follows.

.1 Hinge side: 1.0 mm.

.2 Latchside and head: 1.5 mm.

.3 Finished floor: 13 mm.

.3 Adjust operable parts for correct function.

3.4 FINISH REPAIRS

.1 Touch up, with primer, finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.5 GLAZING

.1 Install glazing for doors and frames in accordance with Section 08 80 50 - Glazing.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC)

.1 Architectural Woodwork Standards, Edition 2, 2014.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 71.19-M88, Adhesive, Contact, Sprayable.

.2 CAN/CGSB 71.20-M88, Adhesive, Contact, Brushable.

.3 Canadian Standards Association (CSA)

.1 CSA O115-M1982 (R2001), Hardwood and Decorative Plywood.

.2 CAN/CSA O132.2 Series-90 (R1998), Wood Flush Doors.

.3 CAN/CSA O132.5-M1992 (R1998), Stile and Rail Wood Doors.

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, data sheets and installation instructions. Include door core materials, thickness, construction, and veneer species.

.2 Submit WHMIS Material Safety Data Sheets. Indicate VOC content for door materials and adhesives.

.3 Shop Drawings:

.1 Indicate door types and cut-outs for glazing, sizes, core construction, transom panel construction, locations, swings, undercuts, hardware locations and preparation requirements, blocking for hardware, finishes, glass, and other pertinent data.

.4 Samples:

.1 Submit one 150 x 150 mm corner sample of each type of flush wood door.

.2 Show door construction, faces, core, and glazing detail representative of specified door types.

.3 Submit pre-finished veneer sample illustrating colour of specified door faces.

.5 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.3 QUALITY ASSURANCE

.1 Perform work to custom grade in accordance with requirements of AWMAC Architectural Woodwork Standards.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, protect, and handle products in compliance with AWMAC Architectural Woodwork Standards, and with manufacturer's recommendations.

.2 Arrange for delivery after work causing abnormal humidity has been completed.

.3 Accept doors on site in manufacturer's packaging. Inspect for damage.

.4 Storage and Protection:

.1 Protect doors from dampness.

.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.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Remove waste material in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Ensure products contain no added urea formaldehyde resins and adhesives.

2.2 WOOD FLUSH DOORS

.1 Manufacture doors to ANSI/WDMA I.S. 1a-11 Heavy Duty performance level.

.2 Solid core: To CAN/CSA O132.2, stile and rail frame, 5-ply construction.

.1 Core: Structural composite lumber.

.3 Face Panels:

.1 Faces of wood veneered doors intended for transparent finish: A - custom Grade, Fir species.

.4 Edges: Square.

.5 Adhesive: Type I (waterproof) for exterior doors.

2.3 GLAZING

.1 Glass: Refer to Section 08 80 50 – Glazing.

2.4 FABRICATION

.1 Vertical edge strips to match face veneer.

.2 Provide waterproof non-staining membrane at cut-outs on exterior doors to exclude moisture from core.

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 INSTALLATION

.1 Unwrap and protect doors in accordance with CAN/CSA O132.2 Series.

.2 Install doors and hardware in accordance with manufacturer's printed instructions and CAN/CSA O132.2 Series.

.3 Adjust hardware for correct function.

.4 Install glazing in accordance with Section 08 80 50 - Glazing.

.5 Install stops.

3.3 ADJUSTMENT

.1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

3.4 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer 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 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 12.8-97, Insulating Glass Units.

.2 CAN/CGSB 12.20-M89, Structural Design of Glass for Buildings.

.2 Canadian Standards Association (CSA)

.1 AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights.

.2 CAN/CSA A440.4-07, Window, Door, and Skylight Installation.

1.2 PERFORMANCE REQUIREMENTS

.1 Window System: To AAMA/WDMA/CSA 101/I.S.2/A440, supplemented as follows:

.1 Design windows to provide overall thermal resistance U value ≤ 1.6 W/(m^2·K).

.2 Deflection limit of framing members; L/175.

.3 Performance Class: CW.

.4 Performance Grade: Minimum 40.

.2 Provide anchorage capable of withstanding wind load design in accordance with National Building Code.

.3 Design to accommodate expansion and contraction within service temperature range of -35°C to 35°C.

.4 Allow for movement between system and perimeter framing components or substrate.

.5 Glazing: Size glass thickness and glass unit dimensions to limits in accordance with CAN/CGSB-12.20.

1.3 SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Submit manufacturer's instructions, printed product literature and data sheets for windows; include product characteristics, performance criteria, physical size, finishes, and limitations.

.3 Shop Drawings:

.1 Indicate materials and details in full size scale, showing window dimensions, elevations, sections, details, attachments to other work, and installation details.

.1 Interior trim and exterior junctions with adjacent construction.

.2 Core thicknesses of components.

.3 Type and location of exposed finishes, method of anchorage, number of anchors, supports, reinforcement, and accessories.

.4 Arrangement of reinforcing for hardware and joints.

.5 Arrangement of hardware and required clearances.

.6 Location of caulking.

.4 Samples: Submit duplicate samples of vertical-to-horizontal intersection of frame system, minimum size 200 x 200 mm, showing:

.1 Profiles, colour, glazing stop, finish.

.2 Joinery, including concealed welds.

.3 Anchorage.

.4 Expansion provisions.

.5 Flashing and drainage.

.5 Test and Evaluation Reports: Submit test reports from approved independent testing laboratories, certifying compliance with specifications, for:

.1 Air tightness.

.2 Water tightness.

.3 Wind load resistance.

.4 Condensation resistance.

.6 Certifications: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

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 cleaning and maintenance of frame finishes, for incorporation into manual.

1.5 QUALITY ASSURANCE

.1 Perform Work in accordance with AAMA/WDMA/CSA-101/I.S.2/A440.

.2 Single source supplier: All windows by same manufacturer.

1.6 DELIVERY, STORAGE, AND PROTECTION

.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 Apply temporary protective coating to finished surfaces. Remove coating after erection. Use coatings that are easily removed and residue free.

.2 Leave protective covering in place until final cleaning of building.

.3 Storage and Handling Requirements:

.1 Store materials off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect doors and frames from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Wood: Clear, Douglas Fir species, clear preservative treated, of type suitable for transparent exterior finish.

.2 Metal Cladding (Exterior Surface): Formed aluminum, factory finished, factory fit to profile of wood members and exterior exposed surfaces.

.3 Fasteners: Stainless steel.

2.2 SYSTEM DESCRIPTION

.1 Windows: Wood section frames, factory fabricated, vision glass, related flashings, anchorage and attachment devices.

.2 Configuration: Fixed, awning, and combination as indicated.

2.3 COMPONENTS

.1 Sills: Extruded aluminum, sloped for positive wash; fit under sash to project 12 mm (1/2 inch) beyond wall face; one piece full width of opening.

.2 Stools: Wood, fit under sash to project 12 mm (1/2 inch) beyond interior wall face; one piece full width of opening.

.3 Insect Screen Frame: Rolled aluminum frame of rectangular sections; fit with adjustable hardware; nominal size similar to operable glazed unit.

.4 Insect Screens: CAN/CGSB 79.1, woven aluminum or glass fibre mesh; 14/18 mesh size.

.5 Operable Sash Weather Stripping: Wool or nylon pile; permanently resilient, profiled to effect weather seal.

.6 Fasteners: Stainless steel.

2.4 GLASS AND GLAZING MATERIALS

.1 Insulated glazing units: To CAN/CGSB 12.8, double glazed, manufacturer's standard to achieve specified performance.

2.5 SEALANT MATERIALS

.1 Sealant and Backing Materials: Refer to Section 07 92 00.

2.6 HARDWARE

.1 Operator: Geared rotary handle with limit stops.

2.7 FABRICATION

.1 Fabricate framing, mullions, and sash members with mortise and tenon or doweled joints. Glue and pin joints to hairline fit, weather tight.

.2 Finger joints not permitted in units intended for transparent finish.

.3 Form sills and stools in one piece. Slope sills for wash.

.4 Form glass stops of solid wood, sloped for wash.

.5 Provide weather stop flange for perimeter of unit.

.6 Fabricate components with minimum clearances and shim spacing around perimeter of assembly yet allowing installation and dynamic movement of perimeter seal.

.7 Arrange fasteners to be concealed from view.

.8 Permit internal drainage weep holes and channels to migrate moisture to exterior. Provide internal drainage of glazing spaces to exterior through weep holes.

.9 Assemble insect screen frame, mitre and reinforced frame corners. Fit mesh taut into frame and secure. Fit frame with retainers.

.10 Weatherstrip operable units.

.11 Factory glaze window units.

2.8 FINISHES

.1 Exterior Surfaces: Aluminum, anodized black.

.2 Interior Surfaces: Site painted, transparent as specified in Section 09 91 10.

.3 Screens: Colour Black.

.4 Operators: Baked enamel.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify wall openings and adjoining air and vapour seal materials are ready to receive work of this section.

3.2 INSTALLATION

.1 Install windows to manufacturer's written instructions.

.2 Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

.3 Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

.4 Install sills and stools.

.5 Provide thermal isolation where components penetrate or disrupt building insulation.

.6 Coordinate attachment and seal of perimeter air and vapour barrier materials.

.7 Install operating hardware.

.8 Install glass to glazing method required to achieve performance criteria.

.9 Install perimeter sealant in accordance with Section 07 92 00.

3.3 ERECTION TOLERANCES

.1 Maximum Variation from Level or Plumb: 1.5 mm/m (1/16 inches every 3 ft) non-cumulative, or 3 mm/3 m (1/8 inches per 10 ft), whichever is less.

3.4 ADJUSTING

.1 Adjust hardware for smooth operation and secure weathertight closure.

3.5 CLEANING

.1 Section 01 74 11: Cleaning installed work.

.2 Remove protective material from factory finished surfaces.

.3 Wash surfaces by method recommended and acceptable to sealant and window manufacturer; rinse and wipe surfaces clean.

.4 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)

.1 ANSI A117.1-2009, Standard for Accessible and Usable Buildings.

.2 ANSI/BHMA A156.1-2013, Butts and Hinges.

.3 ANSI/BHMA A156.2-2011, Bored and Preassembled Locks and Latches.

.4 ANSI/BHMA A156.4-2013, Door Controls - Closers.

.5 ANSI/BHMA A156.5-2014, Auxiliary Locks and Associated Products.

.6 ANSI/BHMA A156.8-2010, Door Controls – Overhead Stops and Holders.

.7 ANSI/BHMA A156.14-2013, Sliding and Folding Hardware.

.8 ASNI/BHMA A156.16-2013, Auxiliary Hardware.

.9 ANSI/BHMA A156.21-2014, Thresholds.

.10 ANSI/BHMA A156.22-2012, Door Gasketing and Edge Seal Systems.

.2 Canadian Standards Association (CSA)

.1 CSA B651-12 – Accessible Design for the Built Environment.

.3 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)

.1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 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 door hardware and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.

.4 After approval samples will be returned for incorporation in Work.

.4 Hardware List:

.1 Submit contract hardware list.

.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.5 Manufacturer's Instructions: Submit manufacturer's installation instructions.

.6 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 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 Cylindrical lock: To BHMA A156.2, Series 4000, Grade 2.

.1 Latchbolt: Minimum 13 mm throw.

.2 Levers: Solid cast.

.3 Roses: Heavy wrought.

.4 Cylinders: Brass, 5-pin.

.5 Function: As scheduled.

.2 Deadbolts: To BHMA A156.5, Grade 1, medium duty deadbolt, 25 mm throw.

.3 Hinges: To BHMA A156.1, five-knuckle.

.1 Standard weight: 0.134 gauge steel.

.2 Provide hinges with non-removable pins where scheduled.

.4 Door closers: To BHMA A156.4, Grade 1, and ANSI A117.1, rack and pinion operation, cast aluminum shell, adjustable backcheck intensity.

.1 Arms: Heavy duty forged steel; standard and parallel, as scheduled.

.5 Door bottom: To ANSI/BHMA A156.22, door shoe style, extruded aluminum retainer, neoprene gasket.

.6 Sweeps: BHMA A156.22, extruded aluminum retainer, with replaceable neoprene insert, mechanically attached.

.7 Overhead stop: To BHMA A156.8, Grade 1 and 2; low-profile, concealed mounting.

.8 Floor stops: To BHMA A156.16, dome style, solid cast brass, heavy duty casting with solid pin, complete with rubber bumper.

.1 Provide with riser where scheduled.

.9 Wall stops: To BHMA A156.16; wrought brass, bronze, and stainless steel with convex rubber bumper, 63 mm diameter, 25 mm projection, concealed mounting.

.10 Threshold: To BHMA A156.21, saddle-style threshold, extruded tempered aluminum, alloy 6063-T6, fluted surface.

.11 Flush bolts: To BHMA A156.16; cast brass, corner reinforcing plate, 19 mm bolt throw, 19 mm backset.

.1 Dust proof strike: Brass; compatible with flush bolt; adjustable height, barrel 22 mm diameter x 51 mm depth.

.12 Perimeter gasketing: To BHMA A156.22, extruded tempered aluminum retainer, alloy 6063-T6; with black sponge silicone seal, heavy duty type; stainless steel fasteners.

.13 Roller latches: To BHMA A156.16, brass body and strike; with adjustable nylon roller.

.14 Barn door hardware: To BHMA A156.14, Grade 1, steel, flat track, nylon rollers, anti-rise discs, flat black finish.

.15 Back-to-back pulls: Steel, flat black finish; 38 mm (1-1/2 inch) x 4.8 mm (3/16 inch) grip area.

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 Contact Departmental Representative for Keying Strategy.

.2 Provide keys in duplicate for every lock.

.3 Provide four master keys for each master key group.

.4 Stamp keying code numbers on keys and cylinders.

Part 3 Execution

3.1 INSTALLATION

.1 Manufacturer's Instructions: Comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Supply 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 doorstop 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 SCHEDULE

Set: 1.0

3	Hinge	T2714 4-1/2" x 4"	D4	MK
1	Passage Set	F10 BRW GRW	622	SZ
1	Door Stop	441CU	BSP	RO

Set: 2.0

1	Barn Door Track and Hardware	BLD-FT01BSP Size to Suit		PE
1	Back to Back Door Pull Set	RM4820-12 BTB	Wrought Black	RO

Set: 3.0

3	Hinge	T2714 4-1/2" x 4"	D4	MK
1	Privacy Set	F40 BRW GRW	622	SZ
1	Door Stop	441CU	BSP	RO

Set: 4.0

3	Hinge	TA2714 4-1/2" x 4"	D4	MK
1	Passage Set	F10 BRW GRW	622	SZ
1	Deadbolt	B60	622	SZ
1	Conc Overhead Stop	2-X36	622	RF
1	Surface Closer	8301	693	NO
1	Threshold	172A		PE
1	Gasketing	319DS		PE
1	Door Bottom	217DPK		PE

Set: 5.0

3	Hinge	TA2314 NRP 4-1/2" x 4"	D4	MK
1	Passage Set	F10 BRW GRW	622	SZ
1	Deadbolt	B60	622	SZ
1	Surface Closer	CLP8301	693	NO
1	Threshold	172A		PE
1	Sweep	315DN		PE
1	Gasketing	2891DS		PE

Set: 6.0

3	Hinge	TA2314 NRP 4-1/2" x 4"	D4	MK
1	Handleset	FCT60 GRW BRW GRW	622	SC
1	Surface Closer	CLP8301	693	NO
1	Threshold	172A		PE
1	Sweep	315DN		PE
1	Gasketing	2891DS		PE

Set: 7.0

6	Hinge	T2714 4-1/2" x 4"	D4	MK
2	Dummy Trim	F170 BRW GRW	622	SZ
2	Roller Latch	594	BSP	RO
2	Door Stop	441CU	BSP	RO

Set: 8.0

6	Hinge	T2714 4-1/2" x 4"	D4	MK
2	Flush Bolt	557	BSP	RO
1	Dust Proof Strike	570	BSP	RO
1	Passage Set	F10 BRW GRW	622	SZ
2	Wall Stop	406	BSP	RO

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 D790-10, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

.3 ASTM D1003-13, Standard Test Method for Haze and Luminous Transmittance of Plastics.

.4 ASTM D1929-14, Standard Test Method for Determining Ignition Temperature of Plastics.

.5 ASTM D2240-05 (2010), Standard Test Method for Rubber Property - Durometer Hardness.

.6 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 12.1-2017, Safety Glazing.

.2 CAN/CGSB 12.8-97, Insulating Glass Units.

.3 Glass Association of North American (GANA)

.1 GANA Glazing Manual – current edition.

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 Show layout, profiles, and product components, including anchorage, accessories, finishes, colours, patterns.

.2 Include detailed plans, elevations, details of framing members, sealants, fasteners, anchors, thicknesses.

.4 Samples:

.1 Submit duplicate 200 x 200 mm size samples of each type of glass proposed for installation.

.5 Certificates: Submit 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 glazing for incorporation into manual.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 Replace defective or damaged materials with new.

1.5 AMBIENT CONDITIONS

.1 Ambient Requirements:

.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 Design Criteria:

.1 Ensure continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:

.1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.

.2 Size glass to withstand wind loads, dead loads and positive and negative live loads acting normal to plane of glass to design pressure of 1 kPa.

.3 Limit glass deflection to flexural limit of glass with full recovery of glazing materials.

.2 Insulating Glass Units:

.1 Insulating glass units: To CAN/CGSB 12.8, double unit, 25 mm overall thickness.

.1 Glass: to CAN/CGSB 12.1, tempered, clear.

.2 Glass thickness: 6 mm each light.

.3 Inter-cavity space thickness: with low conductivity spacers, 12 mm between inner and outer lights.

.4 Glass coating: surface number 2, low "E".

.5 Inert gas fill: Argon.

.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 Glazing clips: Manufacturer's standard type.

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 to be free of dirt and debris.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION: EXTERIOR - DRY METHOD (PREFORMED GLAZING)

.1 Manufacturer's Instructions: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Perform work in accordance with GANA Glazing Manual for glazing installation methods.

.3 Cut glazing tape or spline to length; install on glazing light. Butt-joint tape or spline and seal junctions with sealant.

.4 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.

.5 Rest glass unit on setting blocks; apply pressure against fixed stop for full continuous contact.

.6 Install removable stops without displacing glazing tape or spline. Apply pressure for full continuous contact.

.7 Trim protruding tape edge flush with stop.

3.4 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

.1 Perform work in accordance with GANA Glazing Manual and 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.

.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.

3.5 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.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 After installation, mark each light with an "X" by using removable plastic tape or paste.

.3 Repair damage to adjacent materials caused by glazing installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C475/C475M-15, 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 C645-14, Non-Structural Steel Framing Members.

.4 ASTM C754-11, Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.5 ASTM C840-13, Standard Specification for Application and Finishing of Gypsum Board.

.6 ASTM C954-11, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

.7 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.

.8 ASTM C1047-14a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.9 ASTM C1325-14, Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.

.10 ASTM C1396/C1396M-14, Standard Specification for Gypsum Wallboard.

.2 Canadian General Standards Board (CGSB)

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

.3 Gypsum Association (GA)

.1 GA-214-15, Recommended Levels of Finish for Gypsum Board, Glass Mat, and Fiber-Reinforced Gypsum Panels.

.2 GA-216-13, Application and Finishing of Gypsum Panel Products.

.4 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC S102-10, Standard Method of Fire Endurance Tests of Building Construction and Materials.

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 REGULATORY REQUIREMENTS

.1 Conform to applicable code for fire rated assemblies in conjunction with Section 09 22 16 as follows:

.1 Fire resistance classifications to CAN/ULC S102.

1.4 MOCK-UPS

.1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.

.2 Construct wall assembly, full height by 1200 mm wide, illustrating materials installation and interface.

.3 Locate where directed.

.4 Accepted mock-up may remain as part of finished work.

.5 Allow for inspection of mock-up by Departmental Representative before proceeding with gypsum wall partition Work.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Deliver materials to site in original packaging, labelled with manufacturer's name and identification.

.3 Storage and Handling Requirements:

.1 Store gypsum board assemblies materials level off ground and indoors 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 Protect prefinished aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

.6 Replace defective or damaged materials with new.

1.6 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 gypsum board: ASTM C1396/C1396M, regular and Type X, thickness as shown on Drawings, 1200 mm wide x maximum practical length, ends square cut, edges square.

.2 Cementitious Backer Board: ASTM C1325 or ANSI A118.9, high density, fibre reinforced cementitious board, thickness as shown on Drawings; maximum available size in place; smoothed edges, ends square cut.

.3 Carrying Channels: Cold rolled steel to ASTM C645, galvanized.

.4 Tie Wire: To ASTM C754.

.5 Hangers: To ASTM C754, galvanized.

.6 Steel drill screws: ASTM C1002.

.7 Sealants: In accordance with Section 07 92 00 - Joint Sealants.

.8 Polyethylene: CAN/CGSB 51.34, Type 2.

.9 Joint tape: ASTM C475, 52 mm wide fibre paper tape.

.10 Joint compound: ASTM C475, asbestos-free.

2.2 FRAMING MATERIALS

.1 Framing: As specified in Section 06 10 00 – Rough Carpentry.

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 or GA-216 except where specified otherwise.

3.3 APPLICATION

.1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical work, and mechanical work have been approved.

.2 Apply single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing.

.3 Install fire rated gypsum board in accordance with applicable ULC design number.

.4 Apply board using stud adhesive on furring or framing.

.5 Install gypsum board on walls vertically to avoid end-butt joints.

.6 Install gypsum board with face side out.

.7 Do not install damaged or damp boards.

.8 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 INSTALLATION - GENERAL

.1 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.

.2 Install access doors to electrical and mechanical fixtures as specified in their respective sections.

.1 Rigidly secure frames to furring or framing systems.

.3 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.

.4 Place corner beads at external corners.

.1 Use longest practical length.

.2 Place edge trim where gypsum board abuts dissimilar materials.

.5 Finish gypsum board walls and ceilings to following levels in accordance with GA-214:

.1 Level 2: embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.

.6 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.

.7 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board to be invisible after surface finish is completed.

.8 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.9 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

3.5 CEILING INSTALLATION

.1 Install to ASTM C754 or GA-216.

.2 Install ceiling framing independent of walls, columns, and above ceiling work.

.3 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.5 Install work level, to tolerance of 1:1200.

3.6 TOLERANCES

.1 Maximum variation of finished gypsum board surface from true flatness: 3 mm in 3 m, in any direction.

3.7 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01 74 11 - Cleaning. Leave Work area clean at end of each day.

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

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

3.8 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by installation of gypsum board assemblies.

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 A137.1-2012, American National Standard Specifications for Ceramic Tile.

.2 ASTM International

.1 ASTM C109/C109M-13e1, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.

.2 ASTM C979/C979M-10, Standard Specification for Pigments for Integrally Coloured Concrete.

.3 ASTM E1155-14/E1155M, Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers.

.3 Canadian General Standards Board (CGSB)

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

.2 CGSB 71-GP-22M, Adhesive, Organic, for Installation of Ceramic Wall Tile.

.4 Terrazzo Tile and Marble Association of Canada (TTMAC)

.1 Tile Specification Guide 09 30 00, Tile Installation Manual 2016-2017.

1.2 SUBMITTALS

.1 Submit 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 Levelling compound.

.3 Polymer-modified mortar.

.4 Epoxy grout.

.5 Slip-resistant tile.

.6 Uncoupling membrane.

.7 Finishing strip.

.3 Samples:

.1 Wall and floor tile: Submit duplicate, full-sized samples of each colour, texture, size, and pattern of tile proposed for installation.

.2 Finishing strips: Submit duplicate manufacturer samples of each type of cap and transition strip proposed for installation.

1.3 QUALITY ASSURANCE

.1 Conform to TTMAC Tile Installation Manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

1.5 AMBIENT CONDITIONS

.1 Maintain air temperature and structural base temperature at ceramic 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.

1.6 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 installed to project, for maintenance use. Store where directed.

.3 Maintenance material same production run as installed material.

Part 2 Products

2.1 FLOOR TILE

.1 CT-1: Ceramic tile: To ANSI A137.1.

.1 Dimensions: Nominal 500 x 990 mm x 6 mm thick (20 x 39 inches x ¼ inch thick).

.2 Finish: Matte.

.3 Colour: Dark grey.

.4 Water Absorption Class: MR-1 - Less than 0.5% - impervious.

.5 Dynamic coefficient of friction (ANSI A137.1): Minimum 0.42 when wet.

.6 Installation: Stack bond.

.7 Spacing: 4.8 mm (3/16 inch).

.8 Grout: Epoxy.

.9 Grout colour: Winter grey.

2.2 WALL TILE

.1 CT-2: Ceramic tile: To ANSI A137.1, ceramic gloss wall tile.

- .1 Dimensions: Nominal 125 x 250 mm x 9 mm thick.
- .2 Finish: Gloss.
- .3 Colour: Off-white.
- .4 Water Absorption Class: MR-1 - Less than 0.5% - impervious.
- .5 Installation: Stack bond.
- .6 Spacing: 3 mm (1/8 inch).
- .7 Grout: Cementitious.
- .8 Grout colour: Bleached wood.

.2 CT-3: Ceramic tile: To ANSI A137.1.

- .1 Dimensions: Nominal 200 x 400 mm x 7.5 mm thick.
- .2 Finish: Gloss.
- .3 Colour: Light sky blue.
- .4 Installation: Stack bond.
- .5 Spacing: 3 mm (1/8 inch).
- .6 Grout: Cementitious.
- .7 Grout colour: Snow white.

.3 CT-4: Ceramic tile: To ANSI A137.1.

- .1 Dimensions: Nominal 200 x 200 mm x 7.5 mm thick.
- .2 Finish: Gloss.
- .3 Colour: Dark blue.
- .4 Installation: Stack bond.
- .5 Spacing: 3 mm (1/8 inch).
- .6 Grout: Cementitious.
- .7 Grout colour: Snow white.

.4 CT-5: Ceramic tile: To ANSI A137.1.

- .1 Dimensions: Nominal 200 x 400 mm x 7.5 mm thick.
- .2 Finish: Gloss.
- .3 Colour: Pale blue.
- .4 Installation: Stack bond.
- .5 Spacing: 3 mm (1/8 inch).
- .6 Grout: Cementitious.
- .7 Grout colour: Snow white.

2.3 SURFACE PREPARATION MATERIALS

.1 Primer: Low VOC, low viscosity primer as recommended by manufacturer to suit substrate and site conditions; provide proof of bonding ability of setting system where manufacturer recommends that primer is not necessary to installation.

.2 Leveling compound: Quick-setting, polymer-modified, fibre-reinforced cementitious leveling mortar.

.1 Compressive strength (ASTM C109): 14.5 MPa (2100 psi) at 24 h.

.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.

2.4 BOND COAT

.1 Wall tile systems:

.1 Mortar for thin-set interior installation: To ANSI A118.4, polymer-modified Portland cement.

.2 Floor tile systems:

.1 Thin set interior installation: Unmodified Portland cement mortar meeting or exceeding requirements of ANSI A118.1, rated for floor traffic load bearing performance.

2.5 GROUT

.1 Epoxy grout: To ANSI 118.3, 100% solids, premium grade, high strength.

.1 Apply at floor tile.

.2 Latex Portland cement grout: To ANSI A118.7, unsanded, mould and mildew resistant.

.1 Apply at wall tile.

.3 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.

2.6 ACCESSORIES

.1 Uncoupling membrane: Polyethylene membrane, 3 mm thick, with grid structure of square cavities cut back in dovetail configuration; anchoring fleece laminated to underside.

.2 Finishing strips and tile base caps: Type 304 brushed stainless steel, profile with square visible surface, integrated perforated anchoring leg, and integrated grout joint spacer; brushed finish. Provide with matching inside and outside corners.

.3 Transition strips: Purpose-made roll-formed stainless steel edge strips; height as required to suit installation; with integral perforated anchoring leg for setting strip into setting material.

.4 Sealant: In accordance with Section 07 92 00 - Joint Sealants.

2.7 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.

.2 Ensure substrates are clean and dry by using test methods recommended by bond coat manufacturer.

.3 Confirm flatness of floor substrate by measurements taken in accordance with ASTM E1155/E1155M.

.1 Composite flatness (F_F): Minimum 35.

.2 Composite levelness (F_L): Minimum 25.

.4 Verify flatness of wall substrate. Apply leveling mortar to achieve flatness as required.

.1 Maximum wall substrate variance from flatness: 3 mm in 3.05 metres (1/8 inch in 10 feet).

3.3 INSTALLATION

.1 Perform tile work in accordance with TTMAC Tile Installation Manual, except where specified otherwise.

.2 Perform large-format tile installation in accordance with ANSI A108.19, except where specified otherwise.

.3 Apply tile or backing coats to clean and sound surfaces.

.4 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.

.5 Maximum surface tolerance 1:800.

.6 Make joints between tile uniform, 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 1/2 size.

.9 Sound tiles after setting and replace hollow-sounding units to obtain full bond.

.10 Install divider strips at junction of tile flooring and dissimilar materials.

.11 Allow minimum 24 hours after installation of tiles, before grouting.

.12 Clean installed tile surfaces after installation and grouting cured.

3.4 WALL TILE

.1 Install in accordance with TTMAC 305W-2016-2017, Detail A.

3.5 FLOOR TILE

.1 Install in accordance with TTMAC 311F-2016-2017, Detail A.

3.6 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM D412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.

.2 ASTM D2047-11, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.

.3 ASTM D3389-10, Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader).

.4 ASTM E648-10e1, Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

.5 ASTM E662-12, Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

.6 ASTM E1155-14/E1155M-14, Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers.

.7 ASTM F970-07 (2011), Standard Test Method for Static Load Limit.

.8 ASTM F1700-13a, Standard Specification for Solid Vinyl Floor Tile.

.2 Canadian Standards Association (CSA)

.1 CSA B651-12, Accessibility for the Built Environment.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S102.2-10, Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

1.2 SUBMITTALS

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

.2 Product data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for vinyl planks, adhesive, and subfloor patching compound. Include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Submit WHMIS MSDS in accordance with Section 01 35 29 – Health and Safety Requirements.

.3 Samples:

.1 Submit duplicate sample vinyl planks, full size, in proposed colours and patterns.

.2 Submit duplicate 100 mm pieces of transition strip in proposed colours and finish.

.4 Shop Drawings: Indicate:

.1 Tile installation orientation.

.2 Cut-outs: Show locations where cut-outs are required.

.5 Closeout Submittals:

.1 Provide maintenance data for resilient flooring for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 MOCK-UPS

.1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.

.2 Install vinyl plank mock-up, minimum 3 planks wide x full length, in area designated by Departmental Representative; illustrate selected materials, colour schemes, pattern, texture, direction of installation, finish fit to walls and doorways, seam finish, and quality of work.

.3 Locate where directed.

.4 Allow for inspection of mock-up by Departmental Representative before proceeding with vinyl plank installation.

.5 Accepted mock-up may remain as part of finished work.

1.4 DELIVERY, STORAGE, AND HANDLING

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

1.5 AMBIENT CONDITIONS

.1 Maintain air temperature at flooring installation area above 20°C for 48 hours before, during, and 48 hours after installation.

1.6 MAINTENANCE

.1 Extra Materials:

.1 Provide extra materials of luxury vinyl planks in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide 9 m^2 of each colour, pattern and type flooring material required for project for maintenance use.

.3 Extra materials from same production run as installed materials.

.4 Identify each box of luxury vinyl planks.

.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 Luxury vinyl planks: To ASTM F1700, Class III printed film vinyl tiles.

- .1 Type B embossed.
- .2 Backing: Commercial grade.
- .3 Wear layer: Minimum 0.76 mm (30 mils).
- .4 Finish: Polyurethane.
- .5 Total thickness: 3.0 mm.
- .6 Static load limit to ASTM F970: Minimum 250 psi.
- .7 Slip resistance to ASTM D2047: Minimum 0.5.
- .8 Flame spread to ASTM E648: Class I.
- .9 Smoke evolved to ASTM E662: 450 or less.
- .10 Tile dimensions: 152 x 1220 mm (6 x 48 inches).
- .11 Pattern/Colour: Holly oak.

.2 Transition Mouldings: PVC with additives and colourants, composition homogeneous through material.

- .1 Hardness to ASTM D2240: Minimum 85 Shore A.
- .2 Abrasion resistance to ASTM D3389: 0.22 mg/cycle.
- .3 Slip resistance: To meet ASTM D2047.
- .4 Changes in level to comply with accessibility requirements of CSA B651:
  - .1 0 to 6 mm vertical rise: Vertical transition strip permitted.
  - .2 7 to 13 mm vertical rise: Bevelled transition, not to exceed 1:2 ratio for rise:run.
  - .3 Over 13 mm vertical rise: Bevelled transition, not to exceed 1:12 ratio for rise:run.
- .5 Provide adhesive as recommended by transition strip manufacturer.

.3 Primers and adhesives: Types recommended by resilient flooring manufacturer for specific material on applicable substrate.

.4 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 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 by using test methods recommended by flooring manufacturer.

.3 Confirm flatness of substrate by measurements taken in accordance with ASTM E1155/E1155M.

- .1 Composite flatness (F_F): Minimum 32.
- .2 Composite levelness (F_L): Minimum 20.

.4 Ensure concrete substrate is free of dust, solvent, paint, wax, oil, grease, residual adhesive, adhesive removers; curing, sealing, hardening, or parting compounds; alkaline salts, excessive carbonation or laitance, mould, mildew, and other foreign materials that might prevent adhesive bond.

.5 Confirm moisture levels in concrete are within flooring manufacturer’s recommendations.

.6 Confirm alkalinity of concrete substrate is maximum pH 9.

3.3 PREPARATION

.1 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

.2 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.3 Prime concrete slab to resilient flooring manufacturer's printed instructions.

3.4 APPLICATION: FLOORING

.1 Provide high ventilation rate, with maximum outside air, during installation, and for 48 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.

.2 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.3 Lay flooring with seams parallel to building lines to produce a minimum number of seams. Border widths minimum 1/3 width of full material.

.4 As installation progresses, and after installation, roll flooring with 45 kg minimum roller to ensure full adhesion.

.5 Cut flooring around fixed objects.

.6 Continue flooring over areas that will be under built-in furniture.

.7 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.

.8 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.

3.5 CLEANING

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

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

.3 Remove excess adhesive from floor, base and wall surfaces without damage.

.4 Clean floor surface to flooring manufacturer's printed instructions.

3.6 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 Department of Justice Canada (Jus)

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

.2 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual, 2014.

.4 National Fire Code of Canada 2015.

.5 Transport Canada (TC)

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

1.2 SCHEDULING

.1 Submit work schedule for various stages of painting to Departmental Representative for review. Submit schedule minimum of 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.

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit product data and instructions for each paint and coating product to be used.

.2 Submit product data for the use and application of paint thinner.

.3 Submit Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS). Indicate VOCs during application.

.3 Samples:

.1 Submit full range colour sample chips to indicate where colour availability is restricted.

.2 Submit duplicate 200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:

.1 3 mm plate steel for finishes over metal surfaces.

.2 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.

.3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.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.

.4 MPI Environmentally Friendly classification system rating.

1.4 MOCK-UPS

.1 Mock-ups: Apply mock-ups of each paint system indicated, in each colour and finish selected, to verify preliminary selections made under sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

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

.2 Departmental Representative will select surfaces to represent surfaces and conditions for application of each paint system specified.

.1 Vertical and Horizontal Surfaces: Provide samples of at least 9 m^2 (100 ft^2.).

.2 Other Items: Departmental Representative will designate items or areas required.

.3 Apply mock-up samples after permanent lighting and other environmental services have been activated.

.4 Final approval of colour selections will be based on mock-ups.

.1 If preliminary colour selections are not approved, apply additional mock-ups of additional colours selected by Departmental Representative at no added cost to contract.

.5 Approved mock-up may remain as part of finished work.

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 primer and 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 Packing, Shipping, Handling and Unloading:

.1 Pack, ship, handle and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.

.2 Acceptance at Site:

.1 Identify products and materials with labels indicating:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Storage and Protection:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store materials and supplies away from heat generating devices.

.3 Store materials and equipment in well-ventilated area within 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 CEPA, TDGA, Regional and Municipal, regulations.

.4 Ensure emptied containers are sealed and stored safely.

.5 Unused paint materials must be disposed of at official hazardous material collections site as approved by Departmental Representative.

.6 Paint 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 Empty paint cans are to be 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.

.11 Set aside and protect surplus and uncontaminated finish materials: Deliver to or arrange collection by Departmental Representative for maintenance use.

1.7 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Provide continuous ventilation for seven days after completion of application of paint.

.2 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.

.3 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.

.4 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless with written approval by 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 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.

.2 Perform painting work when maximum moisture content of the substrate is below:

.1 Allow new concrete and masonry to cure minimum of 28 days.

.2 15% for wood.

.3 12% for gypsum board.

.3 Test for moisture using calibrated electronic Moisture Meter.

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.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 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.

.3 Conform to latest MPI requirements for interior painting work including preparation and priming.

.4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

.5 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

.6 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E2 rating.

2.2 COLOURS

.1 Selection of colours from manufacturer’s full range of colours.

.2 Where specific products are available in restricted range of colours, selection based on limited range.

.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 indicated.

2.5 INTERIOR PAINTING SYSTEMS

.1 Systems: 3 coats including primer unless otherwise specified.

.2 Galvanized metal: Doors and door frames.

.1 INT 5.3M – High performance architectural latex.

.1 Doors: G5 finish.

.2 Frames: G4 finish.

.3 Dressed lumber: Trim carpentry, doors and door frames.

.1 INT 6.3A – High performance architectural latex over latex primer, G5 finish.

.4 Wood veneer faced doors:

.1 INT 6.3EE – Polyurethane varnish over waterborne stain – G4 (satin-like) finish.

.5 Gypsum wallboard.

.1 INT 9.2B - High performance architectural latex, G4 finish.

.6 Electrical backboards.

.1 INT 6.4PP – Fire retardant coating, pigmented, waterborne, MPI #64.

.1 Apply in accordance with manufacturer’s instructions. Apply to all six sides of plywood electrical backboards.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

.1 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. Do not proceed with work until conditions are within acceptable range as recommended by manufacturer.

.3 Do not commence until such adverse conditions and defects have been corrected and surfaces and conditions are acceptable.

.4 Maximum moisture content as follows:

.1 Gypsum board: 12%.

.2 Wood: 12%.

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 passing pedestrians, 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 be 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, wiping with dry, clean cloths.

.2 Wash surfaces with a biodegradable detergent and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

.5 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.

.6 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.

.7 Touch up of shop primers with primer as specified.

.8 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 and roller. 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 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.

.4 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.6 Sand and dust between coats to remove visible defects.

.7 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.

.8 Finish closets and alcoves as specified for adjoining rooms.

.9 Finish top, bottom, edges and cut-outs of doors after fitting as specified for door surfaces.

3.6 SITE TOLERANCES

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.7 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 REFERENCES

.1 ASTM International

.1 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM B456-11e1, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.3 ASTM A653/A653M-08, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM A924/A924M-14, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.2 Canadian Standards Association (CSA)

.1 CSA B651-12, Accessible Design for the Built Environment.

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

1.2 SUBMITTALS

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

.2 Product Data: Provide manufacturer's printed product literature and data sheets; include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for toilet and bath accessories, for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Tools:

.1 Provide special tools required for assembly, disassembly, or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.

.2 Deliver special tools to Departmental Representative.

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 indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect toilet and bathroom accessories from nicks, scratches, and blemishes.

.3 Replace defective and damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Sheet steel: To ASTM A653/A653M.

.2 Stainless steel sheet metal: To ASTM A167, Type 304 with No. 4 finish.

.3 Stainless steel tubing: Type 304, commercial grade, seamless welded, 1.2 mm wall thickness.

.4 Fasteners: Concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields: fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 COMPONENTS

.1 Coordinate with Departmental Representative and building operations staff to ensure compatibility of washroom accessories, for use with existing facility consumables.

.2 Paper towel dispenser: for double fold paper towels, stainless steel cabinet, hinged front panel, refill indicator slot, lock and key, surface mounted.

.3 Toilet tissue dispenser: Roll type, surface mounted, chrome plated steel frame, capacity to dispense two jumbo rolls; exposed surfaces in satin finish stainless steel; with supply level viewer.

.4 Soap dispenser: Push-in valve, 1 L capacity, surface mounted, exposed components with stainless steel finish.

.5 Sanitary napkin disposal bin: Surface mounted, all-welded construction; satin finish stainless steel construction; complete with magnet catch and cable door-swing limiter.

.1 Waste bin: Removable, capacity 1.0 L.

.6 Clothes hook: Surface mounted, Type 304 stainless steel with satin finish.

.1 Flange and support arm: 0.8 mm thick.

.2 Mounting bracket: 1.2 mm thick.

.3 Wall plate: 1.0 mm thick, concealed.

.4 Cap: 2.0 mm thick, welded to support arm.

.7 Mirror: To ASTM C1503, silvered back flat glass, tempered, edges ground and polished smooth.

.1 Mounting clips: Stainless or plated steel, J-shaped profile, adjustable.

.8 Mirror: Wall-mounted unit, fixed frame mirror.

.1 Frame: Type 304 stainless steel frame, 19 x 19 mm, with beveled front, corners welded, ground, and polished smooth.

.2 Mirror: 6 mm float glass, electrolytically copper-plated, edges polished.

.3 Backing: Full-size shock absorbing, water resistant, non-abrasive padding.

.9 Shower rod: Stainless steel, Type 304, seamless tube, 25 mm (1 inch) diameter, 0.7 mm (0.028 inch) wall thickness, curved, with flanges for mounting; chrome finish. Length: 1524 mm (60 inches).

2.3 FABRICATION

.1 Weld and grind joints of fabricated components flush and smooth.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back-paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot-dip galvanize concealed ferrous metal anchors and fastening devices to CAN/CSA G164.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.

.9 Provide steel anchor plates and components for installation on studding and building framing.

2.4 FINISHES

.1 Chrome and nickel plating: To ASTM B456, satin finish.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that conditions of substrates and surfaces to receive toilet and bathroom accessories are acceptable for product installation in accordance with manufacturer's instructions prior to toilet and bathroom accessories installation.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Install and secure accessories rigidly in place as follows:

.1 Stud walls: Install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.

.2 Hollow masonry units, existing plaster or drywall: Use toggle bolts drilled into cell or wall cavity.

.3 Solid masonry, marble, stone or concrete: Use bolts with lead expansion sleeves set into drilled holes.

.4 Toilet and shower compartments: Use male to female through bolts.

.2 Use tamper proof screws/bolts for fasteners.

.3 Fill units with necessary supplies shortly before final acceptance of building.

3.3 ADJUSTING

.1 Adjust toilet and bathroom accessories components and systems for correct function and operation in accordance with manufacturer's written instructions.

.2 Lubricate moving parts to operate smoothly and fit accurately.

3.4 CLEANING

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

.2 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.

.4 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 toilet and bathroom accessories installation.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Section 01 33 00: Submittal Procedures.

.2 Product Data: Provide manufacturer's data on equipment and accessories.

.3 Installation Data: Manufacturer's special installation requirements.

.4 Maintenance Documentation: Include maintenance information on regular servicing.

1.2 QUALITY ASSURANCE

.1 Equipment: Conform to applicable code for CSA or UL approval/certification.

Part 2 Products

2.1 APPLIANCES

.1 Stove: Electric, with self-cleaning oven, black ceramic smooth top cooking surface, convection oven, storage drawer, hot surface indicator, electromechanical controls, digital display, clock.

- .1 Width: Nominal 760 mm (30 inches).
- .2 Elements: 5, 3200W.
- .3 Oven capacity: 6.3 cu ft.
- .4 Exterior finish: Stainless steel.

.2 Refrigerator: Upright type, free standing, 838 mm (33 inches) nominal width; nominal height 1778 mm (70 inches), depth 838 mm (33 inches) without handle, Energy Star certified.

- .1 Total capacity: 24.1 cu ft.
  - .1 Refrigerator: 16.4 cu ft.
  - .2 Freezer: 7.7 cu ft.
- .2 Electrical: 115V, 20A.
- .3 Lighting: LED.
- .4 Meat keeper and vegetable crisper drawers.
- .5 Shelving: Tempered glass.
- .6 Door storage: Capacity for 4 L sized milk jugs.
- .7 Door-open alarm.
- .8 Freezer: Bottom mounted, with ice maker function.
- .9 Defrost: Manual.

.10 Exterior finish: Stainless steel.

.3 Clothes washer: Front-loading, high efficiency, 4.5 cu ft capacity, internal water heater, steam function, and vibration reduction; Energy Star certified.

.1 Dimensions: Approximately 685 mm (27 inches) wide x 787 mm (31 inches) deep x 990 mm (39 inches) high.

.2 Controls: Electromechanical, digital display, 12 cycles.

.3 Door: Window style.

.4 Drum: Stainless steel.

.5 Electrical requirements: 120V, 15A.

.6 Motor: Variable speed, reversible, thermoprotected, high-efficiency, controlled induction.

.7 Spin speed: 5 spin speeds, to maximum 1200 rpm.

.8 Dispenser for liquid soap, liquid softener, and bleach.

.9 Finish colour: White.

.4 Dryer: 7.4 cubic foot drum capacity; matched in size and finish to clothes washer, Energy Star certified.

.1 Electric, with interior light and lint screen.

.2 Interior: Stainless steel.

.3 Heating element rating: 5400 W.

.4 Finish colour: White.

.5 Microwave Oven: Countertop style.

.1 Electrical: 1350W, 14A.

.2 Adjustable power levels.

.3 Interior space: 2.0 cu ft.

.4 LED display controls with touchscreen.

.5 Glass turntable, 400 mm (16 inch) diameter.

.6 Interior light.

.7 Exterior finish: Stainless steel.

.6 Dishwasher: Built-in style, tall-tub design, heated drying, Energy Star certified.

.1 Width: Nominal 610 mm (24 inches).

.2 Programs: 5, with cycle status lights, end-of-cycle signal.

.3 Racks: 2 with optional removable 3rd rack.

.4 Tub finish: Stainless steel.

.5 Electrical: 120V, 12A, 1440W.

.6 Operating sound level: Maximum 44dBA.

.7 Exterior finish: Stainless steel.

.7 Range hood: Recirculating, non-vented.

.1 Fan settings; 2.

.2 Light: 75W incandescent.

.3 Fan rating: 190 cfm.

2.2 ACCESSORIES

.1 Power cords: To connect appliances to utilities.

.2 Hoses: To connect washing machine and refrigerator to plumbing.

.3 Duct: For dryer exhaust.

.4 Fasteners and Anchors: Galvanized or stainless steel type, anchors, screws, bolts, expansion shields, set screws; required by the type of construction to which they are attached.

Part 3 Execution

3.1 PREPARATION

.1 Verify that prepared openings are ready to receive work and opening dimensions are as indicated on shop drawings and as instructed by the manufacturer.

.2 Verify that proper power supply is available.

3.2 INSTALLATION

.1 Install appliances to manufacturer's written instructions and CSA requirements.

.2 Set and adjust units level and plumb.

.3 Activate units to confirm correct operation.

.4 Turn refrigerators on to moderate temperature setting.

.5 Connect to utilities and make units operational.

END OF SECTION

Part 1 General

1.1 INFORMATION

.1 This specification applies to all Mechanical specification sections (Division 21, 22, 23 & 25).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Shop drawings:

.1 Drawings to show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.2 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.

.6 Wiring and schematic diagrams.

.3 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.

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 incorporation into manual.

.1 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.

.2 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.

.3 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.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.4 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.

.5 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.6 Site records:

.1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information daily to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.7 As-Built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, 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 HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.8 Submit copies of as-built drawings for inclusion in final TAB report.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish spare parts as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One head gasket set for each heat exchanger.

.4 One glass for each gauge glass.

.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.3 Provide one set of special tools required to service equipment as recommended by manufacturers.

.4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

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 in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

Part 2 Products

2.1 NOT USED.

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 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 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.

3.3 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

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 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.

3.6 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 ASTM International Inc.

.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)

.2 Manufacturers Standardization Society of Valve and Fittings

.1 MSS SP-80, Bronze Gate, Globe, Angle and Check Valves.

.2 MSS-SP-110, Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

Part 2 Products

2.1 SUMP PUMP VERTICAL SHAFT

.1 Construction: simplex.

.1 Vertical shaft centrifugal, cast iron case, bronze impeller, stainless steel shaft.

.2 Column and cast iron parts protected with baked epoxy paint.

.3 Non-corrosive cone type strainer cleanable without pump removal from sump.

.4 Vertical outlet case.

.5 Graphite bronze self lubricated lower bearing.

.2 Motor: rated for continuous duty, built-in overload protection, drip-proof, complete with three-wire rubber covered cord.

.3 Control: heavy duty snap-action switch complete with two adjustable plastic or rubber coated weights on corrosion resistant chain or cable. Unit to have local audible high water alarm.

.4 Refer to schedule and detail on drawings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Make piping and electrical connections to pump and motor assembly and controls as indicated.

.2 Ensure pump and motor assembly do not support piping.

.3 Align vertical pit mounted pump assembly after mounting and securing cover plate.

3.3 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Check power supply.

.2 Check starter protective devices.

.2 Start-up, check for proper and safe operation.

.3 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

.4 Adjust flow from water-cooled bearings.

.5 Adjust impeller shaft stuffing boxes, packing glands.

3.4 START-UP

.1 General:

.1 Procedures:

.1 Check power supply.

.2 Check starter O/L heater sizes.

.3 Start pumps, check impeller rotation.

.4 Check for safe and proper operation.

.5 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.

.6 Test operation of hands-on-auto switch.

.7 Test operation of alternator.

.8 Adjust leakage through water-cooled bearings.

.9 Adjust shaft stuffing boxes.

.10 Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.

.11 Check base for free-floating, no obstructions under base.

.12 Run-in pumps for 12 continuous hours.

.13 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.

.14 Adjust alignment of piping and conduit to ensure full flexibility.

.15 Eliminate causes of cavitation, flashing, air entrainment.

.16 Measure pressure drop across strainer when clean and with flow rates as finally set.

.17 Replace seals if pump used to degrease system or if pump used for temporary heat.

.18 Verify lubricating oil levels.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International Inc.

.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)

.2 Manufacturers Standardization Society of Valve and Fittings

.1 MSS SP-80, Bronze Gate, Globe, Angle and Check Valves.

.2 MSS-SP-110, Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

.3 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.

Part 2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.

.2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

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 joint pressure fittings: to ANSI/ASME B16.18.

.4 Copper alloy solder joint pressure fittings: to ANSI/ASME B16.22.

2.3 JOINTS

.1 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.2 Copper solder joints: lead free tin & silver solder with minimum melting point of 221°C (430°F). Use water soluble solder fluxes.

.3 Threaded joints: use Teflon tape or thread sealing compound

.4 Dielectric connections between dissimilar metals:

.1 Lead free dielectric unions with copper solder ends with gasket to separate tailpieces to prevent electric current.

2.4 SWING CHECK VALVES

.1 NPS 2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.

2.5 BALL VALVES

.1 Up to including 50mm (2”) 4137 kPa (600 psi) non shock CWP

.1 Standard Specification: MSS-SP-110
.2 NSF/ANSI 61 compliant
.3 Connections: Solder or Thread ends
.4 Full port
.5 Operator: Removable, plated steel lever handle with plastic cover
.6 Body and cap: Forged brass; Cast bronze
.7 Stem: Stainless steel
.8 Stem seal: Flourocarbon FKM; TFE; PTFE
.9 Ball seat: PTFE; TFE
.10 Ball: Stainless Steel

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 local authority having jurisdiction.

.2 Install pipe work in accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified herein.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.6 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.3 VALVES

.1 Isolate equipment, fixtures and branches with ball valves.

3.4 PRESSURE TESTS

.1 Conform to requirements of Section 21 05 01 - Common Work Results for Mechanical.

.2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

.3 Pressure test systems in accordance with local regulations.

.4 Pressure test buried systems before backfilling.

3.5 FLUSHING AND CLEANING

.1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean copper to Provincial potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

3.6 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

3.7 START-UP

.1 Timing: start up after:

.1 Pressure tests have been completed.

.2 Certificate of static completion has been issued.

.3 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:

.1 Establish circulation and ensure that air is eliminated.

.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.

.3 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.8 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Standards Council of Canada

.1 CSA B181.2, PVC DRAIN, WASTE, AND VENT PIPE AND PIPE FITTINGS

.2 CAN/ULC S102.2, Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies

.2 ASTM International Inc.

.1 ASTM D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

Part 2 Execution

2.1 PIPING AND FITTINGS

.1 Piping, general:

.1 38mm to 300mm (1½” to 12”) PVC/DWV: to CSA B181.2, CAN/ULC S102.2

.2 Flame spread rating: not to exceed 25.

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

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 local authority having jurisdiction.

.2 Cleanouts:

.1 Install cleanouts:

.1 At all changes of direction

.2 At base of soil/waste stacks

.2 Ensure cleanouts are accessible. Extend cleanouts to face of structure with access cover and frame where located above furred ceilings or in concrete slabs on grade.

3.3 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Affix applicable label (storm, sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 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.

1.2 REFERENCES

.1 Standards Council of Canada

.1 CSA-C22.2, General requirements - Canadian electrical code, part II

.2 ANSI Z21.10.3-2011 CSA4.3-2011, Gas Water Heaters - Volume III, Storage Water Heaters With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous

.3 CSA CAN/CSA-B149.1., Natural gas and propane installation code

.2 The American Society of Mechanical Engineers

Part 2 Products

2.1 GAS (POWER BURNER) WATER HEATER HWT-1 (COTTAGE)

.1 To ANSI Z21.10.1/CSA 1-4.3.

.2 Gas burner: complete with high limit control, gas valve, gas pressure regulator, 100% safety shut-off, firepower gas burner with air distribution ring.

.3 3 year warranty certificate.

.4 Refer to schedule on drawings.

2.2 GAS (POWER BURNER) WATER HEATER HWT-2 (BUNKHOUSE)

.1 To ANSI Z21.10.1/CSA 1-4.3.

.2 Gas burner: complete with high limit control, gas valve, gas pressure regulator, 100% safety shut-off, firepower gas burner with air distribution ring.

.3 3 year warranty certificate.

.4 Refer to schedule on drawings.

2.3 3 YEAR WARRANTY CERTIFICATE.

2.4 TRIM AND INSTRUMENTATION

.1 Drain valve: NPS 1 with hose end.

.2 Thermometer: 100 mm dial type with red pointer and thermowell filled with conductive paste.

.3 Pressure gauge: 75 mm dial type with red pointer and shut-off cock.

.4 Thermowell filled with conductive paste for control valve temperature sensor.

.5 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.

.6 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

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 mounted tanks as required.

.3 Provide insulation between tank and supports.

.4 Install natural gas fired domestic water heaters in accordance with CAN/CSA-B149.1.

3.3 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.

.2 Plumbing and Drainage Institute (PDI)

.1 PDI-WH201, Water Hammer Arresters Standard.

Part 2 Products

2.1 FLOOR DRAINS

.1 Floor Drains and Trench Drains: to CSA B79.

.2 FD-1: general duty; cast iron body round, adjustable head, sediment basket nickel bronze strainer, integral seepage pan, and clamping collar.

2.2 CLEANOUTS

.1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Access Covers:

.1 Wall Access: face or wall type, stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

2.3 NON-FREEZE WALL HYDRANTS

.1 Surface mount with integral vacuum breaker, NPS 3/4 hose outlet, hand wheel operator. Polished bronze finish.

2.4 WATER HAMMER ARRESTORS

.1 Stainless steel construction, bellowstype: to PDI-WH201.

2.5 BACK FLOW PREVENTERS

.1 Preventers: to CSA-B64.

2.6 VACUUM BREAKERS

.1 Breakers: to CSA-B64 Series.

2.7 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

2.8 TRAP SEAL PRIMERS

.1 Brass, with integral vacuum breaker, NPS 1/2 solder ends, NPS 1/2 drip line connection.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturer’s instructions and local authority having jurisdiction.

3.3 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.4 NON-FREEZE WALL HYDRANTS

.1 Install 600 mm above finished grad and as indicated.

3.5 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures [where indicated].

3.6 BACK FLOW PREVENTERS

.1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.

.2 Pipe discharge to terminate over nearest drain or service sink.

3.7 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of risers, at low points to drain systems, and as indicated.

3.8 TRAP SEAL PRIMERS

.1 Install for floor drains and elsewhere, as indicated.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Consultant.

.3 Install soft copper tubing to floor drain.

3.9 STRAINERS

.1 Install with sufficient room to remove basket for maintenance.

3.10 START-UP

.1 General:

.1 In accordance with Section [01 91 13 - General Commissioning (Cx) Requirements]: General Requirements, supplemented as specified herein.

.2 Timing: start-up only after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.3 Provide continuous supervision during start-up.

3.11 TESTING AND ADJUSTING

.1 General:

.1 Test and adjust plumbing specialties and accessories in accordance with Section [01 91 13- General Commissioning (Cx) Requirements] : General Requirements, supplemented as specified.

.2 Timing:

.1 After start-up deficiencies rectified.

.2 After certificate of completion has been issued by authority having jurisdiction.

.3 Application tolerances:

.1 Pressure at fixtures: +/- 70 kPa.

.2 Flow rate at fixtures: +/- 20%.

.4 Adjustments:

.1 Verify that flow rate and pressure meet design criteria.

.2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.

.5 Floor drains:

.1 Verify operation of trap seal primer.

.2 Prime, using trap primer. Adjust flow rate to suit site conditions.

.3 Check operations of flushing features.

.4 Check security, accessibility, removability of strainer.

.5 Clean out baskets.

.6 Vacuum breakers, backflow preventers, backwater valves:

.1 Test tightness, accessibility for O M of cover and of valve.

.2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.

.3 Verify visibility of discharge from open ports.

.7 Access doors:

.1 Verify size and location relative to items to be accessed.

.8 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.9 Water hammer arrestors:

.1 Verify proper installation of correct type of water hammer arrester.

.10 Wall, ground hydrants:

.1 Verify complete drainage, freeze protection.

.2 Verify operation of vacuum breakers.

.11 Strainers:

.1 Clean out repeatedly until clear.

.2 Verify accessibility of cleanout plug and basket.

.3 Verify that cleanout plug does not leak.

.12 Hose bibbs, sediment faucets:

.1 Verify that flow and pressure meet design criteria.

.2 Check for leaks, replace compression washer if required.

.13 Hydronic system water Make-up Assembly:

.1 Verify flow, pressure, and connection.

3.12 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-B45 Series, Plumbing Fixtures.

.2 CAN/CSA-B125.3, Plumbing Fittings.

.3 CAN/CSA B651, Accessible Design for the Built Environment

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.3.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: as indicated.

.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 Water Closets

.1 WC-1: floor-mounted, flush tank

.1 Bowl: vitreous china, syphon jet, elongated rim, close-coupled combination, bowl and bolt caps.

.2 Closet tank: vitreous china with tank liner, flapper type flush valve assembly for ultra low flush cycle: adjustable from 3.8 - 17 litres/flush.

.3 Cold water supplies to fixtures:

.2 Chrome plated flexible supply pipes with screwdriver stop, reducers, escutcheon.

.8 Washroom Lavatories:

.1 L-1: under mount lavatory

.1 Under-mount, enameled cast iron, pop-up drain, oval basin, without overflow, no faucet holes, 498 mm x 381 mm.

.2 Chrome plated brass, single handed mixing faucet, mixing spout, washerless, aerator, handle.

.1 Provide accessories to limit maximum flow rate to 1.9 l/minute at 413 kPa.

.3 Waste fitting: Pop-up

.4 Hot and cold water supplies to fixtures:

.1 Chrome plated flexible supply pipes with screwdriver stop, reducers, escutcheon.

.5 Waste:

.1 Chrome plated brass P trap with clean out on fixtures not having integral trap.

.9 Sinks

.1 S-1 : double compartment, under-mount:

.1 From 18 guage, 18-10 stainless steel, under-mount sink, double compartment, self-rimming, undercoated, clamps. Overall sizes: 889 x 457 x 229 mm.

.2 Trim: matte black, high arc pull down faucet, with swing spout, aerator, single lever handle, washerless controls, accessories to limit maximum flow rate to 5.6 litres/minute at 413 kPa, spray fitting.

.3 Waste fitting: integral stainless steel basket strainer/stopper, tailpiece, cast brass P-trap with cleanout.

.4 Hot and cold water supplies to fixtures:

.1 Chrome plated flexible supply pipes with screwdriver stop, reducers, escutcheon.

.2 S-2: Laundry sink, single compartment, ledge-back.

.1 From 18 guage, 18-10 stainless steel, under-mount sink, single compartment, self-rimming, undercoated, clamps. Overall sizes: 510 x 520 x 300 mm.

.2 Trim: matte black, high arc pull down faucet, with swing spout, aerator, single lever handle, washerless controls, accessories to limit maximum flow rate to 5.6 litres/minute at 413 kPa, spray fitting.

.3 Waste fitting: integral stainless steel basket strainer/stopper, tailpiece, cast brass P-trap with cleanout.

.4 Hot and cold water supplies to fixtures:

.1 Chrome plated flexible supply pipes with screwdriver stop, reducers, escutcheon.

.10 Pot Filler

.1 Locate above stove and coordinate exact location with interior designer prior to rough in.

.2 Chrome plated metal construction, two handle lever handle, double hinged, total extended length of 619 mm, aerated stream, wall mount installation, one hole, 21 l/minute maximum flow at 413 kPA.

.11 Showers/Bathtubs

.1 SH-1:

.1 individual showerhead.

.1 Chrome plated brass, moulded plastic, non-clog, with adjustable spray, ball joint, single lever control (water volume and temperature), standard chrome plated bent arm and escutcheon. Limit maximum flow rate to 5.7 l/minute at 550 kPa.

.2 One-piece plastic shower cabinet.

.1 Cabinet: Acrylic

.2 Sizes: as indicated

.3 Chrome plated brass strainer and tailpiece

.4 Accessories: soap dish, plastic curtain, curtain rod and hooks, grab bar.

.2 BT-1:

.1 individual showerhead.

.1 Chrome plated brass, moulded plastic, non-clog, with adjustable spray, ball joint, single lever control (water volume and temperature), standard chrome plated bent arm and escutcheon. Limit maximum flow rate to 5.7 l/minute at 550 kPa.

.2 One-piece plastic shower/tub cabinet.

.1 Cabinet: Acrylic

.2 Sizes: as indicated

.3 Chrome plated brass strainer and tailpiece

.4 Accessories: soap dish, plastic curtain, curtain rod and hooks, grab bar.

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 Mounting heights:

.1 Standard: to manufacturer's recommendations.

.2 Wall-hung fixtures: measured from finished floor.

.3 Barrier free: to CAN/CSA B651.

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Adjust flush valves to suit actual site conditions.

.4 Adjust urinal flush timing mechanisms.

.5 Set controls of automatic flush valves for WCs and urinals to prevent unnecessary flush cycles.

.3 Checks:

.1 Water closets, urinals: flushing action.

.2 Aerators: operation, cleanliness.

.3 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls:

.1 Verify temperature settings, operation of control, limit and safety controls.

3.4 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Alberta Building Code

.2 Standards Council of Canada

.1 CAN3-C235-83, Preferred Voltage Levels for AC Systems, 0 to 50 000 V

.2 CSA C22.1, Canadian Electrical Code

Part 2 Products

2.1 MOTORS

.1 Provide electric motors for all equipment supplied in this Division. Motors to operate at 29 r/S (1800 rpm), unless noted otherwise. Motor design shall comply with Canadian Electrical Code requirements. All electric motors supplied shall be capable of being serviced locally.

.2 All three phase motors shall have a service factor of 1.15 times nominal rated horsepower of the motor.

.3 Operating voltages: to CAN3-C235-83, 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.

.4 All motors shall be high efficiency type with minimum efficiencies in accordance with Alberta Building Code. List information on shop drawings.

.5 Determine from electrical drawings and specifications, voltage characteristics applying to each individual motor. Where motor voltages are mentioned in this specification, confirmation to be made by reference to electrical drawings and specifications ordering motors.

.6 Division 26 - Electrical to provide starters for all motors, except as otherwise noted. Division 26 - Electrical shall wire from starters to motors.

.7 Wiring required between starters and switching apparatus such as wiring from starters to float switches, pressure switches and all control wiring to be by Division 26 - Electrical except as noted otherwise on drawings and in specifications. Provide proper terminal connections and lead wires at motors and other apparatus ready for connection by Division 26 - Electrical. Provide Division 26 - Electrical with accurate locations of electrical connection points and all necessary schematic and other drawings to facilitate electric work.

.8 Wiring required under Division 25 to be performed by Division 25 except as noted otherwise. Refer also to Division 25 for further requirements.

2.2 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Provide means to permit lubrication and use of test instruments with guards in place.

.3 Unprotected fan inlets or outlets:

.1 Wire or expanded metal screen, galvanized, 19 mm mesh.

.2 Net free area of guard: not less than 80% of fan openings.

.3 Securely fasten in place.

.4 Removable for servicing.

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 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

3.3 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 REFERENCES

.1 ASTM International

.1 ASTM A125, Standard Specification for Steel Springs, Helical, Heat-Treated.

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

.3 ASTM A563, Standard Specification for Carbon and Alloy Steel Nuts.

.2 Factory Mutual (FM)

.3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 MSS SP69, Pipe Hangers and Supports - Selection and Application.

.3 MSS SP89, Pipe Hangers and Supports - Fabrication and Installation Practices.

.4 Underwriter's Laboratories of Canada (ULC)

Part 2 Products

2.1 GENERAL

.1 Piping, ductwork and equipment shall be securely supported from building structure. Perforated strap or wire hangers are not permitted.

.2 Support components shall conform to Manufacturers Standardization Society Specification SP-38.

2.2 INSTALLATION - HORIZONTAL

.1 Hangers shall adequately support piping system. Locate hangers near or at changes in piping direction and concentrated loads. Provide vertical adjustment to maintain pitch required for proper drainage. Allow for piping expansion and contraction. Piping weight and stresses shall be supported independently of any equipment.

.2 Maximum spacing between pipe supports:

.1 Steel Pipe:

.1 Up to 50mm (2") diam. - 2.4m (8 ft.)

.2 Copper Tubing (Hard):

.1 Up to 25mm (1") diam. - 1.8m (6 ft.)

.2 32mm and larger - 2.4m (8 ft.)

.3 Plastic Pipe As recommended by manufacturer.

2.3 INSTALLATION - VERTICAL PIPING

.1 Support vertical pipes at each floor by Anvil Fig. 261 riser clamps. Locate clamps immediately below coupling if possible. Support soil pipe at hub. Brace risers up to 50mm (2") size at intervals not over 2.13m (7'). Support base in approved manner.

2.4 STRUCTURAL ATTACHMENTS

.1 To Concrete:

.1 Place inserts in structural floors for support of piping and equipment prior to pouring of concrete. Inserts in concrete slabs shall be Anvil Fig. 285 Light Weight Concrete Insert for loads up to 182 Kg (400#) or Anvil Fig. 281 Wedge type concrete insert for loads up to 544 Kg (1200#).

.2 Support hangers in corrugated steel deck by 50mm (2") piece of 3mm (1/8") thick steel plate placed across top of steel deck, secured to hanger rod by washer and nut; prior to pouring of concrete topping.

.3 Where inserts must be placed in existing concrete use Hilti H.D.I. steel anchors as recommended by manufacturer, or if heavy weights must be supported, drill hole through slab and provide 50mm x 50mm (2" x 2") washer and nut above rough slab before floor finish is poured.

.2 To Wooden Ceilings and Beams:

.1 Use Anvil Fig. 153 Pipe Hanger Flange or Fig. 156 or equal.

.3 Miscellaneous:

.1 Provide suitable attachments equal in quality to above where required.

2.5 HANGERS AND SUPPORTS

.1 Steel Pipe: Up to 50mm (2") - Anvil Fig. 65 light clevis - size to suit O.D. of pipe. 62mm (2-1/2") and larger - Fig. 260 clevis - size to suit O.D. of insulation.

.2 Copper Tubing (Hard):

.1 Up to 50mm (2") - Anvil CT65 copper plated clevis - size to suit O.D. of pipe. Fig. 65 may be used if isolation is provided - see below.

.2 62mm (2-1/2") and larger - Fig. 260 clevis - size to suit O.D. of insulation - on uninsulated pipe provide isolation as specified below.

.3 Plastic and Other Types of Piping: Support as recommended by manufacturer.

.4 Provide fabricated steel supports as detailed on drawings or as required to adequately support piping and equipment. Details to be approved by Consultant. Supports shall be of welded construction except where adjustment is required.

.5 Where thermal expansion in excess of 12mm (1/2") axially is anticipated, or where indicated, use Anvil Fig. 171 Adjustable Pipe Roll or Anvil Fig. 271 Pipe Roll Stand.

.6 For vertical piping support, use Anvil Fig. 261 clamp. For vertical copper piping, use Fig. CT-121-C.

.7 Above indicates general requirements. Provide hangers and supports of equal quality to suit job requirements where not covered by the above.

.8 Support groups of horizontal pipes by angle iron trapeze hangers.

.9 Rollers and chairs shall not be installed on trapeze hangers.

.10 Several individual hanger rods may be supported from a trapeze or individual inserts in concrete slab.

.11 Hangers to be adjustable after pipe is in place. Parts must be of adequate strength for weight to be supported with safety factor of 5 to 1.

.12 Hanger Rod:

.1 Support hangers with mild steel rod. Load on hanger not to exceed capacity indicated in following table:

.2 Rod Diam. Max. Safe Load

.1 9.5mm(3/8") 277 Kg(610 lbs.)

.2 13mm(1/2") 514 Kg(1130 lbs.)

.3 16mm(5/8") 822 Kg(1818 lbs.)

.4 19mm(3/4") 1232 Kg(2710 lbs.)

.3 Rods to have sufficient threaded length to allow for vertical adjustment after pipe is in place. Use two nuts in each rod, one above clevis or angle iron, and one below.

2.6 ISOLATION

.1 Copper piping shall be isolated from steel supports by copper plated hangers, plastic coated hangers, tinning pipe at supports, or provision of suitable lead or copper isolators. Where no pipe movement or abrasion is expected, suitable plastic electricians tape may be wrapped around pipe at hangers.

2.7 PROTECTION SADDLES

.1 On piping 50mm (2") and smaller, carry insulation over pipe hangers. Canvas jacket shall be neatly cut and formed to fit over hangers. On chilled and cold water piping, insert sections of insulation into space above pipe at each hanger. Seal saddle and pipe with insulation.

.2 On insulated steel pipe over 50mm (2") diam. use at each hanger or support, Anvil Fig. 160, 161 or 162 to suit pipe size and insulation thickness. Pack space between saddle and pipe with insulation.

.3 On copper piping over 50mm (2") diam. use at each hanger or support Anvil Fig. 167 protection shield or equal. Shields shall have minimum length of 300mm (12") to spread weight.

2.8 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel. Submit calculations with shop drawings.

2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.10 HOUSE-KEEPING PADS

.1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.

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:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.4 Clevis plates:

.1 Attach to concrete with [4] minimum concrete inserts, [one] at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:

.1 Vertical movement of pipework is 13 mm or more,

.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:

.1 Transfer of load to adjacent piping or to connected equipment is not critical.

.2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Plumbing piping: authority having jurisdiction.

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

.4 Copper piping: up to NPS 1/2: every 1.5 m.

.5 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

.6 Pipework greater than NPS 12: to MSS SP69.

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

3.7 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Departmental Representative within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and

recommendations contained in these procedures and requirements are mandatory.

1.3 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 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.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Consultant in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 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.

1.9 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.
- .2 Application of weatherstripping, sealing, and caulking.
- .3 Pressure, leakage, other tests specified elsewhere Division 23.
- .4 Provisions for TAB installed and operational.

.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 Filters in place, clean.
  - .2 Duct systems 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 Outlets 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.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

- .1 HVAC systems: plus 5%, minus 5%.

1.11 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 2% of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to Departmental Representative list of instruments 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.

1.13 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

1.15 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

.1 Reported results subject to verification by Departmental Representative.

.2 Provide personnel and instrumentation to verify up to 30% of reported results.

.3 Number and location of verified results as directed by Departmental Representative.

.4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Departmental Representative, 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. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

1.19 AIR SYSTEMS

.1 Standard: TAB to most stringent of this section and TAB standards of AABC, NEBB, SMACNA and ASHRAE.

.2 Qualifications: personnel performing TAB current member in good standing of AABC or NEBB qualified to standards of AABC or NEBB.

.3 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC or NEBB.

.4 Measurements: to include as appropriate for systems, equipment, components, 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, noise, vibration.

.5 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.6 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 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.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 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" - means "not concealed" as previouslydefined.

.3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 Reference Standards:

.1 ASTM International Inc.

.1 ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.2 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.3 ASTM C553, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering Products

Part 2 Products

2.1 MATERIALS

.1 All materials shall be equivalent in all respects to specified products and shall be used only in applications intended by the manufacturer. Materials not specifically intended for the purpose shall not be used. Approved materials shall not be diluted or blended with other materials unless specifically recommended by the manufacturer of the approved material.

.2 All duct installations including insulation, covering and adhesive shall have a ULC Certified flame spread rating of not greater than 25, and a smoke developed classification of not more than 50.

.3 All canvas shall be treated to be fire retardant in accordance with ULC standards.

.4 Wire to be 1.2mm (18 ga.) stainless steel, dead soft annealed, type 304.

.5 U.L.C. label or satisfactory certified report from approved testing laboratory is required to indicate that fire hazard ratings for materials proposed for use do not exceed those specified.

.6 Flameproofing treatments subject to deterioration due to effects of high humidity are not acceptable.

.7 Consultant reserves the right to demand test samples of components of insulation systems for fire hazard test rating.

2.2 COMPATIBILITY OF COMPONENTS

.1 All adhesives, sealers, vapour coating, mastics, laggings and bedding compounds, shall be compatible with materials to which they are applied. They shall not soften, corrode, or otherwise attack such material in either wet or dry state and shall only be those recommended by manufacturer of insulation as suitable for application proposed. They shall be applied at ambient conditions acceptable to the manufacturer.

2.3 VAPOUR BARRIER FLEXIBLE DUCT INSULATION

.1 Following duct externally insulated with Fibreglas RFFRK reinforced foil-faced vapour seal duct insulation PF335, 340 g. (3/4 lb./cu. ft.) density.

.1 50mm (2") Thickness

.1 All round exhaust and relief ducts, supply and return air ducts not shown acoustically lined from roof or wall back for a length of 1.8m (6'-0") or from wall or roof discharge back to damper, whichever is greater.

.2 All outside air ductwork.

.3 Laundry exhaust ductwork.

Part 3 Execution

3.1 INSTALLATION

.1 Work shall be performed by licensed journeymen.

.2 Apply insulation materials, accessories and finishes in accordance with manufacturer's recommendations.

.3 Do not apply coverings until hydrostatic tests have been completed, surfaces are free of grease, scale, moisture, and heat tracing where required has been installed. Insulation shall be clean and dry when installed and during application of any finish.

.4 Apply insulation and coverings to equipment and piping which will operate with hot or warm liquid vapour, while surface is hot. Provide any required temporary heat to accomplish this.

.5 Cold surfaces to be dry and ferrous surfaces to be coated with rust penetrating protective paint before applying insulation and vapour barriers.

.6 Vapour barriers and insulation to be complete over full length of pipe or surface, without penetration for hangers, duct or seams, and without interruption at sleeves, pipe and fittings.

.7 Install insulation with smooth and even surfaces, with round shapes laid to true circular and concentric shape, shaped to blend with fitting insulation and adjacent covering; with full length section and tight to insulated object.

.8 Butt joints

.1 Place joints on top of duct wherever practical. Butt joints on side of duct for flexible duct insulation.

.2 Adhere and seal laps of vapour barrier cover or vapour barrier strip of 100mm (4") minimum width furnished with insulation, using vapour seal adhesives.

.9 Sagging of duct insulation will not be acceptable.

.10 Stagger both longitudinal and horizontal joints, on duct insulation of multilayered construction.

.11 Duct insulation with vapour barrier shall be continuous, except at fire dampers.

.12 Existing duct and pipe covering damaged or cut back during installation work to be made good with same insulation as specified for new work.

.13 Protect insulation against elements during all stages of application.

.14 Do not cover manufacturer's nameplates. Cut insulation on 45 deg. angle to nameplate edge and seal.

.15 Covering to be uniform in diameter, smooth in finish. Place longitudinal seams so as to be invisible

3.2 VAPOR BARRIER FLEXIBLE DUCT INSULATION

.1 Rectangular Ductwork

.1 On ducts 600mm (24") wide and wider apply fasteners to bottom surface of duct by impaling on welded pins on 300mm (12") centres. Spot adhesive on 300mm (12") centres on all sides of duct. Apply insulation with edges tightly butted together and secured with 100% coverage of 3-M No. 17 or approved alternate. Staple joints and seal with 100mm (4") strips of vapor barrier foil of same quality as duct insulation membrane sealed with BF85-15 or approved alternate.

.2 On ducts 575mm (23") wide or less insulation applied as above but welded pins may be omitted.

.2 Round Ducts

.1 Adhere to duct surface applied in strips 150mm (6") wide, 300mm (12") o.c. Butt all edges of insulation, staple and seal all joints with tape adhered over the joint. Seal all breaks with vapor barrier type.

.3 Exposed Ducts

.1 Recover ducts exposed to view with 170 g. (6 oz.) canvas secured with white fire retardant lagging adhesive. Finish with brush coat of same adhesive.

3.3 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .2 ASTM C411, Standard 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 C533, Calcium Silicate Block and Pipe Thermal Insulation.
- .5 ASTM C547, Mineral Fiber Pipe Insulation.
- .6 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.2 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
- .4 CAN/ULC-S702.2, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

Part 2 Products

2.1 MATERIALS

.1 All materials shall be equivalent in all respects to specified products and shall be used only in applications intended by the manufacturer. Materials not specifically intended for the purpose shall not be used. Approved materials shall not be diluted or blended with other materials unless specifically recommended by the manufacturer of the approved material.

.2 All final pipe and duct installations including insulation, covering and adhesive shall have a ULC Certified flame spread rating of not greater than 25, and a smoke developed classification of not more than 50.

.3 All canvas shall be treated to be fire retardant in accordance with ULC standards.

.4 Wire to be 1.2mm (18 ga.) stainless steel, dead soft annealed, type 304.

.5 U.L.C. label or satisfactory certified report from approved testing laboratory is required to indicate that fire hazard ratings for materials proposed for use do not exceed those specified.

.6 Flameproofing treatments subject to deterioration due to effects of high humidity are not acceptable.

.7 Consultant reserves the right to demand test samples of components of insulation systems for fire hazard test rating.

2.2 COMPATIBILITY OF COMPONENTS

.1 All adhesives, sealers, vapour coating, mastics, laggings and bedding compounds, shall be compatible with materials to which they are applied. They shall not soften, corrode, or otherwise attack such material in either wet or dry state and shall only be those recommended by manufacturer of insulation as suitable for application proposed. They shall be applied at ambient conditions acceptable to the manufacturer.

2.3 COLD INSULATION - PLUMBING

.1 Material

.1 On pipes 50mm (2") diam. and under, use 12mm (1/2") Fiberglas 112 kg/m(7 lb./cu. ft.) density pipe insulation with ASJ jacket. 13mm (1/2") Armstrong Armaflex AP or Rubatex equal may be used for domestic cold water and cooling coil condensate drains piping only.

.2 On pipes 62mm (2-1/2") diam. and larger, use 25mm (1") Fibreglas 88 kg/m(5-1/2 lb./cu. ft.) density pipe insulation with ASJ jacket, c/w vapor barrier.

.3 Vent piping in cold attics shall be less vapor barrier jacket and wired on.

.2 Location

.1 All domestic cold water piping.

.2 All cooling coil condensate drains.

.3 Vent piping for a developed length of 3m (10'-0') from roof terminals.

.4 Vent piping located in cold attics and in other cold locations.

.5 Sump pump discharge lines that pass through ceiling spaces.

.6 Water meters.

.7 Run outs from mixing valves to shower heads.

2.4 HOT INSULATION - PLUMBING

.1 Material

.1 Fibreglas insulation with all service jacket (ASJ) and self seal lagging adhesive.

.2 On pipes 50mm (2") diam. and under, use 25mm (1") Fibreglas 112 kg/m(7 lb./cu. ft.) density insulation.

.3 On pipes 62mm (2-1/2") diam. and larger, use 38mm (1-1/2") Fibreglas 88 kg/m(5-1/2 lb./cu. ft.) density insulation.

.2 Location

.1 All domestic hot water, and tempered water supply and hot water recirculation piping.

2.5 WHITE PVC INSULATION COVER

.1 Cover insulation and insulated fittings with white PVC fitting covers.

.2 The fitting cover system shall consist of one-piece pre-molded high impact PVC fitting covers with fiber glass inserts and accessories, including elbows, tee/valves, end caps, mechanical line couplings, specialty fittings, jacketing, tacks, and PVC tape.

.3 Cover shall have a flame spread rating of not more than 25 and a smoke developed classification of not more than 50.

.4 Cover shall be resistant to and not promote growth of fungi or bacteria.

.5 Cover shall be UV resistant for use indoors or outdoors. Paint outdoor fittings for further UV and colorfast protection.

.6 Locations

.1 All exposed piping and piping in mechanical room rooms.

Part 3 Execution

3.1 WORKMANSHIP

.1 Work shall be performed by licensed journeymen.

.2 Apply insulation materials, accessories and finishes in accordance with manufacturer's recommendations.

.3 Do not apply coverings until hydrostatic tests have been completed, surfaces are free of grease, scale, moisture, and heat tracing where required has been installed. Insulation shall be clean and dry when installed and during application of any finish.

.4 Apply insulation and coverings to equipment and piping which will operate with hot or warm liquid vapour, while surface is hot. Provide any required temporary heat to accomplish this.

.5 Cold surfaces to be dry and ferrous surfaces to be coated with rust penetrating protective paint before applying insulation and vapour barriers.

.6 Vapour barriers and insulation to be complete over full length of pipe or surface, without penetration for hangers, duct or seams, and without interruption at sleeves, pipe and fittings.

.7 Install insulation with smooth and even surfaces, with round shapes laid to true circular and concentric shape, shaped to blend with fitting insulation and adjacent covering; with full length section and tight to insulated object.

.8 Pack solid around all pipes where they pass through sleeves in walls, floor slabs, etc. for full thickness of floor with fibreglas or rockwool. Refer to firestopping clause where piping passes through fire separations. On all services, carry full insulation thickness through walls, floors, etc. Protect insulation of exposed pipes passing through floors with 1.2mm (18 ga.) galv. iron 150mm (6") from finished floor.

.9 On piping, gouge out insulation for proper fit where there is interference between weld bead and insulation. Bevel insulation away from studs and nuts to permit their removal without damage to insulation. Closely and neatly trim around extending parts of pipe saddles, supports, hangers and clamp guides. Seal with insulating cement.

.10 Use pipe covering protection saddles with roll type hangers unless otherwise indicated.

.11 Butt joints

.1 Place joints on top of duct wherever practical. Butt joints on side of duct for flexible duct insulation.

.2 Adhere and seal laps of vapour barrier cover or vapour barrier strip of 100mm (4") minimum width furnished with insulation, using vapour seal adhesives.

.12 Sagging of duct insulation will not be acceptable.

.13 Stagger both longitudinal and horizontal joints, on duct insulation of multilayered construction.

.14 Duct insulation with vapour barrier shall be continuous, except at fire dampers.

.15 Ducts acoustically lined need no external insulation, unless specifically noted otherwise.

.16 Existing duct and pipe covering damaged or cut back during installation work to be made good with same insulation as specified for new work.

.17 Protect insulation against elements during all stages of application.

.18 Do not cover manufacturer's nameplates. Cut insulation on 45 deg. angle to nameplate edge and seal.

.19 Covering to be uniform in diameter, smooth in finish. Place longitudinal seams so as to be invisible.

3.2 COLD INSULATION - PLUMBING

.1 Fibreglass

.1 Insulate flanges, fittings and valve bodies, etc.

.2 Fasten longitudinal laps with staples and seal with Swifts Adhesive #3218.

.3 Butt joints wrapped with a 100mm (4") strip of ASJ. Stagger joints on multiple layers.

.4 Refinish exposed piping with canvas and coat with Bakor 120-18 white fire retardant lagging adhesive.

.5 All fittings shall be insulated by wrapping with 25mm (1") thick layers of 340 g. (3/4 lb.) density flexible fibreglass attached with jute twine. Surface shall be wrapped with Friction Tape and sealed with and asphaltic sealing compound. Over this to be applied a smooth coating of insulating cement. Recover fittings with ASJ vapour seal jacket and brush coat with fire retardant white lagging adhesive.

.2 Armaflex

.1 Insulate fittings, valve bodies, etc.

.2 All fittings shall be insulated with mitre-cut pieces of Armaflex AP pipe insulation the same size as on adjacent piping.

.3 Seal joints and seams with Armstrong 520 adhesive, and refinish exposed fitting with Armstrong Armaflex finish.

.4 Refinish all exposed piping with two coats of Armstrong Armaflex finish, colour selected by Consultant.

.5 Where Armaflex insulation comes in close contact with adjacent equipment or piping having surface temperatures above 100 deg. C, Section 21 08 10 shall provide additional protection to ensure against deterioration of insulation by heat.

3.3 HOT INSULATION - PLUMBING

.1 Application as per Clause "Cold Insulation - Plumbing".

.2 Insulate flanges, fittings and valve bodies, etc.

.3 Fasten longitudinal laps with staples and seal with Swifts Adhesive #4518.

.4 Butt joints wrapped with a 100mm (4") strip of ASJ. Stagger joints on multiple layers.

.5 On exposed piping refinish with canvas and coat with Bakor 120-18 white fire retardant lagging adhesive.

.6 All fittings shall be insulated by wrapping with 25mm (1") thick layers of 340 g. (3/4 lb.) density flexible fibreglass attached with jute twine. Surface shall be wrapped with Friction Tape and sealed with and asphaltic sealing compound. Recover fittings with ASJ jacket pasted directly over the smooth coat of insulating cement. Finish with brush coat of Bakor 120-18.

3.4 WHITE PVC INSULATION COVER

.1 Preparation

.1 Proto Fitting Covers shall be applied on clean, dry surfaces.

.2 Application

.1 General

.1 The matching fiber glass insert shall either be wrapped completely around the fitting or snugly positioned inside the Proto Fitting cover for proper fit. The insert shall cover the full inner surface area of the Proto Fitting Cover. The Proto Fitting Cover shall then be applied over the fitting and insert, and the throat secured by either tack fastening, taping, sealing with a solvent type PVC adhesive, or banding.

.2 Cold Pipe

.1 Fitting systems below ambient temperature must have a continuous vapor retarder, either with Proto PVC Tape, Proto Butt Strips, Proto PVC Adhesive, or a vapor retarder mastic as specified by the engineer. When using Proto PVC Tape, a 2" (51mm) minimum downward overlap is recommended for optimum performance. Care should be taken not to stretch the last 2" (51mm) of Proto PVC Tape, to avoid stretching or creeping.

.3 Hot Pipe

.1 Insulate as per General Instructions given above. Due to PVC softening point at approximately 150 deg. F (70.6 deg. C), care should be taken to ensure sufficient insulation thicknesses are applied. For hot piping which requires Knauf Pipe insulation over 1-1/2" (38mm) wall thickness, an extra fiber glass insert shall be applied for each additional inch of pipe insulation wall thickness. Knauf recommends the surface temperature of the pipe insulation and PVC to be no higher than 125 deg. F (52 deg. C). To complete application of Proto PVC Fittings on hot piping, the throat seam shall be riveted or tacked.

.4 Outdoor Pipe

.1 Insulate as per above instructions. When installing Proto PVC fittings outdoors, add one layer aluminum foil over the first fiberglass insert applied, making sure the aluminum foil is extended over the adjacent pipe insulation. A second fiber glass insert shall then be applied over the aluminum foil, and the Proto PVC fitting applied.

.2 Minimum Proto PVC jacketing thickness for outdoor application should be .020" (.5mm). The PVC jacketing shall be overlapped a minimum of 2" (51mm) on the down side so as to shed water. Longitudinal joints shall be completely weather sealed with solvent type PVC sealer. Circumferential joints shall be wrapped with a minimum 2" (51mm) wide butt strips and completely sealed using a solvent type PVC sealer. On hot piping, insulation shall be of sufficient thickness to keep the surface temperature below 125 deg. F (52 deg. C). Additionally, a slip type expansion joint of 4" (101mm) minimum width shall be applied at least every 20 lineal feet (6.1 lineal meters).

3.5 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.6 CLEANING

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

.1 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 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.5, Pipe Flanges and Flanged Fittings.

.2 ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.4 ASME B18.2.1, Square and Hex Bolts and Screws 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 B75M, Standard Specification for Seamless Copper Tube.

.4 ASTM B837, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.

.3 Canadian Standards Association (CSA International)

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

.4 Canadian Standards Association (CSA)/Canadian Gas Association (CGA)

.1 CAN/CSA B149.1HB, Natural Gas and Propane Installation Code Handbook.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

Part 2 Products

2.1 PIPE

.1 Pipe

.1 Up to 150mm (6"): - Schedule 40 carbon steel, continuous weld or electric resistance weld pipe conforming to ASTM A53 Grade B.

2.2 FITTINGS

.1 Up to 50mm (2"):

.1 Screwed fittings - 1034 kPa (150 psi) black malleable iron, banded.

.2 Socket weld fittings - 13,800 kPa (2000 psi) forged steel.

.3 Unions - 1034 kPa (150 psi) brass to iron seat.

.4 Thread-O-Lets and Weld-O-Lets to be manufactured to ASTM A181, Grade 1.

2.3 VALVES

.1 Provincial Code approved.

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 PIPING

.1 Install in accordance wit applicable Provincial Codes and CAN/CSA B149.1.

.2 Install drip points:

.1 At low points in piping system.

.2 At connections to equipment.

3.3 CLEANING

.1 Cleaning: in accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.2 ASTM International

.1 ASTM A480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.

.3 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible

.2 SMACNA HVAC Air Duct Leakage Test Manual

.3 SCAQMD Rule 1168, Adhesives and Sealants Applications.Products

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C
125	Unsealed

.2 Seal classification:

.1 Class C: transverse joints and connections made air tight with gaskets and sealant or combination thereof. Longitudinal seams unsealed.

.2 Unsealed seams and joints.

2.2 SEALANT

.1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

2.3 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.4 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows.

- .1 Rectangular: Centreline radius: 1.5 times diameter.
- .2 Round: Centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:

- .1 To 400mm: with single thickness turning vanes.
- .2 Over 400mm: with double thickness turning vanes.

.4 Branches:

- .1 Rectangular main and branch: 45 degrees entry on branch.
- .2 Round main and branch: enter main duct at 45 degrees with conical connection.
- .3 Provide volume control damper in branch duct near connection to main duct.
- .4 Main duct branches: with splitter damper.

.5 Transitions:

- .1 Diverging: 20 degrees maximum included angle.
- .2 Converging: 30 degrees maximum included angle.

.6 Offsets:

- .1 Full radiused elbows as indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.

- .1 Maximum included angles: as for transitions.

2.5 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA.

.3 Joints: to ASHRAE and SMACNA.

2.6 ALUMINUM (LAUNDRY)

.1 To SMACNA. Aluminum type: 3003-H-14.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with ASHRAE, and SMACNA as indicated.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond insulated duct. Ensure diffuser is fully seated.

.3 Support risers in accordance with ASHRAE and SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with ASHRAE and SMACNA as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 SEALING AND TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

3.4 ALUMINUM (LAUNDRY)

.1 Do work in accordance with ASHRAE, and SMACNA as indicated.

.2 Inside of duct to be free of obstructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m2.

2.3 ACCESS DOORS IN DUCTS

.1 Install airtight, 25mm (1") internal glassfiber insulated access doors in ductwork as noted and at all humidifier dispersion tubes, motorized dampers; at inlet and outlet of vaneaxial and axial fans; at inlet of heating coils; at fire dampers and locations noted on drawings.

.2 On duct branches up 150mm x 150 mm (6" x 6") in size access doors at fire dampers, fire/smoke dampers, and smoke detectors shall not be less than 150mm (6") x 150mm (6"). Enlarge duct as required.Turning Vanes

2.4 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.5 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

Part 3 Execution

3.1 INSTALLATION

.1 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.
  - .3 As indicated.
- .2 Length of connection: 100 mm.
- .3 Minimum distance between metal parts when system in operation: 75 mm.
- .4 Install in accordance with recommendations of SMACNA.
- .5 When fan is running:
  - .1 Ducting on sides of flexible connection to be in alignment.
  - .2 Ensure slack material in flexible connection.

.2 Access Doors and Viewing Panels:

- .1 Locations:
  - .1 Fire and smoke dampers.
  - .2 Control dampers.
  - .3 Devices requiring maintenance.
  - .4 Required by code.
  - .5 Reheat coils.
  - .6 Elsewhere as indicated.

.3 Instrument Test Ports:

- .1 General:
  - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .2 Locate to permit easy manipulation of instruments.
- .3 Install insulation port extensions as required.
- .4 Locations:
  - .1 For traverse readings:
    - .1 Ducted inlets to roof and wall exhausters.
    - .2 Inlets and outlets of other fan systems.
    - .3 Main and sub-main ducts.
    - .4 And as indicated.
  - .2 For temperature readings:
    - .1 At outside air intakes.
    - .2 At inlet and outlet of coils.

.3 Downstream of junctions of two converging air streams of different temperatures.

.4 And as indicated.

.4 Turning Vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

3.2 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

.1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside nylon end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

.6 Neoprene gaskets.

Part 3 Execution

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 Dampers: vibration free.

.6 Ensure damper operators are observable and accessible.

3.2 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 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).

1.2 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, bhp, 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.

Part 2 Products

2.1 FANS GENERAL

.1 Motors:

.1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment supplemented as specified herein.

.2 Sizes as specified.

.2 Factory primed before assembly in colour standard to manufacturer.

.3 Scroll casing drains: as indicated.

.4 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.5 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

.6 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

2.2 CEILING FANS

.1 Fan Diameter: 2.10 m (48 in.)

.2 Tube Length: 1.05 m (32 in.)

.3 Color: White/White

.4 Airfoil Material: Aluminum

.5 Number of Airfoils: 3

.6 Motor Type

.1 EC motor with digital inverter drive

.7 Number of Fan Speeds: 7

.8 Controller Features:

.1 Sleep mode

.2 Fan on/off

.3 Timer

.4 Reverse

.9 Operational Temperature Range: -25°C-49°C

.10 Refer to schedule on drawings.

2.3 DIRECT DRIVE SIDEWALL MOUNTED PROPELLER FANS

.1 General Description:

.1 Fan arrangement shall be exhaust

.2 Sidewall mounted applications

.3 Performance capabilities up to 3,349 l/s and static pressure to 160 Pa.

.4 Fans are available in eight sizes with nominal wheel diameters ranging from 200 mm through 600 (8 - 24 unit sizes)

.5 Maximum continuous operating temperature 54.4 Celsius.

.6 Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number

.2 Wheel:

.1 Propeller shall be aluminum blade riveted to steel hub

.2 A standard square key and set screw or tapered bushing shall lock the propeller to the motor shaft

.3 Statically and dynamically balanced in accordance to AMCA Standard 204-05

.4 The propeller and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency

.3 Motors:

.1 Motor Enclosure: Open drip proof - opening in the frame body and or end brackets

.2 Motors are permanently lubricated, sleeve bearing type on sizes 8-12 and ball bearing type on sizes 14-24 to match with the fan load and furnished at the specific voltage and phase

.3 Accessible for maintenance

.4 Drive Frame:

.1 Drive frame assemblies and fan panels shall be galvanized steel

.2 Drive frame shall have welded wire or formed channels and fan panels shall have pre-punched mounting holes, formed flanges and a deep formed one piece inlet venturi.

.5 Options/Accessories:

.1 Mounting:

.1 Fan panel will be mounted vertically directing the air horizontally into the building. Motor and drives will be accessible from the interior of the building

.6 Refer to schedule on drawings.

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, complete with resilient mountings specified in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment, 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 NOT USED.

Part 2 Products

2.1 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.

2.2 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity.

.2 Frames:

.1 Full perimeter gaskets.

.2 Concealed fasteners.

.3 Concealed manual volume control damper operators.

.4 Colour: to be confirmed on shop drawings.

2.3 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.4 SUPPLY GRILLES AND REGISTERS

.1 Refer to schedule on drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturers instructions.

.2 Install with flat head screws in countersunk holes where fastenings are visible.

3.2 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 NOT USED.

Part 2 Products

2.1 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.

2.2 FIXED LOUVRES - ALUMINUM (L-1)

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.

.4 Frame, head, sill and jamb: 150 mm deep one piece extruded aluminum, minimum 3 mm thick[with approved caulking slot, integral to unit.

.5 Mullions: at 1500 mm maximum centres.

.6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 12 mm exhaust 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 Finish: anodized. Colour: to Consultant's approval.

.9 Refer to schedule on drawings.

2.3 LAUNDRY LOUVRES

.1 Material: Anodized aluminium

.2 Integral backdraft damper.

.3 Finish: anodized. Colour: to Consultant's approval.

.4 Refer to schedule on drawings.

Part 3 Execution

3.1 INSTALLATION

.1 In accordance with manufacturer's and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

3.2 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)/CSA Group

.1 ANSI Z21.47/CSA 2.3, Gas-Fired Central Furnaces.

.2 CSA Group

.1 CSA B149.1, Natural Gas and Propane Installation Code.

.2 CSA C22.1, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

Part 2 Products

2.1 GENERAL

.1 Provide CSA approved, packaged factory assembled unit consisting of cabinet, fan, fan motor, intake/exhaust assembly, heat exchanger, combustion chamber, burner, controls, air filter, condensate drain.

.2 Unit shall be rated for site elevation, contractor to confirm exact elevation.

2.2 CAPACITY

.1 FU-1 (Cottage)

.1 Rated for site elevation.

.2 Input: Natural Gas (96% efficient)

.3 Electrical characteristics: 120 V,1 phase, 60 Hz.

.4 Refer to schedule on drawings.

.2 FU-2 (Bunkhouse)

.1 Rated for site elevation.

.2 Input: Natural Gas (96% efficient)

.3 Electrical characteristics: 120 V,1 phase, 60 Hz.

.4 Refer to schedule on drawings.

2.3 TYPE

.1 Downflow type with natural gas burner.

2.4 CABINET

.1 1.0 mm thick minimum steel with baked enamel finish.

.2 Welded steel base for floor type.

.3 Easily removed and secured access doors for components requiring service.

.4 Thermally insulated cabinet.

2.5 HEAT EXCHANGER

.1 Primary: steel tube with stainless steel fins.

.2 Warranty: non-prorated 10 years.

2.6 AIR FILTER(S)

.1 Filter(s): 25 mm thick, glass fiber, disposable type MERV 8 efficiency.

2.7 HEATER BURNER

.1 General: to bear CSA and ULC labels.

2.8 INTAKE AND VENT ASSEMBLY

.1 Provide manufacturer's standard roof separate vent and intake complete with termination assembly for high efficiency gas (condensing) furnace.

.2 CPVC schedule 40 plastic pipe.

2.9 CONDENSATE DRAIN

.1 Provide CPVC condensate drain trap.

2.10 CONTROLS

.1 General: conform to CSA C22.2 No.24.

.2 Gas firing:

.1 Operating controls:

.1 Heating-cooling thermostat.

.2 Electronic pilot ignition.

.3 Manual main shut-off valve, automatic safety pilot, automatic electric valve and gas pressure regulator.

.4 Fan operating control switch with adjustable set points and continuous operating switch.

.2 Safety controls:

.1 Electronic combustion control relay with flame rectification sensor to detect and supervise flame by shutting off fuel upon flame failure or safety interlock signal within seconds, in sequence pre-purge-pilot ignition, supervision-main valve opening-pilot cut-off-burner operation and roll out switch.

.2 Blocked vent shut-off switch or control system.

.3 Limit control to shut down furnace if heat exchanger temperature exceeds limit setting. Combination fan and limit control to be spiral wound.

.4 Door interlock switch on fan compartment access panel to shut down furnace when panel is removed.

.5 Electronic board built-in diagnostics.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions, regulations of authorities having jurisdiction and to CSA B149.1 and Canadian Electric Code.

.2 Provide Consultant written report of test results.

3.2 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 NOT USED.

Part 2 Products

2.1 AIR TO AIR FIXED PLATE EXCHANGER

.1 6" Round Ports

.2 Speed Control on unit: Low and High speeds. Unit to be complete with remote wall controller capable of programmed operation, humidity setpoint, on/off. Each bathroom to have timer switch to start HRV.

.3 Type: Crossflow

.4 Core: Polypropylene

.5 Drains: 1/2" (1.2 cm) fittings with 10 ft. (3 m) PVC drain hose

.6 Mounting: Suspension by chains and springs

.7 Filters: 15 ppi washable reticulated foam

.8 Motor: 1 PSC Motor

.1 Protection type: Thermally protected

.2 Insulation class: B

.9 Unit Electrical Characteristics:

.1 120 volts, 60 Hz, 1.5 amps, 160 watts

.10 Casing: 0.8 mm thick galvanized steel.

.11 Thermal Efficiency: 60%

.12 Refer to schedule on drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Support independently of adjacent ductwork with flexible connections.

3.2 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.2 DESIGN REQUIREMENTS

.1 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01330 - Submittal Procedures.

.2 Final Report: submit report to Departmental Representative.

.1 Include measurements, final settings and certified test results.

.2 Bear signature of commissioning technician and supervisor

.3 Report format to be approved by Departmental Representative before commissioning is started.

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Departmental Representative in accordance with Section 01 78 00 - Closeout Submittals.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.4 CLOSEOUT SUBMITTALS

.1 Provide documentation, O M Manuals, and training of O M personnel for review of Departmental Representative before interim acceptance in accordance with Section 01 78 00 - Closeout Submittals.

1.5 COMMISSIONING

.1 Do commissioning in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements.

1.6 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

.1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

Part 2 Products

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 Instrumentation accuracy tolerances : higher order of magnitude than equipment or system being tested.

.3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.

.4 Locations to be approved, readily accessible and readable.

.5 Application: to conform to normal industry standards.

Part 3 Execution

3.1 PROCEDURES

.1 Test each system independently and then in unison with other related systems.

.2 Commission each system using procedures prescribed by the Consultant.

.3 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.

3.2 TRAINING

.1 In addition to start-up supervision and instruction of Departmental Representative required of individual equipment manufacturers and systems as noted, Contractor's construction supervisor to instruct Departmental Representative in operation and maintenance of all equipment and systems to satisfaction of Consultant.

.2 All instructions to Departmental Representative personnel shall be video taped by the Contractor.

.1 This video will remain property of the Departmental Representative and will be used for the sole purpose of training and orientation of Departmental Representative's maintenance staff.

.2 Instruction shall include visual materials such as drawings, diagrams, and printed handouts.

.3 Instructor(s) shall provide the necessary audio-visual equipment and other aids necessary to convey thorough understanding of system and/or equipment operation and maintenance.

.4 Provide Departmental Representative with one copy of video taped session in digital format. Coordinate with Departmental Representative for final video format.

.3 Review instructions with Departmental Representative to ensure Departmental Representative has a thorough understanding of equipment and its operation.

.4 At minimum contractor shall allow for 8 hours of training with Departmental Representative.

3.3 ADJUSTING

.1 Final adjusting: upon completion of commissioning as reviewed by Consultant, set and lock devices in final position and permanently mark settings.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).

.1 ANSI/ISA 5.5, Graphic Symbols for Process Displays.

.2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).

.1 ANSI/IEEE 260.1, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

.3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.1 ASHRAE STD 135, BACNET - Data Communication Protocol for Building Automation and Control Network.

.4 Canadian Standards Association (CSA International).

.1 CAN/CSA-Z234.1, Canadian Metric Practice Guide.

.5 Consumer Electronics Association (CEA).

.1 CEA-709.1, Control Network Protocol Specification.

.6 Department of Justice Canada (Jus).

.1 Canadian Environmental Assessment Act (CEAA).

.2 Canadian Environmental Protection Act (CEPA).

.7 Electrical and Electronic Manufacturers Association (EEMAC).

.1 EEMAC 2Y-1, Light Gray Colour for Indoor Switch Gear.

.8 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.9 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act (TDGA).

1.2 SYSTEM DESCRIPTION

.1 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:

.1 Building Controllers.

.2 Field control devices.

.3 Complete operating and maintenance manuals.

.4 Training of personnel.

.5 Acceptance tests, technical support during commissioning, full documentation.

.6 Wiring interface co-ordination of equipment supplied by others.

.7 Miscellaneous work as specified in these sections and as indicated.

.2 Design Requirements:

.1 Design and provide conduit and wiring linking elements of system.

.2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by Departmental Representative prior to installation.

.3 Location of controllers as reviewed by Departmental Representative prior to installation.

.4 Metric references: in accordance with CAN/CSA Z234.1.

.3 Language Operating Requirements:

.1 Provide English for all information and systems.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

.1 Have local office within 50km of project staffed by trained personnel capable of providing instruction, routine maintenance and emergency service on systems,

.2 Provide record of successful previous installations submitting tender showing experience with similar installations utilizing computer-based systems.

.3 Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.

.4 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.

Part 2 Products

2.1 EQUIPMENT

.1 Control Network Protocol and Data Communication Protocol: to CEA 709.1 ASHRAE STD 135.

.2 Complete list of equipment and materials to be used on project and forming part of tender documents by adding manufacturer's name, model number and details of materials, and submit for approval.

2.2 ADAPTORS

.1 Provide adaptors between metric and imperial components.

Part 3 Execution

3.1 MANUFACTURER'S RECOMMENDATIONS

.1 Installation: to manufacturer's recommendations.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.2 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and coordinate with requirements in this Section.

.2 Shop Drawings to consist of 3 hard copies and 1 soft copy of design documents, shop drawings, product data and software.

.3 Hard copy to be completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.

.4 Soft copy to be in Microsoft Word latest version format, structured using menu format for easy loading and retrieval on OWS.

1.3 DETAIL SHOP DRAWING REVIEW

.1 Submit detailed shop drawings within 60 working days after award of contract and before start of installation and include following:

.1 Wiring diagrams.

.2 Piping diagrams and hook-ups.

.3 All equipment.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for identification of devices, sensors, wiring tubing, conduit and equipment, for building Energy Monitoring and Control System (EMCS) Work and nameplates materials, colours and lettering sizes.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.1, The Canadian Electrical Code, Part I (19th Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 For acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.4 SYSTEM DESCRIPTION

.1 Language Operating Requirements: provide identification for control items in English.

1.5 EXISTING CONDITIONS – BUILDING LABELLING STANDARDS

.1 The contractor shall review the existing facility labelling standards and shall comply with them. Where there is not a standard or a new condition, the following specification shall be followed.

1.6 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures supplemented and modified by requirements of this Section.

.2 Submit to Departmental Representative for approval samples of nameplates, identification tags and list of proposed wording.

Part 2 Products

2.1 NAMEPLATES FOR PANELS

.1 Identify by Plastic laminate, 3 mm thick black core, square corners, lettering accurately aligned and engraved into core.

.2 Sizes: 25 x 67 mm minimum.

.3 Lettering: minimum 7 mm high, white.

.4 Inscriptions: machine engraved to identify function.

2.2 NAMEPLATES FOR FIELD DEVICES

.1 Identify by plastic encased cards attached by chain.

.2 Sizes: 50 x 100 mm minimum.

.3 Lettering: minimum 5 mm high produced from laser printer in black.

.4 Data to include: point name and point address.

.5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

2.3 WARNING SIGNS

.1 Equipment including motors, starters under remote automatic control: supply and install orange coloured signs warning of automatic starting under control of EMCS.

.2 Sign to read: "Caution: This equipment is under automatic remote control of EMCS".

2.4 WIRING

.1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.

.2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

.3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

2.5 CONDUIT

.1 Colour code EMCS conduit.

.2 Pre-paint box covers and conduit fittings.

.3 Coding: use fluorescent orange paint and confirm colour with Departmental Representative during "Preliminary Design Review".

Part 3 Execution

3.1 NAMEPLATES AND LABELS

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

END OF SECTION

Part 1 General

1.1 References

.1 American National Standards Institute (ANSI).

.1 ANSI C12.7, Requirements for Watthour Meter Sockets.

.2 ANSI/IEEE C57.13, Standard Requirements for Instrument Transformers.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM B148, Standard Specification for Aluminum-Bronze Sand Castings.

.3 National Electrical Manufacturer's Association (NEMA).

.1 NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

.4 Air Movement and Control Association, Inc. (AMCA).

.1 AMCA Standard 500-D-98, Laboratory Method of Testing Dampers For Rating.

.5 Canadian Standards Association (CSA International).

.1 CSA-C22.1, Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant, assembly.

.3 Operating conditions: -25 degrees C - 32 degrees C with 10 - 90% RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

2.2 WIRING

.1 In accordance with Section 26 27 26 - Wiring Devices.

.2 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.

.3 Wiring must be continuous without joints.

2.3 NAMEPLATES FOR PANELS

.1 Identify by Plastic laminate, 3 mm thick black core, square corners, lettering accurately aligned and engraved into core.

.2 Sizes: 25 x 67 mm minimum.

.3 Lettering: minimum 7 mm high, white.

.4 Inscriptions: machine engraved to identify function.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.4 Electrical:

.1 Complete installation in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

3.2 PANELS

.1 Arrange for conduit and tubing entry from top, bottom or either side.

.2 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.3 Identify wiring and conduit clearly.

3.3 NAMEPLATES AND LABELS

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 At minimum detailed narrative description of Sequence of Operation of each system including ramping periods and reset schedules.

.1 Control Description Logic (CDL) for each system.

.2 Input/Output Point Summary Tables for each system.

.3 System Diagrams consisting of the following; EMCS System architectural diagram, Control Design Schematic for each system (as viewed on OWS), System flow diagram for each system with electrical ladder diagram for MCC starter interface.

1.2 REFERENCES

.1 Public Works and Government Services Canada (PWGSC) / Real Property Branch / Architectural and Engineering Services.

.1 MD13800-September 2000, Energy Management and Control Systems (EMCS) Design Manual. English: ftp://ftp.pwgsc.gc.ca/rps/docentre/mechanical/me214-e.pdf

1.3 SEQUENCING

.1 Sequencing of operations for systems as follows:

.1 Ceiling Fans

.1 The fans shall be controlled by the factory provided wall controller.

.2 Furnace (FU-1 & FU-2)

.1 7-day programmable thermostat shall control furnance to maintain space temperature setpoint. Thermostat to have toggle switch to control fan (on-off-auto) and toggle switch to control heating (on-off).

.3 HRV (HRV-1 & HRV-2)

.1 HRV controller and bathroom timer switches to control HRV.

.4 Pumps

.1 Sump pump controls are packaged with pump. Sump pump to have local audible high water alarm.

.5 Crawlspace Ventilation

.1 The exhaust fan shall operate on a demand from a dehumidistat located in the space.

.2 Prior to exhaust fan start motorized damper shall open.

.3 When exhaust fan is off motorized damper shall close.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section Includes:

.1 General requirements that are common to sections found in Division 26 – Electrical, and 28 – Electronic Safety and Security.

.2 This Section covers items common to Section of Division 26. This section supplements requirements of Division 1.

.3 All drawings and all sections of the specification shall apply to and form an integral part of this section.

.4 Carefully examine all plans and specifications pertaining to this Contract and become familiar with all details. Visit the site and determine all factors affecting this section of the work and include all costs for same in tender.

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 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 American National Standards Institute/ International Electrical Testing Association (ANSI/NETA)

.1 ANSI/NETA Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.

.3 The electrical installation shall comply with the requirements of the Electrical Supply Authority, the latest edition of the Canadian Electrical Code, latest edition of referenced standards, with all Provincial and Municipal Laws, Rules and Ordinances, and to the satisfaction of those persons having jurisdiction over same.

.4 Notify the Departmental Representativeof any discrepancies or conflictions with any regulation seven (7) working days before tenders close. Failing such notification, meet all such requirements without change to the contract price.

.5 In no instance shall the standard established by these specifications and drawings be reduced by any of the codes, rules or ordinances.

.6 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

1.3 REQUEST FOR INTERPRETATION PROCESS

.1 General:

.1 Refer applicable requirements in Division 01.

.2 Immediately on discovery of the need for interpretation of the Contract Documents, Contractor shall prepare and submit an RFI to the Departmental Representative.

.3 Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

.4 For RFIs submitted electronically, include project name and RFI number in subject line of email.

.2 Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

.1 Project name (including building number).

.2 Project number.

.3 Date.

.4 Name of Contractor.

.5 Name of Departmental Representative.

.6 RFI number, numbered sequentially. (eg: RFI-001)

.7 RFI subject.

.8 Specification Section number, title and related paragraphs, as appropriate.

.9 Drawing number and detail references, as appropriate.

.10 Field dimensions and conditions, as appropriate.

.11 Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Price, Contractor shall state impact in the RFI.

.12 Contractor's signature.

.13 Attachments: Include sketches, descriptions, measurements, photos, product data, shop drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

.1 Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

.3 RFI Forms: Contractor generated form including all content indicated in this Section.

.1 Form and attachments shall be electronic files in Adobe Acrobat PDF format.

.4 Derpartmental Representative's Action: Departmental Representativewill review each RFI, determine action required, and respond. Allow 10 working days for Departmental Representative's response for each RFI. RFIs received by

Departmental Representativeafter 1:00 p.m. will be considered as received the following working day.

.1 The following Contractor-generated RFIs will be returned without action:

.1 Requests for approval of submittals.

.2 Requests for approval of substitutions.

.3 Requests for approval of Contractor's means and methods.

.4 Requests for approval of corrective actions for deficient work.

.5 Requests for coordination information already indicated in the Contract Documents.

.6 Requests for adjustments in the Contract Time or the Contract Sum.

.7 Requests for interpretation of Departmental Representative's actions on submittals.

.8 Incomplete RFIs or inaccurately prepared RFIs.

.2 Departmental Representative's action may include a request for additional information, in which case Departmental Representative's time for response will date from time of receipt of additional information.

.3 If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Deptarmental Representative in writing within 10 days of receipt of the RFI response. Failure to notify will result in the work being included as part of the contract.

.5 RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log with progress meeting minutes. Include the following:

.1 Project name.

.2 Name and address of Contractor.

.3 Name and address of Departmental Representative.

.4 RFI number including RFIs that were returned without action or withdrawn.

.5 RFI description.

.6 Date the RFI was submitted.

.7 Date Departmental Representative's response was received.

.6 On receipt of Departmental Representativeaction, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Departmental Representativewithin 10 days if Contractor disagrees with response.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit for review single line electrical diagrams under plexiglass and locate as indicated.

.1 Electrical distribution system in main electrical room.

.4 Submit for review fire alarm riser diagram, plan and zoning of building under plexiglass at fire alarm control panel and annunciator.

.5 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.

.2 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.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 Submit copies of drawings and product data to authority having jurisdiction.

.6 If changes are required, notify Departmental Representativeof these changes before they are made.

.6 Certificates:

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for 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 to Departmental Representative.

.7 Manufacturer's Field Reports: submit to Departmental Representativemanufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.5 COORDINATION

.1 The Contractor is responsible for installing a complete, fully functional and fully operational system, and is responsible for reviewing all other trades’ drawings to ensure all electrical requirements are included in the tender price. Inform the Departmental Representativeof any discrepancies during the tender process.

Any discrepancies not identified, shall be incorporated by the Contractor at no cost during construction.

.2 The Contractor is responsible for coordination with all other trades and Contractors on site.

.3 Through the General Contractor, coordination shall include regular meetings, exchange of shop drawings and other technical information. Compile working combined systems drawings, where parts of the installation are complex or require input of several trades. Ensure the General Contractor is in attendance and is aware of all coordination. Obtain and exchange schedules with all other trades and Contractors to ensure work which impacts another trade or Contract is completed in sufficient time.

.4 All work is to be properly phased to enhance coordination. Where it is evident that work outside of phase has inhibited the work of another Contractor, the Departmental representativeshall reserve the right to instruct the Contractor to remove said work at the cost of the Contractor.

1.6 DRAWINGS

.1 Drawings are intended to communicate the general design intent. They are not to be interpreted as a description of means and methods of construction. The Contractor is responsible for reviewing the drawings and specifications of this and all other trades on the project to ensure that they deliver a fully coordinated, complete and fully operational system. Any component or service not described, but reasonably obvious as required for completion shall be included by the Contractor at no cost.

.2 Carefully examine all drawings and specifications relating to all work (including, but not limited to, all other disciplines' drawings and specs), and all electrical work indicated thereon shall be considered as a part of the work by this section unless indicated otherwise. Prior to the date of the last addendum report at once to the Departmental Representative, any defect, discrepancy, omission or interference affecting the work of this section, or the guarantee of same.

.3 Install all equipment as shown or as specified and in accordance with manufacturer's approved shop drawings.

.4 The drawings accompanying these specifications are intended to show the general arrangement and extent of the work to be carried out, but the exact location and arrangement of all parts shall be determined as the work progresses. The location of equipment, outlets, etc., as given on the drawings are approximately correct, but it shall be understood that they are subject to such modifications as may be found necessary or desirable at the time of installation to meet any structural or architectural requirements. Such changes shall be implemented as directed by the Departmental Representative, without additional charge.

.5 Electrical drawings do not show all structural and other details. Architectural and structural conditions shall govern, and this Section shall make without charge, changes or additions to accommodate these conditions. Check all architectural

plans, elevations and details for location of electrical devices, equipment and equipment to be connected.

.6 Where drawings indicate the general location and route to be followed by conduit, cable, etc., these locations must be governed by job conditions. Where the required conduit, cable, and boxes are not shown on drawings or only shown diagrammatically, they shall be installed to conserve maximum head room and interfere as little as possible with free use of space through which they pass. Maximum clearance above floor shall be maintained under all suspended conduit and equipment, unless otherwise shown on the drawings, or approved by the Departmental representative.

.7 Submit a complete set of drawings for the proposed installation to the Inspection Department having jurisdiction and receive written approval before installation or fabrication of any equipment. No extra compensation will be allowed for any changes or rearrangement of any electrical apparatus or materials necessary due to failure to receive this approval.

.8 Provide the Electric Utility with three copies of a drawing showing the main distribution and the proposed method of metering for approval prior to the manufacture of equipment.

1.7 COORDINATION OF EQUIPMENT AND SERVICES IN ABOVE-CEILING SPACES AND SERVICE ROOMS

.1 Coordinate installation of equipment and services in above-ceiling spaces and service rooms with other trades.

.2 Install equipment and services in such way to utilize spaces efficiently and to maximize accessibility for installations and maintenance of equipment and services of all trades. Review requirements of other trades. Consider required clearances for maintenance and repairs of equipment provided by other trades.

.3 Examine contract documents for ceiling space. Examine structural, architectural and mechanical obstructions. Examine manufacturer’s requirements for maintenance.

.4 Examine shop drawings of equipment of other trades.

.5 Assign space priorities and lay out equipment and route services so they can be installed efficiently in these spaces and provide code-compliant access to equipment and services for maintenance.

.6 The location of equipment in ceiling spaces shall be such that it can be accessed for maintenance from a location immediately below the equipment, by two hands at a time, by removal of a ceiling tile or an access panel.

.7 All above-ceiling installed equipment shall be located such that there is no interference with furniture and equipment in spaces below ceiling or above-ceiling mechanical and electrical systems.

.8 Where access to equipment or service is required for maintenance, removal or relocation of another equipment or service shall not be required.

1.8 PENETRATIONS IN STRUCTURAL MEMBERS

.1 Penetrations in existing structural members.

.1 Provide electrical services through structural members as shown on drawings.

.2 Penetrations in new structural members.

.1 Coordinate work with structural for penetrations through new structural members.

.2 Review structural drawings.

.3 Coordinate shop drawings to include for penetrations of electrical services through structural members. Review structural shop drawings prior to submission to Structural Departmental Representativefor review.

.3 Installations that deviate from structural drawings are not acceptable.

.4 Submit proposals for deviations to Departmental Representativefor review.

1.9 TEMPORARY LIGHTING AND POWER

.1 All temporary and construction lighting and power work and costs for same are not included as part of the scope of the work of this section. Refer to such clauses in other sections of the specification.

1.10 AS-BUILT DRAWINGS INDICATING CONDUIT/CABLE RUNS & EQUIPMENT LOCATIONS

.1 Record the horizontal and vertical routing of all electrical cables and conduits installed under this Contract. This includes the entire electrical distribution, all Div. 26, 28 electrical systems, and lighting.

.2 As-built drawing information shall be organized and presented as follows. Each of the following groups of systems shall be recorded on separate As-built drawing sets. Do not 'crowd' drawings with as-built record information. Use additional drawing prints as required. In addition to the plan As-built drawings, provide supplemental riser schematics for clarity. As-built drawings to include the following:

.1 Power: Power and receptacles for all cable/wiring 120 Volts or greater excluding lighting.

.2 Lighting: Normal and night lights, exit lights.

.3 Low voltage lighting control system.

.4 Battery bank lighting system (DC wiring).

.5 Voice/data, and other data communication systems.

.6 Fire alarm and door security systems.

.7 Conduits, wiring sizes and quantity and actual route for each system.

.3 Record the location of the following: All power distribution equipment, cable splices, pull boxes, junction boxes, access fittings, power supplies and system control equipment, furniture whips, etc.

.4 As work progresses, record on one (1) set of contract drawings, installed conduit layout as well as any approved changes and deviations from the original contract and/or working drawings, including outlets, equipment and panel locations. Have these drawings available for reference and observation at all times.

1.11 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 equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse by manufacturer of packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, 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 labels for control items in English and French.

.4 Use one nameplate label for each language.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from authority having jurisdiction 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.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Provide wiring to thermostats for unit heaters as required.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction.

.2 Decal signs, minimum size 175 x 250 mm.

2.5 WORKMANSHIP AND MATERIALS

.1 The installation shall consist of material and equipment specified unless as provided herein. Electrical equipment provided under this contract shall be built in accordance with EEMAC standards and shall be C.S.A. certified (or certified by an equivalent recognized certifying agency to meet Canadian Standards) and/or locally approved. All equipment supplied under this contract shall be new and the best of its respective kind and of uniform pattern throughout.

.2 Any material or equipment ordered or installed without the Departmental Representative's prior approval shall, if so directed by the Departmental Representative, be removed and replaced with approved material or equipment without a change to the contract.

.3 Replace inferior work if so ordered by Departmental representativewithout a change to the contract.

.4 Retain same foreman or superintendent on the job until completed, unless otherwise directed by the Departmental representative.

.5 All tradesmen shall carry all tools on their person at all times. Any tool not in use shall be under lock and key in an area authorized by the building supervisor.

2.6 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.7 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates labels as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, black face, white core, lettering accurately aligned and engraved into core.

.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 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Departmental Representativeprior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

.8 Room names and numbers used shall be actual room names and numbers that will be used on the project. Co-ordinate and confirm with trades involved.

.9 Co-ordinate names of equipment and systems with Mechanical section to ensure that identical names are used.

.10 Nameplates for control devices: indicate equipment controlled.

.11 Adjacent to each breaker in CDP type panelboards, provide and mount lamacoid nameplates identifying the respective load and location.

.12 Receptacle Identification

.1 All convenience receptacles shall have a lamacoid size 1 plate on which the panel and circuit number from which it is fed, is indicated. The identification shall be mechanically secured to the coverplate on the appropriate outlet. Pressure indented adhesive strip nameplates are not acceptable and shall not be used.

.13 Wiring Identification

.1 Identify wiring with permanent indelible identifying markings on both ends of phase conductors of feeders (coloured plastic tapes) and branch circuit wiring (numbered wire markers). Conductor marker identification shall correspond with panel or terminal board directory information.

.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. Colour coding used shall be documented by individual systems in Maintenance Manuals.

.5 Insulated grounding conductors shall have a green finish and shall be used only as a grounding conductor.

.14 Conduit and Cable Identification

.1 Confirm identification method with Departmental Representativeprior to start of work.

.2 Identify conduit and cables as follows:

.1 At entry to and exit from equipment, within 300mm from equipment, including pull boxes and junction boxes.

.2 At penetrations through walls, ceilings, floors, at each side, within 300mm from penetration.

.3 At every 10m along the run.

.4 Label indoor and outdoor installation.

~~.5~~ Provide self adhesive vinyl labels, UV resistant, with following wording, as applicable:

.1 For normal power: “NORMAL POWER, 120/208V”, or with an appropriate voltage.

.2 VOICE

.3 DATA

.4 Other communication systems, label as required

.5 DC EMERGENCY LIGHTING

.6 CONTROLS

.7 FIBRE OPTIC

.8 Other systems, label as required.

.6 Label sizes per following table.

Outside Conduit/Cable Diameter		Minimum Length Label		Minimum Letter Height	
Inches	mm	Inches	mm	Inches	mm
.75-1.25	19-32	4	100	0.5	13
1.5-2	38-51	4	100	0.75	19
2.5-6	64-152	6	150	1.25	32

.7 Provide larger label to suit wording as required.

.8 Label colors

.1 Black letters on orange background. Wording shall be uppercase.

.9 Labels installed outdoors shall be rated for outdoor applications.

.10 Labels shall be manufactured in accordance to ANSI Z535.4 Product Safety Signs & Labels.

.3 Branch circuit junction box identification

.1 Show circuit numbers in black felt marker on inside of covers.

.15 Equipment serviced by underground conductors

.1 Identify all new equipment serviced by underground conductors of #1/0 AWG and larger conductors.

.1 Provide permanently secured lamacoid posted on or near each electrical distribution, service box or overcurrent device equipment cover.

.2 Label size shall be minimum size 76mm x 127mm and shall indicate the following:

UNDERGROUND CONDUCTORS			
CIRCUIT I.D.	_____		
YEAR INSTALLED	_____		
INSTALLED PER DIAGRAM	_____	DETAIL	_____
RATED PER TABLE	_____		
SIZE/TYPE OF CONDUCTOR	_____		
AMPACITY	_____	MAX. OVERCURRENT	_____

.16 Underground conductors

.1 Underground warning tape

.1 Identify underground power, lighting, control, communications and fibre optic conductors with underground warning tape.

.2 Polyethylene tape, minimum 76mm wide.

.3 Printing on tape shall be permanent and shall not be damaged by burial operations.

.4 Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

.2 Power and lighting conductors:

.1 Red tape with black wording: "CAUTION - BURIED ELECTRIC CABLE BELOW".

.3 Telephone conductors:

.1 Orange tape with black wording: "CAUTION - BURIED TELEPHONE LINE BELOW".

.4 Fibre optic conductors:

.1 Orange tape with black wording: "CAUTION - BURIED FIBRE OPTIC LINE BELOW".

.5 Install tape along entire conductor run, at half depth, between finished grade and underground conductors.

.6 Concrete cable markers

.1 Size: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.

.2 Mark cable every 150 m along runs and changes in direction.

.3 Where markers are removed to permit installation of additional cables, reinstall existing markers.

.4 Lay concrete markers flat and centred over cable with top flush with finished grade.

.17 Identification Of Workplace Clearance

.1 Identification on equipment

.1 Provide adhesive-backed vinyl on equipment, 3.5 mil thick, minimum size 76mm x 127mm , yellow background with black letters, with wording: "WARNING - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 1 METER."

.2 Identification on floor

.1 Floor warning tape: Pressure sensitive vinyl, with overlaminate and self-adhesive.

.1 Color: Yellow and black diagonal stripes.

.2 Size: Rolls - 51mm wide, 5-mil thick.

.2 Verify that surfaces to receive tape have been finished, and that substrate finishes are dry and correctly cured.

.3 Install floor tape at locations shown on drawings.

2.8 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.

2.9 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	
Other Security Systems	Red	Yellow

2.10 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" .

.2 Paint indoor switchgear and distribution enclosures light gray.

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 equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representativeof 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 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.2 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.

.3 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.4 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.5 Arrange for holes through exterior wall and roof to be flashed and made weatherproof.

.6 All conduits to be hidden in all locations except mechanical and electrical rooms.

.7 Redundant, unused or empty conduits, raceways, cable trays, supports, junction and pull boxes and other equipment, including associated cables and wiring, that was installed under this project but was not used shall be removed from the site unless otherwise noted. Where conduits, raceways, cable trays, supports, junction and pull boxes and other equipment, including associated cables and wiring, were required to be installed to facilitate construction work, such as temporary feeds these shall be removed from the site unless otherwise noted.

3.5 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.

3.6 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. Verify equipment heights with Department Representative prior to rough-in.

- .1 Local switches: 1100 mm.
- .2 Wall receptacles:
  - .1 General: 400 mm.
- .3 Voice/data: 400mm.
- .4 Fire alarm pull stations: 1200mm.
- .5 Fire alarm pre-acknowledge buttons: 1200mm.
- .6 Fire alarm audible devices:
  - .1 Not less than 2300mm above the finished floor level. Shall be installed at least 150mm below the ceiling, measured to the top edge of the device.
  - .2 If ceilings are lower than 2300mm, install device at least 150 mm below the ceiling, measured to the top edge of the device.
  - .3 No point of device shall be lower than 2000mm above finished floor.
- .7 Fire alarm visible devices:
  - .1 Shall be installed such that the entire lens is not less that 2000mm and not more than 2400mm above finished floor.
  - .2 No point of device shall be lower than 2000mm above finished floor.
- .8 Fire alarm combination audible/visible devices:
  - .1 Where ceiling heights allow, install so that the top of the device will not be less than 2300mm above the finished floor level.
  - .2 Shall be installed at least 150mm below the ceiling, measured to the top edge of the device.
  - .3 If ceilings are lower than 2300mm, install device at least 150mm below the ceiling, measured to the top edge of the device.
  - .4 No point of device shall be lower than 2000mm above finished floor.

.9 End-of-line resistors: 1800mm to the top edge of the device.

.10 Television outlets: 400mm.

.4 All controls for the operation of building services or safety devices including electrical switches, thermostats, card access readers, door security request to exit pushbuttons, fire alarm pull stations, etc. that are intended to be operated by the occupant, must comply with the Accessible design for the built-environment CSA B651.

3.7 FIELD QUALITY CONTROL

.1 General

.1 This Section specifies general requirements common to all starting and testing of electrical equipment and systems. Read this Section in conjunction with related Sections which specify specific portions of electrical starting and testing work.

.2 Except where otherwise specified, arrange and pay for the testing and related requirements specified in this and related Sections.

.3 If test results do not conform with applicable requirements, repair, replace, or adjust or balance equipment and systems. Repeat testing as necessary until acceptable results are achieved.

.1 Prior to testing ensure all electrical equipment is cleaned and free of dust.

.2 After testing, protect equipment subject to dust from construction activities.

.3 Do not conceal or cover equipment until observed and approved by Departmental Representative.

.4 Assume all liabilities associated with starting, testing and balancing procedures.

.5 Assume all costs associated with starting, testing, adjusting and balancing, including supply of testing equipment and witnessing.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Coordinate starting of electrical equipment and systems with other Divisions.

.6 Notify Departmental Representativewhen starting and testing of all systems has been completed.

.7 Upon completion of the work and adjustments of all equipment, all systems shall be operated in the presence of the Departmental Representativeto demonstrate that all equipment furnished and installed or connected as part of this section of the contract shall function in the required manner as determined by the Departmental Representative. The Departmental Representativemay elect to not attend demonstration.

.2 Reference Documents

.1 Perform tests in accordance with:

.1 These Contract Documents

.2 Requirements of authorities having jurisdiction

.3 Manufacturer's published instructions

.4 CAN/ULC S537 - Verification of Fire Alarm Systems

.5 NETA Standard For Acceptance Testing Specifications for Electrical Power Equipment and Systems

.6 Other applicable standards

.2 If requirements of any of the foregoing are in conflict, notify Departmental Representativebefore proceeding with tests and obtain clarification.

.3 Witnessing of starting and testing on site

.1 Where any equipment or systems requires testing prior to starting, ensure that such work has been completed prior to starting of electrical equipment and systems.

.2 Prior to starting and testing of electrical equipment or systems, prepare a start-up and testing schedule of all tests specified.

.3 Review schedules with Departmental Representative. Provide a complete schedule to the Departmental Representativea minimum 2 weeks prior to commencement of testing.

.4 Advise Departmental Representativeof dates and times for all testing with sufficient advance notice (minimum five working days) to allow Departmental Representativeto make arrangements to attend.

.5 Departmental Representativeor the Departmental Representative may witness all or any portion of testing and starting procedures performed by Contractor or Contractor's Testing Agent.

.6 Contractor shall be present for all tests specified, even where test is being performed by a supplier or sub-contractor.

.4 Manufacturer's Starting Recommendations

.1 Prior to starting equipment or systems, obtain and review manufacturer's installation, operation and starting instructions.

.2 Use manufacturer's and supplier's starting personnel where required to maintain validity of manufacturer's warranty. Confirm with manufacturer that all testing specified in this Section will not void any warranties.

.3 Compare installation to manufacturer's published data and record discrepancies. Modify procedures detrimental to equipment performance prior to starting equipment.

.5 Manufacturer's Field Services

.1 Arrange and pay for qualified manufacturer's representatives to supervise starting and testing of equipment and systems when in the opinion of the manufacturer such representatives are necessary for the supervision of the starting and the testing.

.2 Manufacturer's personnel shall be experienced in design and operation of equipment and systems being started and have ability to interpret results of readings, and tests and report results in a logical fashion.

.3 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 SUBMITTALS.

.4 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for observation of product installation in accordance with manufacturer's instructions.

.6 Contractor’s and Manufacturer’s Reports

.1 Submit for Departmental Representative’s review completed test report forms in PDF file format immediately after each test is completed.

.2 After a test has been successfully completed, each test report shall contain a summary which clearly states that all results were satisfactory.

.3 Record all data gathered on site on test report forms.

.4 Obtain test report forms from equipment manufacturers. When test report forms are not available of specific tests are requested in this specification create your own test report forms based on those requirements. Where applicable, create test report forms based on samples provided in this specification.

.5 Provide testing personnel names and signatures and date and time of testing.

.6 Note any damage, missing parts or incomplete work on test form.

.7 Record date of corrected deficiencies on form.

.8 Maintain one copy on site of all data taken during starting and testing period.

.9 Maintain one copy of all final starting, testing, balancing and adjusting reports on site up to interim acceptance of the work for reference purposes.

.10 Arrange for manufacturer to submit copies of all production test records for production tests required by EEMAC and CSA standards for manufactured electrical equipment to the Departmental Representativeprior to shipping.

.11 Arrange for manufacturer to submit certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.12 Insert final test results, check lists, programming details and certifications in Maintenance Manuals.

.13 Provide calibration certificates for each test equipment.

.7 Test Equipment

.1 Provide all required test equipment.

.2 Test equipment must be calibrated within one year of testing.

.8 Departmental Representative's Testing Agent(s)

.1 The Departmental Representative, at his option, may arrange for services of a performance testing agent to separately test or re-test electrical equipment or systems.

.2 Performance testing agent may witness any or all tests or start-ups which are the responsibility of the Contractor.

.3 Performance testing of any system by the Departmental Representativedoes not reduce the Contractors obligations for complete testing and start-up of systems as specified.

.9 Starting 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.

.2 Measure and record operating load amp readings for all motors.

.10 Correction Of Deficiencies

.1 Correct all contract deficiencies found during electrical starting and testing of equipment and systems and Departmental Representative's performance verification.

.11 Testing After Project Completion

.1 Return to site three (3) months after completion to perform load balance, power factor and voltage testing.

.2 Provide test reports and provide corrective actions as required by this specification.

.12 Basic Testing

.1 Perform the following testing:

.2 Bolted Conductor Terminations Testing

.1 Bolted conductor terminations shall be tightened to manufacturer’s published torque values using torque tools.

.2 Torque tools shall be calibrated not more than one year before the date of use.

.3 Obtain torque values from equipment manufacturer.

.4 In absence of manufacturer’s published torque values, use recommended tightening torque values from Canadian Electrical Code.

.5 Report to include following:

.1 Project name _____

.2 Project # _____

.3 Provide completed form as sample below.

.4 After all terminations have been completed, provide summary in the report to clearly state that all terminations are completed per manufacturer's (or Code) recommendations.

.5 Provide details if torque values deviate from manufacturer's or Code recommended values.

.6 Submit tool calibration certificate with report.

.7 Table 1. Sample form

Equipment name and rating	Phase	Bus bar	Terminal Block	Conductor Lug	Bolt Size	Torque Value	Date	Technician Name
CDP-A 400A/240V/1ph/3W	A			X	½" x 2"	50ft/lbs	Nov 2/14	John Smith
	B			X	½" x 2"	50ft/lbs	Nov 2/14	
All terminations are completed per manufacturer's recommendations.								John Smith

.3 Load Balance and Adjusting

.1 Test load balance on all feeders for distribution centres (CDP's), and panelboards.

.2 Perform load tests with as many loads on as possible and make necessary reconnection of single phase loads from one leg or phase to another to balance the load on legs or phases as nearly as possible.

.3 Revise equipment directories and wiring identification accordingly.

.4 Record all changes on Record Drawings.

.5 Submit, at completion of work, report listing phase and neutral currents on CDP's and panelboards operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

.4 Voltage Testing and Adjusting

.1 Test and record voltage at service entry point, CDP's, panelboards and loads, operating under normal load.

.2 Record all changes on Record Drawings.

.3 Submit, at completion of work, report listing phase and neutral voltages at each location tested. State hour and date on which each load was measured, and voltage at time of test.

.5 Insulation resistance testing:

.1 Branch circuits and feeders rated 1000V and less:

.1 Rated up to 350V with a 500V instrument.

.6 Test all circuits and wires for continuity and high impedance grounds.

.7 Those circuits which test non-continuous, with an insulation resistance less than minimum recommended resistance or with high impedance grounds shall be replaced.

.8 All circuits shall be tested to ensure that the circuit numbers are correct and that the proper neutral conductors have been provided and installed.

.9 Test ground rods resistance.

.13 Fire Alarm System Testing And Verification

.1 The Contractor is responsible for retaining, testing and verification of fire alarm system, by a licensed engineer registered to practice in Alberta, in accordance with:

.1 CAN/ULC-S537, "Verification of Fire Alarm System Installations", and

.2 Requirements of authority having jurisdiction.

.2 Submit a stamped testing and verification report to Departmental Representativefor review. Testing and Reports to be stamped by a licensed Engineer, registered to practice in the province of Alberta

3.8 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay all associated fees for inspection of the work by authorities having jurisdiction.

.3 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work to Departmental Representative. Copies to be included in Maintenance Manuals.

3.9 RESPONSIBILITY

.1 Be responsible for any damage caused to the Departmental representative, or their Contractors due to improperly carrying out this work.

.2 Install all components of this work promptly and where applicable, in advance of concrete pouring, or similar construction. Provide and set in the proper sequence of construction, all sleeves, hangers, inserts, etc. and arrange for all necessary openings, where required to accommodate the electrical installation.

.3 Work shall be arranged in co-operation with other Divisions of this specification in such a manner that it doesn't interfere with the progress of the project. In areas where ducts or pipes must be installed along with conduit or cable, co-operate with other divisions so that the finished job will represent the most efficient use of the space.

.4 In no case proceed with any work in uncertainty. Obtain, from the Departmental representative, any clarification necessary and thoroughly understand all portions of the work to be performed.

3.10 MODIFICATIONS

.1 Locations of all light fixtures, convenience receptacles, outlets, switches, voice/data or similar outlets, etc. are subject to modification by the Departmental representative, who reserves the right to move these up to 3000 mm from the position shown, without change to the contract price, provided notice is given before the related work has commenced.

3.11 GUARANTEE

.1 Guarantee the satisfactory operation of all work and equipment supplied and installed as a part of this section of the specifications.

.2 Replace forthwith, at no additional material or labour cost, any part which may fail, or prove defective within a period of twelve (12) calendar months after the final acceptance of the complete installation, provided that such failure is not due to improper usage, or ordinary wear and tear.

.3 No certificate given, payment made, partial or entire use of the equipment by the Departmental Representative or his representative shall be construed as acceptance of defective workmanship or materials.

.4 This general guarantee shall not act as a waiver of any specified guarantee or special equipment guarantees covering a greater length of time.

3.12 FIREPROOFING

.1 Where cables or conduits pass through floors, block or concrete walls and fire rated walls, seal openings with ULC rated fireproofing product, to maintain fire rating.

.2 Seal all holes resulting from removal of cables, conduits and equipment.

.3 Fireproofing of electrical cables, conduits, etc. passing through fire barriers shall conform to local codes and inspection authorities.

3.13 EQUIPMENT SECURITY

.1 Provide temporary locking system, comprising of padlocks, equipment door locks, keys, etc. during construction period, to prevent unauthorized access to components within equipment.

.2 Equipment doors shall be kept locked (with keys removed from padlocks and locks) at all times, except when work is performed on actual equipment.

.3 At completion of work, remove temporary locking system from equipment.

.4 Equipment door locks and keys provided by equipment manufacturers to remain. Hand over to Departmental Representative such keys, tagged with equipment names.

.5 New locking system, after completion of work, shall be provided by Departmental Representative.

.6 In cases where Departmental Representative enters into maintenance agreement with utility, typically the utility provides own locking system for that equipment. Coordinate work with utility and the Departmental Representative.

.7 No equipment shall remain without means for locking at any time.

3.14 SYSTEM STARTUP

.1 Instruct Departmental Representative operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.15 INTERIM AND FINAL OCCUPANCY CERTIFICATION BY DEPARTMENTAL REPRESENTATIVE

.1 Interim Occupancy Certification

.1 When final occupancy is not practical due to project phasing or Departmental representative’s requirements an interim occupancy may be granted for a finished portion of the site.

.2 A Certification letter for Interim Occupancy, will be issued to the Authority Having Jurisdiction (AHJ), by the Departmental representative, under seal of a Professional Engineer solely for the purpose of applying for Interim Building Occupancy Permit, under following conditions:

.1 The construction was carried out in substantial compliance with the applicable provisions of the Electrical STANDATA, the Alberta Building Code and the National Energy Code for Buildings and the plans and specifications submitted in support of the application for the building permit. This shall include any additional plans, documents and design decisions that have been part of the contract that were not detailed as part of the submitted permit application.

.2 Life safety systems for the entire structure (occupied and non occupied areas) must be completed entirely. This shall include but not limited to the following (all systems may not apply):

.1 Fire Alarm System

.1 Fire alarm control panel and associated devices and auxiliaries

.2 A certified fire alarm verification report shall be submitted 3 working days before the date the Letter

of Certification is required. Including Schedule A where applicable.

.2 Emergency Lighting

.1 Emergency AC lights

.2 Emergency DC lights

.3 Exit signs

.4 Emergency battery packs

.5 General lighting

.6 Lighting controls

.3 Distribution breakers shall be set to the approved coordination study.

.4 No open wiring shall be present, all terminations shall be installed in a box with cover.

.5 All electrical installations shall be made safe.

.6 All applicable life safety systems shall be fully commissioned, tested and certified by respective testing agencies.

.7 Certification sheets and test reports shall be submitted to Departmental Representative with no deficiencies.

.8 Electrical and Building permit numbers, project name and address shall be submitted to Departmental Representative.

.9 All Observation Reports shall be submitted to the Departmental Representative, clearly indicating that all deficiencies relating to any of the above are complete. Any items not completed shall be clearly indicated, and the Contractor shall provide a date indicating when the work will be complete.

.2 The interim occupancy certification letter will not be issued until all information required above, including final certification sheets and test reports are received by Departmental representative, with no deficiencies.

.3 The interim occupancy certification letter will state the applicable non-life-safety exceptions and points of non-compliance with the Electrical By-laws, the Alberta Building Code and the National Energy Code for Buildings.

.4 The letter will also state how long the building may be occupied under these conditions, without compromising the health or safety of occupants.

.5 The decision as to whether the Letter of Certification for Interim Occupancy is to be issued lies entirely with the Departmental representative, and it is incumbent on the Contractor to successfully demonstrate to the satisfaction of the Departmental Representativethat the building is ready for Interim Occupancy. Ultimately, once the Letter of Certification for Interim Occupancy is provided to the AHJ, the decision as to whether an Interim Building Occupancy Permit is to be granted lies with the AHJ.

.6 Final Occupancy Certification

.1 A Certification letter for Final Occupancy, shall be issued to the Authority Having Jurisdiction (AHJ), by the Departmental representative, under seal of a Professional Engineer solely for the purpose of applying for Final Building Occupancy Permit, under following conditions:

.1 The building is to be complete. As such, all items noted in the Interim Occupancy Certification Letter and any correspondence with the AHJ shall be complete including but not limited to the following (all systems may not apply):

.1 All receptacles and switches are installed

.2 All device covers are installed

.3 All panel covers are installed

.4 Arc flash labels are installed to electrical equipment

.5 Nurse call system is installed

.6 Electrical equipment is identified with name plates

.7 Panel directories are completed and installed.

.8 A certified fire alarm verification report shall be submitted 3 working days before the date the Letter of Certification is required.

.9 All non-life-safety exceptions and points of non-compliance noted under Interim Occupancy Certification, including all deficiencies noted on Departmental Representative's Observation Reports are completed in compliance with all applicable codes and standards and the plans and specifications submitted a minimum of 3 working days ahead of the date required for the Letter of Certification, in support of the application for the building permit. This shall include any additional plans, documents and design decisions that have been part of the contract that were not detailed as part of the submitted permit application.

.10 All electrical installations are made safe.

.7 Certification letter will not be issued until all information required above, including final certification sheets and test reports are received by Departmental representative, with no deficiencies.

.8 The decision as to whether the Letter of Certification for Final Occupancy is to be issued lies entirely with the Engineer of Record, and it is incumbent on the Contractor to successfully demonstrate to the satisfaction of the Departmental Representativethat the building is ready for Final Occupancy. Ultimately, once the Letter of Certification for Final Occupancy is provided to the AHJ, the decision as to whether a Final Building Occupancy Permit is to be granted lies with the AHJ.

3.16 FIRE ALARM INSTALLATIONS

.1 Keep copy of latest edition of CAN/ULC-S524, Installation of Fire Alarm Systems, all time during the construction of the fire alarm system.

.2 The above standard may be referenced and reviewed during the engineering observations.

.3 It is highly recommended the Contractor to be familiar with the above standard.

.4 Newly installed or altered fire alarm systems to be verified in accordance with CAN/ULC-S537, Verification of Fire Alarm Systems and local Codes.

.1 Provide verification report to Departmental Representativefor review.

3.17

3.18 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.

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes and Fittings.

.2 CAN/CSA-C22.2 No.65, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-543-ANCE-03).

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

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 wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

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 wire and box connectors for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials 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 sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to NEMA to consist of:

- .1 Connector body and stud clamp for copper conductors.
- .2 Clamp for copper conductors.
- .3 Stud clamp bolts.
- .4 Bolts for copper conductors.
- .5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, flexible conduit, non-metallic sheathed 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 EEMAC 1Y-2 and 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.

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.

.2 CSA C22.2 No. 38 Thermoset Insulated Wires and Cables.

.3 CSA C22.2 No. 51 Armoured Cables.

.4 CSA C22.2 No. 131, Type TECK 90 Cable.

1.2 PRODUCT DATA

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

1.3 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse by manufacturer of 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 600V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE.

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 Cross-linked polyethylene XLPE.

.2 Rating: 600V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride, FT4 rated.

.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.

.3 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:

.1 Watertight, approved for TECK cable.

2.3 CONTROL CABLES

.1 Type: LVT: soft annealed copper conductors, sized as indicated:

.1 Insulation: thermoplastic.

.2 Sheath : thermoplastic jacket.

.2 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated LVT: soft annealed copper conductors, sized as indicated:

.1 Insulation: PVC.

.2 Shielding: over each conductor.

.3 Overall covering: PVC jacket.

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 cable 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 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 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.

.6 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

.7 All branch circuits wiring and conduits shall be installed to minimize voltage drop.

.8 All branch circuits including lighting circuits shall be minimum #10 AWG for all circuits longer than 21 meters and shall be minimum #8 AWG for all circuits longer than 35 meters.

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 50 00 - Lighting.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable exposed, securely supported by hangers.

3.5 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE 837, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

.2 CSA International

.1 CSA C22.2 No. 0.4, Bonding of Electrical Equipment.

.2 CSA C22.2 No. 41, Ground and Bonding Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

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 grounding equipment for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect grounding equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 EQUIPMENT

.1 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.

.2 Insulated grounding conductors: green, copper conductors, size as indicated.

.3 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, 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 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 GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, 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 Use mechanical connectors for grounding connections to equipment provided with lugs.

.5 Soldered joints not permitted.

.6 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.

.7 Install separate ground conductor to outdoor lighting standards.

.8 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end and load end.

.9 Electrical contractor to verify existing secondary grounding impedance and rectify if required.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to starters, control panels, distribution panels, outdoor lighting, cable trays.

3.4 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall near the electrical and communication equipment.

.2 Ground items of electrical equipment to ground bus with individual bare stranded copper connections size 2/0AWG.

3.5 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone and fire alarm systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

.2 Fire alarm systems as indicated.

3.6 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.

3.7 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.

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

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

END OF SECTION

Part 1 General

1.1 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 hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect hangers and supports from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size and thickness as required, surface mounted, suspended or set in poured concrete walls and ceilings.

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 hangers and supports 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 Secure equipment to masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits use channels at at appropriate spacing.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.3 CLEANING

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

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

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

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

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.

.3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

.1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 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 flat covers.

2.2 CABINETS

.1 Construction: welded sheet steel hinged door, handle, lock, 2 keys, and catch.

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 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.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

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:

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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 Combination boxes with barriers where outlets for more than one system are grouped.

.6 Boxes to be hot dip galvanized to ASTM 924(M) designation. Zinc coating Z180 (G60).

2.2 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 35mm 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 All outlets to be surface mounted.

.4 Provide correct size of openings in boxes for conduit, and 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.

.7 Install pull boxes where run exceeds 23.0M (75feet) in length.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.3 CSA C22.2 No. 83, Electrical Metallic Tubing.

.4 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

1.2 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.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

.1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Reel and mark shielded cables rated 2001 volts and above.

2.2 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.2 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

.3 Rigid pvc conduit: to CSA C22.2 No. 211.2.

2.3 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller.

.1 Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at appropriate distance on centre.

.4 Threaded rods, minimum 6 mm diameter, to support suspended channels or sized for the load.

2.4 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

.1 Polypropylene with 3m spare length at each conduit end.

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 Use epoxy coated conduit in corrosive areas.

.3 Use electrical metallic tubing (EMT) where exposed above 2.4m and not subject to mechanical injury.

.4 Use flexible metal conduit for connection to motors in dry areas, connection to surface or suspended fluorescent fixtures, and for work in movable metal partitions.

.5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.6 Use rigid pvc conduit underground unless otherwise specified. Install expansion fittings on the pvc duct risers for services run underground. Follow expansion fitting manufacture recommendation for installation.

.7 Minimum conduit size for lighting and power circuits: 19 mm.

.8 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.9 Mechanically bend steel conduit over 19 mm diameter.

.10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.11 Install fish cord in empty conduits.

.12 Run 2- 25 mm spare conduits up to ceiling space and 2- 25 mm spare conduits down to ceiling space from each flush panel.

.1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

.13 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.14 Dry conduits out before installing wire.

.15 Liquid tight flexible conduit run should not exceed 1.5m.

.16 Provide directional boring for external conduits entry to building.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended or surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

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 REFERENCES

.1 CSA International

.1 CAN/CSA-Z809, Sustainable Forest Management.

.2 Forest Stewardship Council (FSC)

.1 FSC-STD-01-001, FSC Principle and Criteria for Forest Stewardship.

.3 Insulated Cable Engineers Association, Inc. (ICEA)

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 cables and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect cables from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CABLE PROTECTION

.1 38 x 140 mm planks pressure treated with coloured or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

2.2 MARKERS

.1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.

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 cable 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.

.2 Provide directional boring for external conduits entry to building.

3.2 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.7 After installation of cables, seal duct ends with duct sealing compound.

3.3 MARKERS

.1 Mark cable every 150 m along cable and duct runs and changes in direction.

.2 Mark underground splices.

.3 Where markers are removed to permit installation of additional cables, reinstall existing markers.

.4 Install cedar post type markers.

.5 Lay concrete markers flat and centred over cable with top flush with finish grade.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform tests using qualified personnel.

.1 Include necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds.

.1 Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance tests:

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests:

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.3 High Potential (Hipot) Testing.

.1 Conduct hipot testing at in accordance with manufacturer's recommendations.

.4 Leakage Current Testing:

.1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.

.2 Hold maximum voltage for specified time period by manufacturer.

.3 Record leakage current at each step.

.7 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.

.8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.5 CLEANING

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

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

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

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

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

3.6 PROTECTION

.1 Repair damage to adjacent materials caused by cables installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No.29, Panelboards and Enclosed Panelboards.

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 panelboards 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 Alberta, Canada.

.2 Include on drawings:

.1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

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 panelboards for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect panelboards from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 250 V panelboards: bus and breakers rated for 10kA (symmetrical) interrupting capacity or as indicated.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Minimum of 2 flush locks for each panel board.

.6 Two keys for each panelboard and key panelboards alike.

.7 Aluminum bus with neutral of same ampere rating of mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked enamel.

.11 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.

.12 Where exposed to weather minimum NEMA 4 enclosure shall be provided.

2.2 BREAKERS

.1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Departmental Representative.

.5 Lock-on devices for receptacles, fire alarm emergency, door supervisory, exit and night light circuits.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate 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 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

3.3 CLEANING

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

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

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

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

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

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by panelboards installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CAN/CSA C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA C22.2 No.55, Special Use Switches.

.4 CSA C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

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 wiring devices for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wiring devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SWITCHES

.1 15A and 20 A, 120 V, single pole, double pole, three-way, four-way switches to: CSA C22.2 No.55 and CSA C22.2 No.111.

.2 Manually-operated general purpose AC switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 White toggle.

.3 Toggle operated fully rated for fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

2.2 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, CSA type 5-20 R, 125 V, 20 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.

.3 Duplex GFCI receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.144.1 complete with auto-monitoring, visual and/or audible indicator and trip with the ability to reset.

.4 Duplex GFCI receptacles, CSA type 5-20 R, 125 V, 20 A, U ground, to: CSA C22.2 No.144.1 complete with auto-monitoring, visual and/or audible indicator and trip with the ability to reset.

.5 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 White urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

.6 Range receptacles to be NEMA #14-50, 125/250V, 50 Amp., White, c/w cordset.

.7 Dryer receptacles to be NEMA #14-30, 125/250V, 30 Amp., White, c/w cordset.

.8 Duplex receptacles c/w USB ports (2) to be provided where noted on drawings. Receptacle colour to match standard duplex receptacle. Duplex receptacle to be tamper resistant, c/w green LED to indicate that USB power is available. Each USB port (2) shall be rated at 3 amps, 5 VDC.

.9 Other receptacles with ampacity and voltage as indicated.

.10 Receptacles of one manufacturer throughout project.

2.3 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 Sheet metal cast cover plates for wiring devices mounted in surface mounted FS of FD type conduit boxes.

.4 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.5 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

.6 Weatherproof cover plates to be weatherproof “while in use” cover plates.

2.4 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 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 in accordance with Section 26 05 00 - Common Work Results for Electrical.

.3 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 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.

3.4 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 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide fuse performance data characteristics for each fuse type and size. Performance data to include: average melting time-current characteristics.

.3 Shop Drawings:

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

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

1.2 DELIVERY, STORAGE AND HANDLING

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Store fuses in original containers in storage cabinet.

.4 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.3 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Six spare fuses of each type and size installed up to and including 600 A.

Part 2 Products

2.1 FUSES - GENERAL

.1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.

.2 Fuses: product of one manufacturer.

2.2 FUSE TYPES

.1 Class L fuses.

.1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type L2, fast acting.

.2 Class J fuses.

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type J2, fast acting.

.3 Class R -R fuses.

.1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.

.2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.

.4 Class C fuses.

2.3 FUSE STORAGE CABINET

.1 Fuse storage cabinet, manufactured from 2.0 mm thick aluminum 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door finished in accordance with Section 26 05 00 - Common Work Results for Electrical.

Part 3 Execution

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.1 Install rejection clips for Class R fuses.

.3 Ensure correct fuses fitted to assigned electrical circuit.

.4 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

.5 Install spare fuses in fuse storage cabinet.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No. 5, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE).

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 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.

.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 Departmental Representative 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 Departmental Representative. Unless complying with this requirement, Departmental Representative 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:

.1 Project title: _____.

.2 End user's reference number: _____.

.3 List of circuit breakers: _____.

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 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 circuit breakers in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect circuit breakers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, Circuit breakers, ground-fault circuit-interrupters, fused circuit breakers: 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 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have minimum 10kA at 250 volts and 14kA at 600 volts symmetrical rms interrupting capacity rating.

.7 All devices must be fully rated. Series rated devices are not acceptable.

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.

2.3 MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 OPTIONAL FEATURES

.1 Include:

.1 Shunt trip.
.2 Auxiliary switch.
.3 Motor-operated mechanism c/w time delay unit.
.4 Under-voltage release.
.5 On-off locking device.
.6 Handle mechanism.

2.5 MANUFACTURERS

.1 Acceptable manufacturers:

.1 Eaton
.2 Schneider
.3 Square D
.4 Siemens

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.
.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 circuit breakers as indicated.

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.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CAN/CSA C22.2 No.144, Ground Fault Circuit Interrupters.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA PG 2.2, Application Guide for Ground Fault Protection Devices for Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for ground fault circuit interrupters 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 Alberta, Canada.

.4 Test and Evaluation Reports: submit test report for field testing of ground fault equipment to Departmental Representative and certificate that system as installed meets criteria specified.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for ground fault circuit interrupters for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect ground fault circuit interrupters from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA C22.2 No.144 and NEMA PG 2.2.

.2 Components comprising ground fault protective system to be of same manufacturer.

2.2 GROUND FAULT PROTECTOR UNIT

.1 Self-contained with 15 A, 120 V circuit interrupter and duplex receptacle complete with:

- .1 Solid state ground sensing device.
- .2 Facility for testing and reset.
- .3 CSA Enclosure 1, surface or flush mounted with stainless steel face plate.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for ground fault circuit interrupters installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Do not ground neutral on load side of ground fault relay.

.2 Pass phase conductors including neutral through zero sequence transformers.

.3 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and co-ordinate with Section 01 45 00 - Quality Control if required.

.2 Arrange for field testing of ground fault equipment by Contractor before commissioning service.

.3 Demonstrate simulated ground fault tests.

3.4 CLEANING

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

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

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

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA Group

.1 CAN/CSA-C22.2 No.4, Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162 and UL 98).

.2 CSA C22.2 No.39, Fuseholder Assemblies.

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 disconnect switches - fused and non-fused and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect disconnect switches - fused and non-fused from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible and Non-fusible disconnect switch in CSA enclosure as outlined in Canadian Electrical Code, to CAN/CSA-C22.2 No.4 size as indicated.

.2 Where exposed to weather minimum NEMA 4 enclosure shall be provided.

.3 Provision for padlocking in on-off switch position by 3 locks.

.4 Mechanically interlocked door to prevent opening when handle in ON position.

.5 Fuses: size as indicated, in accordance with Section 26 28 13.01 - Fuses - Low Voltage.

.6 Fuseholders: to CSA C22.2 No.39 relocatable and 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 for Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

2.3 APPROVED MANUFACTURES

.1 Eaton, Schneider, Square D, Siemens.

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 disconnect switches - fused and non-fused 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 disconnect switches complete with fuses if applicable.

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.

END OF SECTION

Part 1 General

1.1 SUBMITTAL

.1 Submit shop drawings in accordance with Section 26 05 00 - Common Work Results - For Electrical.

.2 Indicate:

.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout of identified internal and front panel components.
.4 Enclosure types and colour.
.5 Wiring diagram for each type of starter.
.6 Interconnection diagrams.
.7 Indicate quantities and respective load. Load name to match load name on drawings (i.e. starter for Pump P-3).

Part 2 Products

2.1 MATERIALS

.1 Starters: EEMAC E14-1.

.1 Half size starters not acceptable.
.2 Provide NEMA rated starters only, in metal enclosures; IEC rated starters are not acceptable.

2.2 MANUAL MOTOR STARTERS

.1 Single and Three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.
.2 Overload heaters, manual reset, trip indicating handle.

.2 Accessories:

.1 Toggle switch: heavy duty labelled as indicated.
.2 Indicating light: heavy duty type and colour as indicated.
.3 Locking tab to permit padlocking in "ON" or "OFF" position.
.4 Flush mounted in public areas, finished areas or as indicated.

.3 Enclosure shall be NEMA 3R.

.4 Where exposed to weather minimum NEMA 4 shall be provided.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.5 Starters to be two speed where required; type to match requirement of motor provided by Mechanical Trade.

.2 Combination type starters to include fused disconnect switch or circuit breakers with operating lever on outside of enclosure to control disconnect or circuit breaker, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

.3 Accessories:

.1 Pushbuttons, Selector switches: heavy duty labelled as indicated.

.2 Indicating lights: heavy duty oil tight type and colour as indicated.

.3 2-N/O and 2-N/C spare auxiliary contacts unless otherwise indicated.

.4 HOA selector switch.

.5 Two speed single winding starters shall have individual Red run pilot lights for LOW and HIGH speed run indication.

.6 An adjustable 20 sec. - 3 min. time delay relay (set at 30 sec.) shall be installed in two speed starters. It shall function only during the transition from HIGH SPEED to LOW SPEED where the motor will be in a de-energized state for a period of 30 seconds after initiation of this switching.

.4 Enclosure shall be NEMA 3R.

2.4 Where exposed to weather minimum NEMA 4 shall be providedFINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results - For Electrical.

2.5 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - For Electrical.

.2 Manual starter designation label, size 1, engraved as indicated.

.3 Magnetic starter designation label, size 4 engraved as indicated.

2.6 MANUFACTURERS

.1 Acceptable manufacturers: Allen Bradley Canada Ltd.; Eaton Canada Ltd.; "System 89" Siemens Electric Limited; Square D.

.2 All manufacturers shall provide their industrial quality product line; commercial quality starters are not acceptable.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload devices elements installed.

.3 All starters for two speed motors to be provided with six pole disconnect switches and wired with six conductors. Refer to motor schedule and drawings for two speed motors.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - For Electrical and manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

.5 Ensure motor rotation corresponds with the direction required by the driven equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C82.1, Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

.3 ASTM International Inc.

.1 ASTM F1137, Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 Canadian Standards Association (CSA International)

.5 ICES-005, Radio Frequency Lighting Devices.

.6 Underwriters' Laboratories of Canada (ULC)

.7 American National Standards Institute (ANSI)

.1 ANSI C136.15, External label

.2 ANSI C136.22, Internal label

.8 United States of America, Federal Communications Commission (FCC)

.1 FCC (CFR47) EM and RF Interference Suppression.

.9 Illuminating Engineering Society of North America (IESNA)

.1 LM-79 photometric test reports shall be provided for all LED luminaires. LM-79 luminaire photometric reports shall be produced by an independent test laboratory.

.2 LM-80 lumen maintenance test report shall be provided for each respective LED light source

.10 Design Lights Consortium (DLC)

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 review by Departmental Representative.

.3 Photometric data to include: VCP Table where applicable and spacing criterion.

.3 Samples:

.1 Provide samples as indicated.

.4 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.

.5 Photometric data to include:

.1 Total input watts, visual comfort probability (VCP), spacing criterion, candlepower summary, candela distribution zonal lumen summary, luminaire efficiency, CIE type, coefficient of utilization, spectral power distribution (SPD) lamp type and lumen rating in accordance with IESNA testing procedures.

1.3 QUALITY ASSURANCE

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

1.4 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 Packaging Waste Management: remove for reuse by manufacturer of packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Divert unused metal materials from landfill to metal recycling facility.

.5 Disposal and recycling of fluorescent lamps as per local regulations.

Part 2 Products

2.1 LED DRIVER

.1 Shall be CSA certified.

.2 Rated case temperature shall be suitable for operation in the Luminaire operating in the ambient temperature range of -40° to +40° C.

.3 Shall be rated for voltage specified in the Luminaire schedule at 60Hz, and shall operate normally for input voltage fluctuations of ±10%. Efficient at full load >80%.

.4 Shall have a minimum Power Factor (PF) of 0.90 at full input power and across specified voltage range.

.5 Shall have a maximum 600mA driver operating current for interior lighting and maximum of 700mA for exterior lighting. Unless specified on the luminaire schedule.

.6 Shall be suitable for full-range dimming. The luminaire shall be capable of continuous dimming without perceivable flicker over a range of 100%-10% of rated lumen output with a smooth shut off function. Dimming shall be controlled by a 0-10V signal.

.7 Shall be UL listed.

.8 Thermal management:

.1 The thermal management (of the heat generated by the LEDs) shall be of one sufficient capacity to assure proper operation of the Luminaire over the expected useful life.

.2 Heat sinks on area/site lighting luminaire shall facilitate hose-down cleaning and discourage debris accumulation.

.3 The driver manufacturer's maximum case temperature shall not be exceeded at the maximum operating ambient. Thermal management shall be passive by design (mechanical or protruding external surface (heat sink fins)). The use of fans other mechanical devices shall not be allowed.

.9 Surge Suppression: The Luminaire shall include a surge protection to withstand high repetition noise and other interference. The surge protection which resides within the driver shall protect the Luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C62.41 for location Category A, where failure does not mean a momentary loss of light during the transient event.

.10 Total Harmonic distortion (THD): induced into an AAC power line by a luminaire shall not exceed 20% at any standard input voltage.

2.2 LENS

.1 K12 distribution acrylic lenses. 3.2mm (0.125") thick, shall have a recessed prismatic pattern of 5mm (3/16") square based female cones running 45° to the parallel and perpendicular axis to the panel or unless specified otherwise. Panel shall be made of ultraviolet inhibited injection moulded clear virgin acrylic.

.2 Panels shall be strain-free and uniform in production. There shall be no fade-outs or streaks to detract from job performance.

.3 Lenses shall be low brightness, sparkling crystal panel that provides maximum efficiency and good brightness control in the direct glare zone.

.4 Fall to the bottom of the test apparatus before igniting when tested in conformance with CAN/ULC-102.3,”Fire Test of Light Diffusers and Lenses,”

.5 Are not prevented from falling from the ceiling by construction located beneath the elements, and

.6 Are not used in a corridor that is required to be separated from the remainder of the building by a fire separation or in an exit shaft unless individual diffusers or lenses are not more than 1m^2 in area and are not less than 1.2m apart.

.1 Standard of Acceptance

.1 A.L.P. Lighting and Ceiling Products

.2 I.C.I. Acrylics Canada Inc.

.3 Holophane Canada Inc.

2.3 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.4 LUMINAIRES

.1 As indicated in luminaire schedule found in specification.

2.5 LED LUMINAIRES

.1 Minimum L80 rating of 50,000 hours and L70 rating of 100,000 hours at 25° C. Unless noted otherwise in the luminaire schedule. Provide a summary of reliability testing performed for LED driver.

.2 Minimum Color rendering Index (CRI) of 80 with a Correlated Color Temperature (CCT) of 3500K to 5000K.

.3 Luminaire shall start and operate in -40° to +40° ambient.

.4 LED light sources and drivers shall be RoHS compliant.

.5 The Luminaire manufacturer shall have no less than five (5) years of experience in manufacturing LED-based lighting products and the manufacturing facility must be ISO 9001 certified.

.6 Luminaire shall be listed for wet locations if applicable.

.7 Luminaire shall be Design Light Consortium (DLC), Lighting Facts and UL listed and labeled.

.8 Luminaire construction:

.1 Housing to have no visible welding, screws, springs, hooks, rivets, bare LED's or plastic supports.

.2 Shall be a single, self-contained device, not requiring on-site assembly for installation. The power supply and circuit board for the Luminaire shall be integral to the unit.

.3 Shall be fabricated from post painted cold rolled steel and shall be a rigid structure with mounting brackets

.4 Integral Grid Clips required on recessed mounted luminaires along with integral tie wire mounting points.

.5 The assembly and manufacturing process for the SSL luminaire shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration.

.9 LED Sources: Nichia, Samsung, Philips, Panasonic, CREE or OSRAM

.10 Lumen efficacy to be 60 lumens/Watt minimum for exterior lighting.

.11 Warranty: The manufacturer shall provide a warranty against loss of performance and defects in materials and workmanship for the Luminaires for a period of 5 years after acceptance of the luminaires. Warranty shall cover all components comprising the Luminaire. all warranty documentation shall be provided to customer prior to the first shipment.

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 recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No.141-10, Emergency Lighting Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.

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 emergency lighting for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect emergency lighting from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.5 WARRANTY

.1 For batteries in this Section 26 52 00 - Emergency Lighting, 12 months warranty period is extended to 120 months.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: as indicated on drawing.

.3 Output voltage: as indicated on drawing.

.4 Operating time: as indicated on drawing.

.5 Battery: sealed, long life, lead acid or lead calcium maintenance free.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.10 Lamp heads: integral on unit and remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, 6 W, minimum.

.11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.12 Battery bank shall be provided with internally or externally, zone sensing relays.

.13 Zone sensing relays shall be pre wired.

.14 Each zone shall have its own 'push to test' push button.

.15 Finish: White polyester paint.

.16 Auxiliary equipment:

.1 Ammeter.
.2 Voltmeter.
.3 Test switch.
.4 Time delay relay.
.5 Battery disconnect device.
.6 AC input and DC output terminal blocks inside cabinet.
.7 Shelf or Bracket.
.8 Cord and single twist-lock plug connection for AC.
.9 RFI suppressors.

2.2 WIRING OF REMOTE HEADS

.1 Conduit: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Conductors: in accordance with Section 26 05 21 - Wires and Cables (0-1000 V), sized in accordance with manufacturer's recommendations.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for emergency lighting 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 unit equipment for emergency lighting in accordance with CSA C22.1.

.2 Install conduit and wiring as indicated.

.3 Install unit equipment and remote mounted fixtures as indicated.

.4 Cut and re-cap cord to remove surplus.

.5 Direct heads indicated to provide maximum lighting level along means of egress routes.

.6 Mount double remote heads on outlet box such that the two heads will be horizontal with the building lines.

.7 Charge the batteries and test the system for proper operation (minimum of 35 or 65 minutes discharge time).

.8 Adjacent to each battery bank unit install a duplex receptacle and wire to AC night lighting circuit.

3.3 CLEANING

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

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

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

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

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

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by emergency lighting installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141-10, 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, Life Safety Code.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

.4 Quality Assurance Submittals: submit following in accordance with Section01 45 00 - Quality Control.

.1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 STANDARD UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 Refer to fixture schedule.

.3 Lamps: LED light bar type c/w internally mounted transformers as required.

.4 Designed for 10 years of continuous operation without relamping.

.5 Full height green running man symbol on white door background in an overall green background with full height directional white arrow in front of the running man on the same overall green background in compliance with the National Building Code requirements.

.6 No external holes or slots to eliminate light leaks.

.7 Built-in switch-over relays for 12 Volt DC operation.

.8 Face plate to remain captive for relamping.

.9 Units c/w punch-out directional arrows as required.

.10 Units c/w universal mounting canopies as required.

2.2 DESIGN

.1 Wall or ceiling mounting.

.2 Single and double face with die-cast face plate to remain captive for relamping.

.3 Arrow: as required and as shown on drawings.

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.

.2 **INSTALLATION**

.3 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.

.4 Connect fixtures to exit light circuits.

.5 Ensure that exit light circuit breaker is locked in on position.

.6 **CLEANING**

.7 Proceed in accordance with Section 01 74 11 - Cleaning.

.8 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 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 for the following;

.1 Grounding termination connectors.

.2 Grounding bus bars

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 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect communication raceway systems from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.3 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.

.4 Grounding and bonding of the telecommunications system in accordance with ANSI/TIA–607-B Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

.1 Obtain, familiarize and keep a copy of standard (ANSI/TIA–607-B Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises) on site during the length of construction.

Part 2 Products

2.1 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

.1 Predrilled solid copper busbar, listed by NRTL, electrotin plated with 30 attachment points (two rows of 15 each) for two-hole grounding lugs.

.2 The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 27 lugs with 15.8 mm hole centers and 3 lugs with 25.4 mm hole centers.

.3 Dimensions 6.4 mm thick, 100 mm wide, 200 mm long to: ANSI J-STD-607-A.

.4 The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 100 mm standoff from the wall.

.5 The busbar shall be cUL Listed as grounding and bonding equipment.

.6 Length of ground bar to allow for 40% future growth (minimum). Revise as required.

2.2 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

.1 Predrilled solid copper busbar, listed by NRTL, electrotin plated with 9 attachment points (one row) for two-hole grounding lugs.

.2 The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 6 lugs with 15.8 mm hole centers and 3 lugs with 25.4 mm hole centers.

.3 Dimensions 6.4 mm thick, 50 mm wide, 200 mm long to: ANSI J-STD-607-A.

.4 The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 100 mm standoff from the wall.

.5 The busbar shall be cUL Listed as grounding and bonding equipment.

.6 Length of ground bar to allow for 40% future growth (minimum). Revise as required.

2.3 BONDING CONDUCTOR FOR TELECOMMUNICATIONS (BCT)

.1 Copper conductor, FT4 green insulated marked to: ANSI J-STD-607-A.

.2 The BCT shall be, as a minimum, the same size as the largest TBB.

2.4 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

.1 Copper conductor, FT4 green insulated marked to: ANSI J-STD-607-A.

2.5 SIZING OF TELECOMMUNICATIONS BONDING BACKBONE (TBB)

.1 The minimum TBB conductor size shall be a #6 AWG copper conductor. The TBB should be sized at 2 kcmil per linear foot of conductor length up to a maximum size of 3/0. Bonding conductors used for telecommunications should be sized using engineered calculations.

Table 1 –TBB conductor size vs length

TBB linear length m (ft)	TBB size (AWG)
less than 4 (13)	6
4 – 6 (14 – 20)	4
6 – 8 (21 – 26)	3
8 – 10 (27 – 33)	2
10 – 13 (34 – 41)	1
13 – 16 (42 – 52)	1/0
16 – 20 (53 – 66)	2/0
20 and above	3/0

2.6 WARNING LABELS

.1 Non-metallic warning labels in English and French to: TIA/ANSI -607.

.2 Label each conductor at each ground bar location TMGB/TGB as follows:

.1 “TMGB – Alpine Cottage”

.2 “TGB – Smaller bunk house “

.3 Install sub-label with wording "If this connector is loose or must be removed, please call the building telecommunications manager".

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communication raceway systems installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.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 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

.1 Install TMGB in [entrance facility (EF)] [telecommunications entrance room] [equipment room (ER)] on insulated supports [100 mm] [4 in] high at location close to electrical power panel if one is installed in same room as indicated.

.2 Install #6 AWG copper bonding conductor from TMGB to alternating current equipment ground (ACEG) enclosure of serving electrical power panel (panelboard).

.3 Label ground bar “Telecommunications Main Grounding Busbar” (TMGB).

3.3

3.4 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

.1 Install TGB in [equipment room (ER)] and each telecommunications room (TR).

.2 Install #6 AWG copper bonding conductor from TGB to alternating current equipment ground (ACEG) enclosure of serving electrical power panel (panelboard).

.3 Label ground bar “Telecoms Grounding Busbar” (TGB).

3.5 BONDING CONDUCTORS GENERAL

.1 When placed in ferrous metallic conduit or EMT, bond to each end of conduit or EMT using grounding bushing #6 AWG copper conductor.

3.6 BONDING CONDUCTOR FOR TELECOMMUNICATIONS (BCT)

.1 Install bonding conductor for telecommunications from TMGB to service equipment (power) ground grid.

.2 Install bonding conductor for telecommunications from TGB to service equipment (power) ground grid.

.3 Use exothermic welding (below ground), approved 2 hole compression lugs for connection to TMGB.

3.7 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

.1 Install TBB from TMGB to each TGB at each telecommunication cabinet location.

.2 Install copper bonding conductor from TMGB to each TGB in a radial configuration, following cabling pathways between telecommunication rooms. Connect to TGB ground bar. Use compression clamp at each ground bar to route on to next to allow removal of ground bar without affecting integrity of conductor.

.3 Use exothermic welding (below ground), approved 2 hole compression lugs for connection to TMGB and TGBs.

3.8 BONDING TO TMGB

.1 For cables at each telecommunication cabinet location having shield or metallic member, bond shield or metallic member to TMGB using #6 AWG FT4 green insulated copper conductor.

.2 Bond equipment cabinet located in each telecommunication cabinet location to TMGB using #6 AWG FT4 green insulated copper conductor.

.3 Where a bonding conductor does not exceed 30 m in length, a minimum of a #6 AWG green insulated copper conductor is sufficient for referencing all metallic surfaces within the telecommunications environment. However, a bonding conductor that is run at distances longer than 30 m should be calculated for a size that meets the requirements of the applicable electrical code for site. Refer to TDMM, most recent edition.

3.9 BONDING TO TGB

.1 Bond metallic raceways at each telecommunication cabinet location to TGB using #6 AWG FT4 green insulated copper conductor.

.2 For cables at each telecommunication cabinet location having shield or metallic member, bond shield or metallic member to TGB using #6 AWG FT4 green insulated copper conductor.

.3 Bond telecommunication cabinet to TGB using #6 AWG FT4 green insulated copper conductor.

.4 Where a bonding conductor does not exceed 30 m in length, a minimum of a #6 AWG green insulated copper conductor is sufficient for referencing all metallic surfaces within the telecommunications environment. However, a bonding conductor that is run at distances longer than 30 m should be calculated for a size that meets the requirements of the applicable electrical code for site. Refer to TDMM, most recent edition.

3.10 OUTDOOR GROUNDING AND BONDING CONNECTIONS

.1 All outdoor grounding and bonding (earthing) connections shall be accomplished using exothermic welding.

3.11 WALL-MOUNT BUSBARS

.1 Attach busbars to the wall with appropriate hardware according to the manufacturer's installation instructions.

.2 Conductor connections to the TMGB or TGB shall be made with two-hole bolt-on compression lugs sized to fit the busbar and the conductors.

.3 Each lug shall be attached with stainless steel hardware after preparing the bond according to manufacturer recommendations and treating the bonding surface on the busbar with antioxidant to help prevent corrosion at the bond.

.4 The wall-mount busbar shall be bonded to ground as part of the overall Telecommunications Bonding and Grounding System.

3.12 RACK-MOUNT BUSBARS AND GROUND BARS

.1 When a rack or cabinet supports active equipment or any type of shielded cable or cable termination device requiring a ground connection, add a rack-mount horizontal or vertical busbar or ground bar to the rack or cabinet. The rack-mount busbar or ground bar provides multiple bonding points on the rack for rack and rack-mount equipment.

.2 Attach rack-mount busbars and ground bars to racks or cabinets according to the manufacturer's installation instructions.

.3 Bond the rack-mount busbar or ground bar to the room's TMGB or TGB with appropriately sized hardware and conductor.

3.13 GROUND TERMINAL BLOCK

.1 Every rack and cabinet shall be bonded to the TMGB or TGB.

.2 Minimum bonding connection to racks and cabinets shall be made with a rack-mount two-hole ground terminal block sized to fit the conductor and rack and installed according to manufacturer recommendations.

.3 Remove paint between rack/cabinet and terminal block, clean surface and use antioxidant between the rack and the terminal block to help prevent corrosion at the bond.

3.14 INSTALLATION

.1 Install empty raceway system, including fish wire, outlet boxes, pull boxes, cover plates, conduit and positioning material to constitute complete system.

3.15 PEDESTAL CLAMP

.1 At minimum, bond every fourth raised access floor pedestal in each direction with a minimum #6 AWG conductor to the TMGB or TGB using a pedestal clamp sized to fit the pedestal and the conductor and installed according to the manufacturer's recommendations.

.2 If pedestal clamps are used to construct a signal reference grid, bond the signal reference grid to the TMGB or TGB and bond each rack and/or cabinet to the signal reference grid using a compression tap or similar non-reversible bonding component sized to fit both conductors.

.3 Remove paint between the pedestal and pedestal clamp, clean surface and use antioxidant between the pedestal and the clamp to help prevent corrosion at the bond.

.4 Remove insulation from conductors where wires attach to the pedestal clamp.

3.16 PIPE CLAMP

.1 Bond metal pipes located inside the data center computer room with a minimum #6 AWG conductor to the TMGB or TGB using a pipe clamp sized to fit the pipe and the conductor and installed according to the manufacturer's recommendations.

.2 Remove paint between the pipe and pipe clamp, clean surface and use antioxidant between the pipe and the clamp to help prevent corrosion at the bond.

.3 Remove insulation from conductors where wires attach to the pipe clamp.

3.17 EQUIPMENT GROUND JUMPER KIT

.1 Bond equipment to a vertical rack-mount busbar or groundbar using ground jumper according to the manufacturer's recommendations.

.2 Clean the surface and use antioxidant between the compression lugs on the jumper and the rack-mount busbar or groundbar to help prevent corrosion at the bond.

3.18 LABELLING

.1 Apply warning labels to telecommunications bonding and grounding conductors.

.2 Apply additional administrative labels to: TIA/EIA-606.

3.19 INSTALLATION

.1 Install empty raceway system, including fish wire, outlet boxes, pull boxes, cover plates, conduit and positioning material to constitute complete system.

3.20 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.

3.21 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 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.

1.2 SYSTEM DESCRIPTION

.1 Empty telecommunications raceways system consists of outlet boxes, cover plates, conduits, cable trays, pull boxes, sleeves and caps and fish wires.

1.3 REFERENCES

.1 Latest edition of the following:

.1 EIA/TIA-569; Commercial Building Standards for Telecommunications Pathways and Spaces (refer to CSA standards CAN/CSA T530-M90, CAN/CSA-C22.2 No. 214-M90)

.2 ANSI/TIA-758-B; Customer-Owner Outside Plant Telecommunications Infrastructure Standard

.3 ABC Alberta Building Code

.4 CAN/CSA-C22.1 Canadian Electrical Code Part One

.5 CAN/CSA-C22.1 Canadian Electrical Code Part One Section 60 "Electrical Communication Systems".

.6 CAN/CSA-C22.2 No. 0-M91 General Requirements - Canadian Electrical Code, Part Two.

.7 NRC-CNRC National Building & Fire Codes of Canada

.8 IEEE STD 1100 - 1992 IEEE Recommended Practice for Powering & Grounding Sensitive Electronic Equipment "Emerald Book"

1.4 DESCRIPTION OF SYSTEM

.1 System to include:

.1 The communications horizontal cabling pathway shall consist of a conduit raceway.

.2 The Voice Communications backbone cabling pathway shall consist of a conduit raceway system.

.3 The Data Communications backbone cabling pathway shall consist of a conduit raceway system.

.4 All backboards, cable support hardware, clamps, bonding clamps, and grounding to provide a complete system as specified.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location 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.

Part 2 Products

2.1 MATERIAL

.1 Equipment and materials to be CSA or ULC certified. Where there is no alternative to supplying equipment which is not CSA or ULC certified, obtain special approval from local Electrical Inspection Department or authority having jurisdiction.

.2 Submit for Departmental Representative's approval, a duplicate list of shop drawings for this project prior to placing of orders for same.

2.2 EMT CONDUIT

.1 Refer to Section 26 05 34.

.2 Minimum trade size shall be 25mm.

2.3 EQUIPMENT BACKBOARDS

.1 Equipment backboards shall be 19mm plywood backing, 2.4m high located as shown on drawings.

.2 At least two walls are to be lined with AC grade or better, void-free plywood. To reduce warping, equipment backboard/plywood should be kiln-dried to a maximum moisture content of 15 percent.

.3 Mount equipment backboard/plywood 200mmabove finished floor to avoid damaging plywood. Install equipment backboard/plywood with the grade A surface exposed. The equipment backboard/plywood should be securely fastened to wall-framing members to ensure that it can support attached equipment.

.4 Equipment backboard/plywood should be void-free and painted on all sides and within cut-out areas with at least two coats of fire-retardant light colored paint.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communication raceway systems installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.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 CONDUITS

.1 Refer to Canadian Electrical Code Section 12.

.2 Refer to Section 26 05 34.

.3 Conduit sleeves shall be installed with acceptable fire stop to meet local fire codes.

.4 Conduit sleeves shall extend a minimum of 100mm above the finished floor.

.5 Spare sleeves with no cables installed within them shall be fitted with an acceptable firestop.

.6 Raceways shall enter Communication Cabling Wiring Closets at a minimum height of 2.4m AFF.

.7 Conduit runs shall not contain more than two (2) 90 degree bends between pull points or pull boxes.

.8 Conduits shall have long sweep bends.

.9 Continuous conduit runs shall not exceed 30m without a pull point or pull box.

.10 If a conduit run requires more than two 90 degree bends provide a pull point or pull box between sections with two bends or fewer.

.11 If a conduit requires a reverse bend (ie. between 100 degrees and 180 degrees) insert a pull point or pull box at each bend having an angle from 100 degrees to 180 degrees.

.12 If a conduit requires a third 90 degree bend (ie. between pull points or pull boxes) derate conduit capacity of the run that has the third bend by 15%.

.13 A third bend may be acceptable in pull section without derating the conduit's capacity if one of the following statements is true:

.1 The total run is not longer than 10m.

.2 The conduit size is increased.

.3 One of the bends is located within 300mm of the cable feed end.

.14 Conduits shall be reamed to eliminate sharp edges.

.15 Conduit couplings and connectors shall be steel type.

.16 Steel connectors shall be terminated with an insulated bushing to prevent cable abrasion.

.17 Pull boxes shall be installed in such a manner that the conduits that enter the pull box shall be aligned at opposite ends from each other, the cable shall not have a bend within the pull box.

.18 Conduit runs shall remain clear of areas in which flammable material may be stored. Conduits shall not be installed adjacent to sources of heat.

.19 All conduits shall be left with a nylon pull cord with a minimum test rating of 90kg.

.20 Provide one 25mm conduit stubbed up to accessible ceiling space from a single gang communications outlet.

.21 Conduit fill shall be as per cable manufacturers recommendations, but shall in no case exceed the maximum fill allowed by code.

3.3 INNERDUCTS

.1 Where optical fiber cables will be used, provide innderducts inside each 103mm conduit designated for this purpose to ensure the maximum amount of cables can be placed.

.2 Each innerduct should be equipped with a pull cord rated for 400 lb pulling tensile.

.3 Innerduct to be sized to accommodate optical fiber cable installed within.

.4 Provide a copper conductor within the conduit system for locating purposes when non-metallic optical fiber cable is used.

.5 Innerduct Polyvinyl Chloride (PVC) – For installation in conduit.

.6 Aluminum threaded innerduct couplers shall be used to join two segments of corrugated innerduct together. Non-metallic couplers are not acceptable.

.7 Each innerduct run shall be of the same manufacturer and model. Confirm sizes with Departmental Representative.

.8 All runs with cables leaving the building shall be water and gas proof sealed using a method approved by the Departmental Representative.

.9 Innerduct sealing plugs shall be used to seal used and unused innerducts. Use in conjunction with triplex duct sealing plugs.

3.4 OUTLET BOXES

.1 Fill boxes with paper, sponges, foam, or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.2 Information outlet boxes shall not be placed back to back when servicing adjacent rooms, there shall be a minimum of 200mm offset between boxes.

.3 Mount communication outlet boxes at the same height as the electrical power outlets unless noted otherwise. Communication outlets shall be mounted adjacent (within 200mm) to power outlets.

3.5 PULL BOXES

.1 Refer to Section 26 05 31 - Splitters, Junction, Pull Boxes, Cabinets and Underground Enclosures.

.2 Supply and install pull boxes of sufficient size where required. Provide pull boxes where runs exceed [30m][100ft] in length and in runs where more than two 90 degree bends are necessary. Fittings will not be accepted as pull boxes. Pull boxes must be readily accessible and shall not be located above light fixtures or other equipment, or above tiles that are captive by speakers, detectors, etc.

.3 The minimum length of a pull box shall be at least 16 times the diameter of the largest conduit entering the pull box. Pull box to have width and depth adequate for fishing, pulling and looping the cable.

.4 Refer to below noted for typical (minimum) pull box sizes dependant on the diameter of the conduit that meets the minimum sizing requirement.

Conduit Trade Size mm (in)	Box Width mm (in)	Box Length mm (in)	Box Depth mm (in)	Box Width Increase For Each Additional Conduit mm (in)
19 (3/4)	102 (4)	305 (12)	76 (3)	51 (2)
27 (1)	102 (4)	406 (16)	76 (3)	51 (2)
35 (1-1/4)	152 (6)	508 (20)	76 (3)	76 (3)
41 (1-1/2)	203 (8)	686 (27)	102 (4)	102 (4)
53 (2)	203 (8)	914 (36)	102 (4)	127 (5)
63 (2-1/2)	254 (10)	1067 (42)	127 (5)	152 (6)
78 (3)	305 (12)	1220 (48)	127 (5)	152 (6)
91 (3-1/2)	305 (12)	1370 (54)	152 (6)	152 (6)
102 (4)	381 (15)	1525 (60)	204 (8)	204 (8)

3.6 INSTALLATION

.1 Install empty raceway system, including fish wire, outlet boxes, pull boxes, cover plates, conduit and positioning material to constitute complete system.

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.

.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.

3.8 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 REFERENCES

.1 Latest edition of the following:

.1 EIA/TIA-568-C; Commercial Building Telecommunications Cabling Standard (refer to CSA standard CAN/CSA T529-M91, CAN/CSA-C22.2 No. 214-M90).

.2 EIA/TIA-569; Commercial Building Standards for Telecommunications Pathways and Spaces (refer to CSA standards CAN/CSA T530-M90).

.3 EIA-TIA-606; The Administration Standard for the Telecommunications Infrastructure of Commercial Building (refer to CSA standard CAN/CSA T528-93).

.4 EIA/TIA-607; Commercial Building Grounding and Bonding Requirements for Telecommunications (refer to CSA standard CAN/CSA T527-94).

.5 EIA/TIA TSB 72 Centralized Optical Fiber Cabling Guidelines.

.6 EIA/TIA TSB 75 Cabling practices for Open Offices.

.7 NBC National Building Code of Canada.

.8 CAN/CSA-C22.1 Canadian Electrical Code Part One.

.9 CAN/CSA-C22.1 Canadian Electrical Code Part One Section 60 "Electrical Communication Systems".

.10 CAN/CSA-C22.2 No. 0-M91 General Requirements - Canadian Electrical Code, Part Two.

.11 CSA C22.2 No. 154 (latest edition) Data Processing Equipment.

.12 NRC-CNRC National Building & Fire Codes of Canada.

.13 IEEE STD 1100 (latest edition) IEEE Recommended Practice for Powering & Grounding Sensitive Electronic Equipment "Emerald Book".

.14 ISO/IEC 11801 Generic Cabling for Customer Premises.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Technical data sheet supplied by cable manufacturer for the cables which are to be used. The data sheets shall include:

.1 Mutual Capacitance

.2 Impedance

.3 DC Resistance

.4 Attenuation

.5 Near End Crosstalk

.6 ACR

.7 Delay Skew

.8 ELFEXT

.2 Information outlets c/w faceplates.

.3 Backboards, patch panels, troughs, equipment racks, wall mounted equipment racks, wire management panels.

.4 Fiber Optic interconnection units, connectors, couplings.

.5 Grounding termination connectors.

.6 All test equipment.

.3 This information is to be revised to "as-built" after construction is completed. Insert as part of the Operating and Maintenance Manuals.

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 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect communication raceway systems from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.4 SYSTEM DESCRIPTION

.1 Information outlets, c/w faceplates, recessed enclosures, located in the work area for connection to communications devices.

.2 Unshielded Twisted Pair (UTP) Category 6 copper cable for the Voice Communications horizontal cabling system.

.3 Unshielded Twisted Pair (UTP) Category 6 copper cable for the Data Communications horizontal cabling system.

.4 50/125 6 strand OM4 tight-buffered multimode fiber optic cable (indoor/outdoor rated) for the Data Communications backbone cabling system.

.5 Unshielded Twisted Pair (UTP) Category 3 copper cable for the Voice Communications backbone cabling system.

.6 All patch panels, troughs, labeling, clamps, bonding clamps, and grounding to provide a complete system as specified.

.7 All connector cables, splices, and miscellaneous material to provide a complete system as specified.

.8 Wiring connections to the Local Telephone Service Provider shall originate at the demarcation point. The cross connect and disconnect links shall be provided by this division.

1.5 COPPER CABLE CONSTRUCTION (BY TYPE)

.1 Listed CMR cable: Solid copper conductors with high-density polyolefin insulation and an overall low smoke polyvinyl chloride (PVC) jacket to achieve a riser (i.e., non-plenum) rating by applicable CEC requirements.

.2 Listed CMP cable (FT6 Rated): Solid copper conductors with fluorinated ethylene propylene (FEP) insulation and an overall low smoke PVC jacket to achieve plenum rating by applicable CEC requirements.

.3 LSZH cable: Solid copper conductors with non-halogen high-density polyethylene (HDPE) insulation and a low smoke, zero halogen, compound jacket to achieve a LSZH rating by applicable IEC standards

.4 LC cable: Solid copper conductors with FEP fluoropolymer insulation and overall FEP fluoropolymer jacket to achieve CMP 50 rating by ULC standards

.5 OSP outdoor cable rated for wet locations: Solid copper conductors with polyethylene insulation, polyolefin fluted center member with flooding compound, and black polyethylene jacket

.6 Comply with following general physical specifications:

.1 Maximum pulling tension: 110 Newton's (25 pound-force).

.2 Operating temperature: –20 to 60 degrees C [–4 to 140 degrees F].

1.6 STANDARDS

.1 The equipment and installation shall comply with the following current requirements:

.1 Alberta Building Code

.2 Canadian Electrical Code

.3 EIA/TIA and CSA Telecommunications Building Wiring Standards

.4 Alberta Fire Code

.5 Local and Municipal By-laws

.6 Authorities having jurisdiction

1.7 APPROVED VOICE AND DATA CONTRACTOR

.1 Voice and Data Communications Cabling System Contractors shall adhere to the following:

.1 Contractor shall indicate vendor to be used in bid submission.

.2 Vendor must be supported by at least three certified local installers.

.3 Contractor shall be certified by the vendor they represent.

.4 Contractor shall be experienced in all aspects of this work and shall have direct experience on recent systems of similar type and size.

.5 Contractor shall own and maintain tools and equipment necessary for successful installation and testing of UTP and Optical Fiber Voice and Data Communications Cabling Systems and shall have personnel who are adequately trained in the use of such tools and equipment.

.6 Contractor shall not subcontract any portion of the work out to other contractors.

1.8 OPERATION AND MAINTENANCE MANUALS

.1 Provide Operation and Maintenance data for the Structured Cabling for Communications Systems for incorporation into manual specified in Section 01300 - Submittals.

.2 Include:

.1 Instructions for complete Structured Cabling for Communications Systems to permit effective operation and maintenance.

.2 Technical data - illustrated parts lists with parts catalogue numbers.

.3 Copy of approved shop drawings with corrections completed and marks removed except for reviewed stamps.

.4 Vendor's list of recommended spare parts for system.

.5 Provide name, address and telephone number of the Contractors service representative to be contacted during the warranty period.

.6 Provide name, address and telephone number of the Vendor's service representative to be contacted during the warranty period.

.7 Complete records of all Administration labeling data. Administrative labeling to be in electronic database format on USB memory device, and included on hardcopy of Record Drawings.

.8 A table of all test results to be included in hardcopy and USB memory device.

.9 Complete Record Drawings.

1.9 QUALIFICATION OF SYSTEM

.1 The installed horizontal backbone cabling system shall be covered by the Manufacturer’s Certification, issued by the successful manufacturer and delivered by the Communications Cabling Contractor to the client.

.2 The installed voice data cabling system shall conform to all applicable local building and electrical codes.

.3 The manufacturer’s representative shall attend the site, as appropriate, in order to inspect the installation of the various phases of the project and to confirm that the installation is being performed in accordance with the manufacturer’s installation guidelines. The manufacturer shall provide documentation, if required, evidencing the date and time that such inspections were performed and the results of such inspections.

1.10 TWENTY-FIVE YEAR COMPONENT WARRANTY

.1 Warranty all passive equipment, materials, installation and workmanship for twenty-five (25) years as per the Certified Manufacturers Programs. The warranty must assure the support of all communications standards applications as outlined in EIA/TIA standards (reference document). Defective and/or improperly installed products shall be replaced and/or reinstalled at no cost to the client.

1.11 CERTIFICATION

.1 To qualify for System Certification, the manufacturer of the voice/data and fiber cabling system shall be installed and tested by the Certified Communications Cabling Contractor for this project (no third party testing is allowed).

.2 To qualify for System Certification, the installed cabling system shall fully comply with all relevant manufacturer design and applications guidelines, including any pre-approved deviations as specified in the latest release of the manufacturer Certification Guide.

.3 To qualify for System Certification, only products made or approved by the cabling manufacturer shall be used to ensure the end-to-end performance of the manufacturer's cabling system. The manufacturer's 25-Year Component Warranty and Lifetime Application Assurance can only be provided to installations consisting of products supplied by the manufacturer of the cabling system.

.4 The successful manufacturer will not provide certification or warranty coverage for products manufactured by other entities. Certification or warranty coverage is to be provided by other entities for products manufactured by other entities.

.5 The Communications Cabling Contractor will provide a pre-approved draft of the manufacturer's Letter of Certification within two weeks of award of this project. The document must include the following:

.1 Verification of the performance of the installed cabling system.

.2 Manufacturer's Certification Number.

.3 Identification of the Installation by location and project number.

1.12 LIFETIME APPLICATION ASSURANCE

.1 The cabling system certification shall provide the assurance that all present and future commercially available applications engineered for the performance level of the installed cabling system will work for the lifetime of the certified cabling system manufacturer.

.2 Should the certified cabling system fail to support the networking technologies designed to operate over it at the time of cutover, during subsequent use, or after upgrading active network devices the cabling manufacturer and the Communications Cabling Contractor shall take prompt corrective action at no cost to the Departmental Representative.

1.13 TRAINING

.1 Contractor shall provide one 2 hour on-site training sessions, together with vendor's representative, for Structured Cabling for Communications Systems to operational personal in use and maintenance of system. Contractor shall provide all equipment and personal necessary to video tape training session and submit two copies to Departmental Representative. Training sessions shall be provided at a time convenient to Departmental Representative.

.2 The Contractor shall provide a technician to assist the Departmental Representative in cross connecting the voice and data services throughout the facility. Contractor shall also perform cross connecting of the station assignments between the Departmental Representatives service demarcation.

1.14 CO-ORDINATION WITH LOCAL TELEPHONE UTILITY

.1 Contractor shall provide and install all cross connects and patch cords required at demarcation. Co-ordinate all cross connects with local telephone utility.

Part 2 Products

2.1 MATERIALS

.1 Equipment and materials to be CSA or ULC certified. Where there is no alternative to supplying equipment which is not CSA or ULC certified, obtain special approval from local Electrical Inspection Department or authority having jurisdiction.

.2 All cabling and termination hardware shall be of one manufacturer.

.3 End-to-end structured cabling solution shall be of one manufacturer.

.4 Submit for Departmental Representative's approval, a duplicate list of shop drawings for this project as specified prior to placing of orders for same.

2.2 WALL MOUNTED EQUIPMENT CABINETS

.1 Wall mounted equipment cabinets shall meet ANSI/EIA-310.

.2 Constructed of lightweight steel, charcoal gray or black in color.

.3 Complete with steel mounting hardware.

.4 Cabinet hardware must provide vertical wire management on wall mounted equipment cabinet.

.5 Front lockable, smoked acrylic front door.

.6 Wall mounted low profile equipment cabinet frames shall meet the following specifications:

- .1 Dimensions: 36.75in (H) x 24in (W) x 11in (D) (min)
- .2 Minimum 6RU design in total.
- .3 Low profile vertical racking with rack rails that pivot out, from the top or from the bottom of the body for equipment access.
- .4 Provision in bottom for cooling fan.
- .5 Vented lockable door
- .6 Multiple knockouts for side, bottom and top.
- .7 Include a hinged 1U patch panel mounting bracket.

.7 Confirm equipment rack depth, size and equipment load barring capacity with Departmental representative.

.8 Cabinets shall be wall mounted on 19mm equipment backboard.

.9 Each equipment cabinet designated with space for active electronics shall be provided with a surge suppressor power bar.

.10 Each cabinet to be installed with 120V, 60Hz dual fan (220 CFM) assembly.

.11 Additional acceptable Manufacturers: RF Mote, Middle Atlantic, Chatsworth (CPI), Hammond, Electron Metal, Ortronics.

2.3 FACEPLATE AND PATCH PANEL ICONS

.1 The following icon descriptions and colors shall be utilized throughout the voice and data networking systems at all workstations and patch panels.
- .1 Telephone - "Phone", gray
- .2 Fax - "Fax", gray
- .3 Modem - "Modem", gray
- .4 Data LAN - "Data", blue

.2 Provide blank icons for all unused ports.

.3 Confirm colors with departmental representative.

2.4 FACEPLATES

.1 Faceplates shall accept dual port installation kits.

.2 Faceplates shall accept a minimum of four workstation jacks as specified.

.3 Faceplates shall be iconable.

.4 Faceplates shall be provided with integral administrative labeling strips.

2.5 CATEGORY 6 JACKS

.1 Jacks shall incorporate insulation displacement connections specified for 23 AWG wire.

.2 Jacks shall be 8 position, 8 conductor modular type.

.3 All unused jack locations shall be installed with blank inserts.

.4 The connecting hardware for the Category 6 cabling system channel shall meet the electrical characteristics of the cabling system as specified in Clause 2.11 System Performance. The channel shall meet the requirements specified with the connecting hardware provided.

.5 Jacks shall be an unshielded T568A wiring configuration.

2.6 CATEGORY 6 PATCH PANELS

.1 Patch Panels shall be 8-position, 8-conductor modular jack on face to 110 terminations on rear of panel. Wiring patterns to be T568A.

.2 All patch panels shall be CSA or ULC approved and shall be of one manufacturer.

.3 Termination blocks shall have the following characteristics:
- .1 Type: all plastic insulants.
- .2 Termination type: insulation displacement, dry, gas tight.

.3 Wire Size supported: 23AWG
.4 Retermination rate: greater than 200.
.5 Wire insertion force (23AWG): 59-127 Newtons.
.6 Wire retention force: (23AWG): 8lbs Horizontal. 1.8 lbs Vertical.
.7 Insulation resistance: 100M ohms
.8 Dielectric strength: 2.0kV at 60 Hz.
.9 The patch panels for the Category 6 cabling system channel shall meet the electrical characteristics of the cabling system as specified in Clause 1.5 System Performance. The channel shall meet the requirements specified with the patch panels provided.

.4 Designation strips shall be provided for each jack. All cables shall be terminated in numerical sequence and labeled as per approved labelling scheme.

2.7 FIBER OPTIC PATCH PANELS

.1 Provide combination units for cross connect, inter connect, and splicing capabilities which contain the proper troughs for supporting and routing the fiber cables/jumpers.

.2 Consist of a modular enclosure with retainer rings in the slack storage section to limit the bending radius of the fibers.

.3 Contain a front face "window" section to insert connector panels for mounting of connectorized fiber LC, SC or ST connectors (as required).

.4 Confirm fiber connector type (LC, SC or ST) with Departmental Representative.

.5 Shall be available in the following configurations:

.1 1U (24 fiber LC, SC or ST; 48 fiber LC)

.6 Patch panels shall have clear, Lexan tops for 1U, 2U and 3U with integrated label inserts that accept standard, laser printed or hand-held printed, adhesive strips. The 4U patch panel shall have integrated label inserts that are stored in the bottom of the housing and can be moved to the front doors for easy reading. Designation strips shall be provided for each port.

.7 All fibers shall be terminated in numerical sequence and labeled as per approved labelling scheme. Labelling scheme to be submitted to Departmental Representative for approval prior to installation.

2.8 FIBER OPTIC CONNECTORS

.1 Connectors shall be no-epoxy, no-polish style. The connector installation tool kit will contain an integrated continuity test systems (CTS), which will give immediate Go/No-Go feedback of successful connectivity.

.2 Multimode connectors shall have an average insertion loss of 0.1 dB. Single mode connectors shall have an average loss of 0.2 dB. Maximum insertion loss of any installed connector shall be no greater than 0.75 dB.

.3 Cable retention: 10 lb ≤ 0.2 dB change on jacketed cable exceeds; 0.5 lb ≤ 0.2 dB change on 900 µm cable, per FOTP-6.

.4 Operating temperature of -40º to +75ºC, exceeding EIA/TIA 568-C.3.

.5 Connection repeatability: 0.2 dB change, 500 rematings, per FOTP-21.

.6 Tip material: ceramic.

.7 Connector type: LC, SC or ST with Departmental Representative.

2.9 CATEGORY 6 PATCH CABLES

.1 Shall meet EIA/TIA 568A standards.

.2 23 AWG stranded tinned copper, insulated with high density plyethylene data grade cordage. The cord shall be jacketed in flame retardant PVC.

.3 Shall be four pair configuration and terminate with eight pin modular plug.

.4 Capable of high data rates to support voice, data, and video applications.

.5 DC resistance per lead: 94 ohms/100m maximum.

.6 DC resistance unbalanced: 5% maximum.

.7 Mutual capacitance: 6.6nF/100m maximum.

.8 Characteristic Impedance: 100 ohms (+/- 15 ohms) 1 to 250MHz.

.9 The patch cables for the Category 6 cabling system channel shall meet the electrical characteristics of the cabling system as specified in Clause 1.5 System Performance. The channel shall meet the requirements specified with the Category 6 patch cables provided.

.10 Provide 2 patch cables per horizontal cable run (3m length each).

.11 Individual balanced twisted-pair cords used in the channel but not within the permanent link shall be no longer than:

.1 5m for 24 AWG cords.

.2 3.96m for 26 AWG cords.

2.10 FIBER OPTIC PATCH CABLES

.1 Shall be tight-buffered, OM4 50/125 bend-insensitive fiber for multimode. The fiber cladding shall be covered by aramid yarn and a jacket of flame retardant PVC. Patch cables shall be available in LC duplex, SC duplex, or ST as required and must be manufactured by the warranty providing optical cable system manufacturer.

.2 Cable retention: 220N minimum.

.3 Individual fiber optic patch cords used in the channel but not within the permanent link shall be no longer than:

.1 3m.

2.11 DATA COMMUNICATIONS HORIZONTAL CABLING

.1 Category 6 Unshielded Twisted-Pair (UTP) Cable.

.1 All Cables shall be of round construction.

.2 Each cable shall contain 4 colour coded pairs.

.3 Cable shall be listed for the environment where it will be installed (Plenum, Riser, LSZH, etc.).

.4 Insulation shall meet FT-6 fire rating, when installed outside air plenum and installed in plenum.

.5 Category 6 mutual capacitance range: 44 to 46 pF/m.

.6 Characteristic Impedance: 100 ohms (+/- 15 ohms) 1 to 250MHz.

.7 CSA or ULC certified.

.2 Category 6 horizontal cabling shall provide the following Margin to the specification when installed in a 4 connector Channel.

Electrical Parameter (1-250MHZ)	Guaranteed Margins to Category 6 Class E Channel Specifications
Insertion loss	5%
NEXT	6 dB
PSNEXT	7.5 dB
ELFEXT	6 dB
PSELFEXT	8 dB

.3 Category 6 horizontal cabling shall meet or exceed the performance specifications listed in the following table when installed in a 4 connector Channel.

Guaranteed Channel Performance Specifications for 4-Connection GigaSPEED U/UTP Systems										
Freq (MHz)	Insertion Loss (dB)	NEXT (dB)	ACR (dB)	PSNEXT (dB)	PSACR (dB)	ELFEXT (dB)	PSELFEXT (dB)	Return Loss (dB)	Delay (ns)	Delay Skew (ns)
1.0	2.0	71.0	69.0	69.5	67.5	69.3	68.3	23.0	580	30
4.0	3.8	69.0	65.2	68.0	64.2	57.2	56.2	23.0	562	30
8.0	5.4	64.2	58.8	63.1	57.7	51.2	50.2	23.0	557	30
10.0	6.0	62.6	56.6	61.5	55.5	49.3	48.3	23.0	555	30
16.0	7.6	59.2	51.6	58.1	50.4	45.2	44.2	22.0	553	30
20.0	8.6	57.6	49.1	56.5	47.9	43.2	42.2	21.5	552	30
25.0	9.6	56.0	46.4	54.8	45.2	41.3	40.3	21.0	551	30
31.25	10.8	54.4	43.6	53.2	42.4	39.4	38.4	20.5	550	30
62.5	15.6	49.4	33.7	48.1	32.4	33.3	32.3	18.0	549	30
100.0	20.2	45.9	25.7	44.6	24.3	29.3	28.3	16.0	548	30
200.0	30.0	40.8	10.8	39.4	9.4	23.2	22.2	13.0	547	30
250.0	34.1	39.1	5.0	37.7	3.5	21.3	20.3	12.0	546	30

.1 The table provides reference values only. All parameters comply with the governing equations over the entire frequency range.

.2 All values and equations apply to worst-case channels utilizing four-pair cables with full cross-connects, consolidation points and work area outlets (4 connectors in a channel) for any channel lengths up to 100 meters.

2.12 VOICE BACKBONE CABLING

.1 Voice backbone cabling shall consist of 12 pair 100 ohm unshielded twisted pair (UTP).

.1 Meet Category 3 specifications and CSA or ULC certified.

.2 All cables shall be of round construction.

.3 23 AWG solid copper conductor.

.4 Cable shall be listed for the environment where it will be installed (Plenum, Riser, LSZH, etc.).

.5 Insulated with suitable plastic dielectric material, FT-6 rated.

.6 When mixing multiple dissimilar signals the 12 pair Category 3 cable must support distances up to 100m.

.7 DC resistance 9.4 ohms/100m maximum.

.8 Mutual capacitance: 5.6pF/100m.

.9 Characteristic Impedance: 100 ohms (+/- 15 Ohms) at 1 to 16MHz.

.10 Worst Pair Attenuation dB/100m:

MHz	dB
1.00	2.6
4.00	5.6
8.00	8.5
10.00	9.7
16.00	13.1

.11 Worst Pair Near End Crosstalk (NEXT) dB at 100m:

MHz	dB
1.00	41
4.00	32
8.00	27
10.00	26
16.00	23

2.13 COMMUNICATION OPTICAL FIBER BACKBONE CABLING

.1 General Multimode Optical Fiber

.1 Cable shall support current and next generation LAN, SAN, and WAN applications through laser-optimized 50/125 micrometer optical fibers and shall extend distance of low-cost 850 nanometer vertical cavity surface-emitting laser (VCSEL) based electronics.

.2 Cable shall support dual speed 1 gigabit per second/10 gigabits per second ports, allowing incremental upgrades of switches and servers with less disruption.

.3 Optical fibers shall be differential mode delay (DMD) tested using a high-resolution test bench that exceeds fiber optic test procedure (FOTP) 220 standards and independently certified by ULC or CSA.

.4 Cable shall also support existing and legacy multi-mode applications that traditionally operate in 850 and 1300 nanometer regions.

.5 Minimum bending radius of 20x cable diameter during installation and 10x cable diameter after installation minimum or as per manufacturers recommendations.

.2 OM4 Multimode Optical Fiber Specification

.1 The multimode fibers shall fully meet or exceed the OM4 fiber specifications in:

EN 50173-1:2011
ISO/IEC 11801:2010
IEC/EN 60793-2-10 (A1a fiber)
ANSI/TIA-492AAAD standards
Local/National Codes and Regulations

.2 The OM4 multimode fiber shall be manufactured with an inside vapor deposition process such as the MCVD (Modified Chemical Vapor Deposition) or PCVD (Plasma Clad Vapor Deposition) processes. Multimode fibers produced with outside vapor deposition processes, such as OVD or VAD, will not be accepted. Inside vapor deposition manufacturing processes results in superior control of Refractive Index Profile required for high bandwidth.

.3 The OM4 Multimode Fiber SCS shall be capable of supporting, at minimum, the following IEEE Ethernet applications:

802.3j	10BASE-F 10 Mb/s
802.3j	10BASE-FL 10 Mb/s
802.3u	100BASE-FX 100 Mb/s
802.3u	100BASE-SX 100 Mb/s
802.3z	1000BASE-SX 1000 Mb/s
802.3ae	10GBASE-SR 10Gb/s
802.3aq	10GBASE-LRM 10Gb/s with EDC
802.3ba	40GBASE-SR4 40 Gb/s
802.3ba	100GBASE-SR10 100 Gb/s

.4 Additionally the OM4 Multimode Fibre SCS shall be capable of supporting the following Fibre Channel Applications Standards, per Technical Committee 11 of INCITS:

1GFC
2GFC
4GFC
8GFC
10GFC
16GFC

.5 The OM4 multimode fibre shall comply with the following physical specifications:

Cladding Diameter	125 µm
Cladding Diameter Tolerance	±1.0 µm
Cladding NonCircularity, maximum	1%
Coating Diameter (Colored)	254 µm
Coating Diameter (Uncolored)	245 µm
Coating Diameter Tolerance (Colored)	±7 µm
Coating Diameter Tolerance (Uncolored)	±10 µm
Coating/Cladding Concentricity Error, maximum	6 µm
Core Diameter	50.0 µm
Core Diameter Tolerance	±2.5 µm
Core/Clad Offset, maximum	1.5 µm
Numerical Aperture	0.200 ± 0.015
Zero dispersion wavelength	1297 – 1316 nm
Zero dispersion slope	≤ 0.105 ps/nm2-km
Maximum DMD (note: must comply with at least one of the 6 templates specified below 850 nm 1300 nm	Meets or exceeds TIA/EIA-492AAAC-A and IEC 60793-2-10 A1a.2 See attached templates 0.88 ps/m

.6 The OM4 multimode fiber shall meet the following requirements:

Maximum Fiber Cabled Loss	3.0 dB/km at 850 nm* 1.0 dB/km at 1300 nm*

Minimum Effective Modal Bandwidth Minimum overfilled Modal Bandwidth	4700 MHz.km at 850 nm (DMD, laser) 500 MHz.km at 1300 nm (DMD, laser) 3500 MHz.km at 850 nm (OFL) 500 MHz.km at 1300 nm (OFL)
Operating Temperature Range (cabled fiber)	-20°C to 50°C (-4°F to 122°F)*
Storage Temperature Range (cabled fiber)	0°C to 50°C (32°F to 122°F) for LSZH -40°C to 65°C (-40°F to 149°F) for others
Maximum Pulling Tension	90 kg
Minimum Tensile Strength	0.7 GPa (100,000 psi)

*

NOTE: this value reflects cabled fiber loss. Un-cabled fiber values will not be accepted

.7 The OM4 multimode fibers shall be color coded to facilitate individual fiber identification. Color coding shall follow industry standard TIA-598-C Optical Fiber Cable Color Coding.

.8 The coating shall be mechanically strippable.

.9 The OM4 fiber shall meet a minimum of one of the DMD templates listed below, accounting for the wider inner and outer mask specifications when compared with TIA 492AAAc and IEC 60793-2-10 standards:

.10 Differential Mode Delay Testing:

The OM4 multimode fiber shall be tested in accordance with:
IEC/EN 60793-1-49
ANSI/TIA-455-220-A
ANSI/TIA-492AAAC-A

.11 The following additional enhancements to the DMD tests must be made to ensure high bandwidth:

Enhancement to IEC/EN 60793-1-49 and ANSI/TIA-492AAAC-A standards	
Parameters	Test Requirement

Speed of Laser	5 ps pulse width
Scan Resolution (Radial Increment)	1 µm
Inner Mask Radial Coverage	0 – 18 µm (no central hole)
Number of Quadrants Tested	4 quadrants
Test Length	300- 550 meters

.12 The Cable Manufacturer must have the capability to test DMD for cabled product. Third party verification of the DMD test bench must be provided with the bid response.

2.14 OPTICAL FIBER CABLING TYPES

.1 Inter Building Stranded Backbone (OSP)

.1 All cable shall be manufactured and constructed for use in the Outside Plant Environment and shall meet one of the following, per bid document.

.1 Outside Plant (OSP) loose tube all dielectric - Dielectric design with MDPE sheath jacket and no metallic elements to provide environmental protection.

.2 Outside Plant (OSP) loose tube metallic sheath - Metallic sheath design with MDPE sheath jacket to provide environmental protection. Metallic armor of corrugated polymer coated steel tape to provide added crush protection. Armor shall meet Telcordia requirements for superior armored cable.

.2 Buffer tubes and optical fibers:

.1 Industry standard buffer tubes stranded around a central strength member and compatible with standard hardware, cable routing, and fan-out kits.

.2 Optical fibers shall be industry-standard color coded and separated into 12-fiber color-coded binder groups surrounded by plastic core tubes.

.3 Water blocking:

.1 OSP Fiber Cables are available as either fully dry or dry core with gel in the buffer tubes. The bid document will specify the cable type.

.1 Dry water-blocking compound suitable for underground conduit, direct burial, and aerial applications in cable and buffer tubes.

.2 Dry water-blocking compound suitable for underground conduit, direct burial, and aerial applications with gel filled buffer tubes.

2.15 OPTICAL FIBER CONNECTIVITY / SPLICING

.1 Optical fiber connectors shall be installed as per the requirements specified by the manufacturer's installation guidelines.

.2 All splicing shall be of the fusion type made under Light Injection and Detection Mode, whenever applicable. The Contractor shall provide certified and experienced personnel for splicing.

.3 Contractor's tools and equipment shall be in excellent working order. Any worn or improperly working tools shall be discarded and not used on this project. All fusion splicers shall be calibrated and labeled according to the manufacturer's specifications. Contractor shall submit certification of calibration for the fusion splicers to the Departmental Representative.

2.16 OPTICAL FIBER CONNECTORS AND PIGTAILS

.1 All optical fiber shards shall be properly disposed in an approved container to prevent injury. The use of tape is not an approved method for disposal.

.2 Application of direct connect fiber connectors(crimp, adhesive or anaerobic) shall be done in accordance with manufacturer's instructions and industry best practice.

.3 Pigtails shall be installed with appropriate fusion splicing equipment that has been calibrated per manufacturer's recommendations.

.4 After polishing/splicing is completed, optical fiber connectors shall be visually checked with an inspection scope (min x200) for damage and debris.

.5 If the optical fiber core is fractured, chipped or scratched it must be re-terminated.

.6 Dust caps to be installed immediately after inspection and insertion into coupler plates.

2.17 GROUNDING

.1 Refer to Section 27 05 26 - Grounding and Bonding for Communications Systems.

Part 3 Execution

3.1 EQUIPMENT

.1 Provide a minimum of 1m clearance between exposed live parts of equipment and cross connect fields.

.2 Racks and cabinets shall be located so as to provide 1m clearance in front and behind each rack or cabinet as measured from the outermost point of the rack, cabinet, or equipment which is mounted within the rack or cabinet.

.3 Wall mounted equipment, racks, cabinets or brackets shall be mounted on 19mm backboard 2.1m to the top AFF.

.4 Equipment shall be mounted on backboards, racks, or cabinets a minimum of 300mm AFF.

.5 Equipment shall be mounted to provide a minimum clearance of 300mm from end walls.

.6 Equipment connected directly to a cross connect shall be connected with cables not more than 3m in length.

.7 Install the surge suppressor power bar on the rack designated for active electronics as directed on site.

3.2 CONNECTORS AND FACEPLATES

.1 Modular jacks shall be mounted with the contacts up.

.2 Four pair 100 ohms UTP cable:

.1 Terminate each four pair 100 ohms UTP cable directly to an 8 position, 8 conductor modular jack assembly at the work area.

.2 Terminate all 8 position, 8 conductor modular jacks as per T568A pin assignment.

3.3 CONNECTORS AND FACEPLATES

.1 Modular jacks shall be mounted with the contacts up.

.2 Four pair 100 ohms UTP cable:

.1 Terminate each four pair 100 ohms UTP cable directly to an 8 position, 8 conductor modular jack assembly at the work area.

.3 Terminate all 8 position, 8 conductor modular jacks as per T568A pin assignment.

3.4 UTP PATCH CABLES

.1 Patch cables shall not exceed a combined length of 6m in a channel.

.2 Provide all patch cables required to cross connect and connect all patch panels and active electronics, and telephone cross connects throughout the communications system including the telephone demarcation field.

.3 Provide 3m patch cables for all jack location.

.4 Install patch cables in an organized manner, neatly laced within the wire management provided.

3.5 FIBER OPTIC PATCH CABLES

.1 Provide all patch cables required to cross connect and connect all patch panels and active electronics.

.2 Install patch cables in an organized manner, neatly laced within the wire management provided.

3.6 HORIZONTAL CABLING

.1 Horizontal cabling shall be installed in a star topology.

.2 Bridged taps shall not be used within the horizontal cabling system.

.3 Hard splices shall not be used within a twisted pair horizontal cabling system.

.4 Equipment shall not be connected directly to horizontal cables.

.5 Ensure minimum cable bend radius and maximum pulling tension, as recommended by the cable manufacturer, is not exceeded. Minimum bend radii for UTP cable is four (4) times the cable diameter, manufacturers recommendations may be greater.

.6 Cables shall be bundled with Velcro cable straps. No tyraps are permitted. Velcro cable straps are for bundling only, Velcro cable straps shall not support the weight of the cable.

.7 When terminating cable in connecting hardware insure that the amount of untwisted wire of UTP cable at the termination does not exceed 13mm.

.8 Ensure cable is mounted, terminated, and managed to meet manufacturers specifications.

.9 Horizontal cabling shall not exceed a distance of 90 meters from cross connect to information outlet.

.10 Provide 1m coil of slack at communication backboard above the equipment rack for balanced twisted-pair cabling.

.11 Provide 2 m coil of slack at communication backboard above the equipment rack for optical fiber cabling.

.12 Provide 0.3m coil of slack in the Work Area to enable the possibility of future changes for balanced twisted-pair cabling.

.13 Provide 1m coil of slack in the Work Area to enable the possibility of future changes for optical fiber cabling.

.14 All horizontal cabling shall maintain the following distances from EMI producing equipment listed:

- .1 Maintain specified distances from possible sources of EMI identified below.
  - .1 Electric motors or transformers 1200mm
  - .2 Unshielded power lines or electrical equipment in proximity to open or nonmetal pathways: <2kVA 125mm
  - .3 Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway: <2kVA 63.5mm
  - .4 Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal conduit pathway: <2kVA <25mm
- .2 Wire in conduit and/or cables >300V 1000mm
- .3 Fluorescent lamps 125mm
- .4 Neon lamps 125mm
- .5 Mercury vapor lamps 125mm
- .6 High-intensity discharge lamps 125mm
- .7 Arc welders 780mm
- .8 Frequency induction heating 1000mm
- .9 When horizontal cabling is required to cross fluorescent lighting, conduit and/or cables used for power they shall cross perpendicular to each

other. No separation is required between power and telecommunication cables crossing at right-angles.

.15 When a building lightning protection system is utilized the communications cabling shall not be installed closer than 1.8m from any lightning protection system conductors.

.16 All horizontal cabling that penetrates fire rated barriers must be provided with fire stop to meet local fire codes.

3.7 UTP BACKBONE CABLING

.1 Backbone cabling shall be installed in a star topology.

.2 Install cables individually.

.3 Bridged taps shall not be used within the backbone cabling system.

.4 Ensure minimum cable bend radius and maximum pulling tension, as recommended by the cable manufacturer, is not exceeded.

.5 When a building lightning protection system is utilized the communications cabling shall not be installed closer than 1.8m from any lightning protection system conductors.

3.8 FIBER OPTIC BACKBONE CABLING

.1 Backbone cabling shall be run in a dedicated conduit.

.2 Backbone cabling shall be run in fiber inner duct, sized to meet the manufacturers percent fill requirements. Install inner duct on dedicated J-hook pathway.

.3 Backbone cabling shall be run in fiber inner duct, sized to meet the manufacturers percent fill requirements.

.4 Ensure minimum cable bend radius and maximum pulling tension, as recommended by the cable manufacturer, is not exceeded.

.5 All conduit or duct shall be 50mm unless otherwise indicated. Pull boxes shall be provided after every two 90 degree bends unless otherwise indicated.

.6 Optical Fiber backbone cable shall be terminated with approximately 1m of fiber slack located within the termination panels.

3.9 ADMINISTRATION

.1 Labeling shall be as per EIA/TIA 606 standards.

.2 All administrative labeling shall be typewritten with electronic label maker printed on self-adhesive ribbon or on integral labeling strip provided with equipment. Clean area where label will be applied with alcohol or equivalent cleaner to remove dirt and grease.

.3 Workstation and Horizontal Patch Panel labeling:
.1 R1-1000/2000

R R - Rack, C - Cabinet
1 Rack or Cabinet #
1000 sequential cable identification number
2000 room number or workstation location

.2 Provide icons as specified on workstation devices and patch panels.

.4 Backbone Patch Panel labeling:

.1 D1000-R1/C2

D D - data backbone, T - telephone backbone
1000 sequential cable identification number
R Head end; R - rack, C - cabinet
1 Head end rack or cabinet identification
C Intermediate end; R - rack, C - cabinet
2 Intermediate end rack or cabinet identification

.2 Provide icons as specified on workstation devices and patch panels.

.5 All horizontal and backbone cabling shall be provided with cable labeling identification at both ends. Provide clear plastic cover over cable labeling.

.6 All administrative labeling shall be recorded on as-built drawings and included in the Operation and Maintenance Manuals.

.7 The use of colored backboards, connections, covers, or labels are an approved method of color coding for the cross connect fields.

.8 Review and confirm labeling standards with Departmental Representative.

3.10 TESTING

.1 General Requirements:

.1 Provide installation testing of equipment where required by manufacturer's installation instructions.

.2 Provide complete end to end testing for all copper and fiber optic systems/channels based on latest applicable standards. Document all testing and submit with final as-built submittal package.

.3 For all controls and operating equipment, submit equipment/systems to at least three complete operational sequences, in which all equipment operations are tested, observed, and verified.

.4 Prior to substantial completion and project acceptance inspection, submit test reports to indicated scope of startup and operational tests, with results of testing for each specified operation.

.2 Copper Cabling System Testing:

.1 General: Copper cabling shall be tested and certified after installation as follows and as required for cable manufacturer's warranty. Twisted-pair copper cable channels shall be tested for continuity as specified below, presence of ac/dc voltage, and performance. All cabling shall be tested for conformance to horizontal cable specifications as outlined herein, and

shall be tested according to test set manufacturer's instructions utilizing latest firmware and software. Testing shall include all of electrical parameters as specified under Product. All cables and termination hardware shall be 100 percent tested by installation contractor for defects in installation and to verify cable performance under installed conditions. All conductors of each installed cable shall be verified useable by Contractor prior to system acceptance. All cables shall be tested according to contract documents, manufacturer's warranty provisions, and best industry practices. If any of these are in conflict, Contractor shall comply with most stringent requirements. All defects in cabling system installation shall be repaired or replaced in order to ensure 100 percent useable conductors in all cables installed, at no additional cost to Departmental Representative.

.2 Continuity: Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. The test shall be recorded as pass/fail as indicated by test unit according to manufacturers' recommended procedures, and referenced to appropriate cable identification number and circuit or pair number. Any faults in wiring shall be corrected and cable re-tested prior to final acceptance.

.3 Length: Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to maximum distances set forth in TIA/EIA-568-C standards and all other applicable standards specified in Appendix 1: Codes, Standards, and Informative References. Cable lengths shall be recorded, referencing cable identification number and circuit or pair number. For multi-pair cables, shortest pair length shall be recorded as length for cable.

.4 Factory testing: Every reel of cable shall be tested by cable manufacturer for all characteristics specified for cable type in this section. This testing shall be performed using a sweep test method and include frequencies specified for cable. A test report shall be available electronically, at no additional cost, for a minimum of five (5) years from the date of manufacture. The test report shall include the reel number, the date of the test, the Lot number, and test results for Return Loss (RL), Insertion Loss (Attenuation), Pair-to-Pair NEXT, and Power Sum NEXT Pair-to-Pair ELFEXT and Power Sum ELFEXT. The test report shall show the "Worst Case Margin" for the listed transmission characteristics.

.5 Test results: Test results shall be automatically evaluated by equipment, using most up-to-date criteria from TIA/EIA-568-C standards and all other applicable standards specified in Appendix 1: Codes, Standards, and Informative References, and result shown as pass/fail. Test results shall be printed directly from test unit or from a download file using an application from test equipment manufacturer. The printed test results shall include all tests performed, expected test result and actual test result achieved.

.6 Test Instruments:

.1 Certification instrument accuracy have been defined for field testing as follows:

.1 Level IIIe field test instruments are required for measurements up to Category 6 and Class E cabling.

.7 Test reports: Test reports for all factory testing and field test reports for copper cabling installation shall be submitted to the Departmental Representative and manufacturer prior to commissioning voice and data system and final contract payment. Refer to Submittals in this Section.

.8 Testing shall be made in accordance with the latest edition of EIA/TIA Standard for Category 6 equipment.

.9 Test kit must have been calibrated/re-calibrated within the period recommended by the manufacturer. Provide a dated paper copy of the calibration/re-calibration report. Include serial number(s), firmware version and date of manufacturer. An accredited laboratory that is traceable to NIST must have completed the calibration.

.10 Only special adapters and/or special patch cables or OEM of test kit are allowed to be used to perform a Channel test.

.11 Test reports must be from software/firmware that is the latest version.

.12 Test kit must test for stray noise on the cable prior to performing test.

.13 The following tests shall be performed and recorded on all the individual Voice and Data Communications cables from both directions using a tester EIA/TIA approved for Category 6 cabling .

.1 Continuity or wiremap testing consisting of:

.1 Open/short testing.

.2 Polarity testing.

.3 Pair transposition testing.

.2 Insertion loss (attenuation) as defined in TIA/EIA-568-C standards.

.3 NEXT as defined by TIA/EIA-568-C standards. Pair to pair near end crosstalk loss shall be tested for each wire pair combination measured from 1 to 250 MHz.

.4 Insertion loss (attenuation) as defined by TIA/EIA-568-C standards shall be tested from 1 MHz to 250 MHz. Identify worst pair, summary, highest attenuation value at the frequency.

.5 ELFEXT loss, pair to pair as defined by TIA/EIA-568-C standards. Measured for each wire pair combination at both ends of the link from 1 to 250 MHz steps.

.6 PSELFEXT as defined by TIA/EIA-568-C standards. Each wire pair is to be tested from 1 to 250 MHz.

.7 PSNEXT loss as defined by TIA/EIA-568-C for each wire pair from both ends of the link.

.8 Return Loss as defined by TIA/EIA-568-C standards. Each defined wire pair shall be measured from 1 through 250 MHz.

.9 ACR (attenuation to crosstalk ratio) from each end of the link.

.10 PSACR (Power Sum ACR) for each pair of wires.

.11 Propogation Delay as defined by TIA/EIA-568-C standards.

.12 Delay Skew as defined by TIA/EIA-568-C standards.

.14 Cables not complying with TIA/EIA-568-C Category 6 standards for 250MHz or passing TSB 67 test guidelines shall be identified to the Departmental Representative for corrective action which may include replacement at no additional expense to the Departmental Representative.

.3 Optical Fiber Cable Testing:

.1 General: Optical fiber cabling shall be tested and certified after installation as described below and as required for cable manufacturer's warranty. Fiber testing shall be performed on all fibers in completed end to end system. Testing shall consist of a bi-directional end to end test in accordance with applicable standards, or a bi-directional end to end test performed by EIA/TIA-455-53A and all other applicable standards. The system loss measurements shall be provided at 850 and 1300 nanometers for multimode type glass and 1310 and 1550 nanometers for single-mode type glass. These tests shall also include continuity checking of each fiber. For spans greater than 90 meters, each tested span must test to a value less than or equal to value determined by calculating a link loss budget. For horizontal spans less than or equal to 90 meters, each tested span must be less than or equal to 2.0 decibels. The insertion loss for each mated optical fiber connector pair shall not exceed 0.40 decibels.

.2 Pre-installation testing: Test all optical fiber cable for all fibers prior to installation of cable.

.3 Performance testing: Where links are combined to complete a circuit between devices, Contractor shall test each link from end to end to ensure performance of system. Only a basic link test is required. Contractor can optionally install patch cords to complete circuit and then test entire channel. The test method shall be same used for test described above. The values for calculating loss shall be those defined in applicable TIA/EIA standards in Appendix 1: Codes, Standards, and Informative References.

.4 Each strand in Optical Fiber cables shall be tested for installed Optical Fiber plant (length, attenuation uniformity, power loss event, etc.) using an approved Optical Time Domain Reflectometer (OTDR) or tested for correctness of termination and overall transmission loss using an approved Optical Loss Test Set (OLTS) and a visible light source. Optical Loss Testing shall be conducted using a one jumper reference method.

.5 Attenuation testing: Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach test equipment to cable plant. The light source shall be left in place after calibration and power meter moved to far end to take measurements.

.6 Loss budget: All fiber cabling shall be tested (bi-directionally if premises optical fiber) at both wavelengths 850 nm and 1310 nm for multimode and 1300 nm and 1550 nm for single mode.

.1 Provide calculated fiber link loss budget. Provide spreadsheet indicating measured fiber loss budget compared to calculated fiber loss budget.

.7 Link loss: A mated connector to connector interface shall be considered a single connector. Loss numbers for installed link shall be calculated by taking sum of bi-directional measurements and dividing that sum by two. All links not meeting requirements of standard shall be brought into compliance by Contractor, at no additional cost to Departmental Representative.

.8 Documentation: Following final documentation shall be submitted to the Departmental representative prior to commissioning data system and final contract payment according to Submittals in this section.

.9 Test results: Test results shall be automatically evaluated by equipment, using most up-to-date criteria from all applicable standards and result shown as pass/fail (including link loss budgets). Test results shall be printed directly from test unit or from a download file using an application from test equipment manufacturer. The printed test results shall include all tests performed, expected test result and actual test result achieved.

.1 Documentation (signature traces for OTDR) shall be submitted listing the test results and both the calculated and measured loss for each fiber (OLTS / OTDR).

.10 End to End Loss Data: final documentation shall be submitted to the Departmental representative.

.11 As Installed/ As Built Diagrams: Final documentation shall be submitted to the Departmental representative.

.4 Test Documentation:

.1 Electronic Format

.1 Certification Test Reports shall be submitted in electronic format using the appropriate software supplied by the test equipment manufacturer. The data format should be that of the test report software (i.e. *.flw files for Fluke). The contractor shall provide any necessary software to view and evaluate the test data.

.1 One electronic copy of the Test Reports shall be provided.

.2 Paper Format

.1 Provide test documentation in 3-ring binders within 2 weeks after completion of project testing. Binders shall be clearly marked on outside front cover and spine with words Test Results, project name, and date of completion (month and year). Major heading tabs, Horizontal and Backbone, shall divide binder. Each major heading shall be further sectioned by test type. Within horizontal and backbone sections, divide by tabs scanner test results by category, optical fiber attenuation test results, and continuity test results. Present test data within each section in sequence listed in administration records.

.2 Provide test equipment by name, manufacturer, model number and last calibration date at the end of document. Unless manufacturer specifies more frequent calibration cycle, annual calibration cycle shall be required on all test equipment used for this installation.

.3 Test document shall detail test method used and specific settings of equipment during test. Scanner tests shall be printed on 8 1/2in x 11in. Hand written test results (attenuation results and continuity results) shall be documented on a suitable test form.

.4 When repairs and re-tests are performed, note problem found and corrective action taken, and collocate in binder both failed and passed test data.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CAN/ULC-S524 Installation of Fire Alarm Systems

.2 CAN/ULC-S525 Audible Signal Appliances for Fire Alarm

.3 CAN/ULC-S526 Visual Signal Appliances for Fire Alarm Systems

.4 CAN/ULC-S527 Control Units, Fire Alarm

.5 CAN/ULC-S528 Manual Pull Stations

.6 CAN/ULC-S529 Smoke Detectors, Fire Alarm

.7 CAN/ULC-S530 Heat Actuated Fire Detectors, Fire Alarm

.8 CAN/ULC-S531 Smoke Alarms

.9 CAN/ULC-S536 Inspection and Testing of Fire Alarm Systems

.10 CAN/ULC-S537 Verification of Fire Alarm Systems

.11 Alberta Building Code

.12 CSA 22.1 Canadian Electrical Code

1.2 DESCRIPTION OF SYSTEM

.1 This specification provides the requirements for the supply and installation, programming, testing, commissioning and verification of a complete Addressable Analog Fire Detection System. The system shall include, but not be limited to: control panels, input and control modules, alarm initiating and indicating peripheral devices, conduit, wire and accessories, etc. required to furnish a complete operational system. Provide 120V circuits for equipment as required, even when not shown on drawings.

.2 System Includes:

- .1 Microprocessor based addressable control panel to carry out fire alarm and protection functions including receiving alarm signals, initiating general alarm, supervising system continuously, actuating zone annunciators, initiating trouble signals, performing fire control functions, etc.
- .2 Trouble signal devices.
- .3 Power supply facilities.
- .4 Manual alarm stations.
- .5 Automatic alarm initiating devices.
- .6 Audible alarm signal devices.
- .7 Visual alarm signal devices.
- .8 End-of-line devices.
- .9 Ancillary devices.
- .10 Standby batteries.
- .11 Auxiliary control.
- .12 Intelligent environmental compensation.

.3 The loading of device loops shall be based on approximately 80% load. Provide additional loops to comply with this loading where required or directed.

.4 The loading of horn circuits and strobe circuits shall not exceed 75% circuit capacity. Provide additional circuits to comply with this loading where required or directed.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

.1 The equipment and installation shall comply with the current ULC and Alberta Building Code requirements.

.2 Alberta Building Code.

.3 Local and Municipal By-Laws.

.4 Authorities having jurisdiction.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00 for the complete Fire Alarm system including:
- .1 All devices.
- .2 Control panel, accessories, etc.
- .3 Programming of the Fire Alarm System.
- .4 All other components of the fire alarm system.
- .5 Description of the operational sequences of the system.
- .6 Pictorial drawings of control equipment indicating the location of the components and parts and their respective catalogue number and electrical characteristics.
- .7 Maintenance instructions.
- .8 Recommended spare parts list.
- .9 Provide name, address and telephone number of the manufacturer's service representative to be contacted during the warranty period.
- .10 Complete wiring diagram, including:
  - .1 Connections to devices
  - .2 Schematics of modules

.2 This information is to be revised to "as-built" after construction is completed. Insert as part of the Operating and Maintenance Manuals.

1.5 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for Fire Alarm System for incorporation into Operation and Maintenance Manual specified in Section 26 05 00.

.2 Include:
- .1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.
- .2 Technical data - illustrated parts lists with parts catalogue numbers.
- .3 Copy of as-built shop drawings.

1.6 WARRANTY

.1 Warranty all Equipment, Sensors, materials, peripherals, installation, workmanship, etc. for one (1) year from the date of final acceptance of the system.

.2 Provide a complete system inspection test 1 year after final acceptance.

.3 Provide all programming of system as directed during the warranty period at no cost to Departmental Representative.

1.7 MAINTENANCE SERVICE

.1 Maintenance Service Contract: Provide maintenance of fire alarm systems and equipment for a period of 12 months, using factory-authorized service representatives.

.2 Basic Services: Systematic, routine maintenance visits on a quarterly basis at times scheduled with the Departmental Representative. In addition, respond to service calls within 24 hours of notification of system trouble. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.

.3 Additional Services: Perform services within the above 12-month period not classified as routine maintenance or as warranty work when authorized in writing. Compensation for additional services must be agreed upon in writing prior to performing services.

.4 Renewal of Maintenance Service Contract: No later than 60 days prior to the expiration of the maintenance services contract, deliver to the Departmental Representative a proposal to provide contract maintenance and repair services for an additional one-year term. Departmental Representative will be under no obligation to accept maintenance service contract renewal proposal.

.5 The supplier of the system must employ factory trained technicians and maintain a service organization within driving distance of the job site.

Part 2 Products

2.1 MANUFACTURER

.1 Being listed as an acceptable Manufacturer in no way relieves obligation to provide all equipment and features in accordance with these specifications.

.2 The Manufacturer shall be a nationally recognized company specializing in fire alarm and detection systems. This organization shall employ factory trained and CFAA certified technicians, and shall maintain a service organization within 100 miles of this project location. The Manufacturer and service organization shall have a minimum of 10 years experience in the fire protective signaling systems industry.

.3 Any equipment proposed as equal to that specified herein must conform to the standards herein. All equipment must be of one manufacturer. In addition, the contractor must obtain the Departmental Representative's approval in writing five (5) working days prior to bidding other than as specified. Refer to Requests for Equals in Section 26 05 00 as well. Approval of other manufacturers does not relieve the contractor from meeting the specification requirements.

.4 Manufacturers
.1 Approved manufacturers:

.1 Chubb Edwards
.2 SimplexGrinnell
.3 Notifier by Vipond

.5 All equipment and components shall be the manufacturer's current models, unless noted otherwise. The system and components must be supplied by one manufacturer. The materials, appliances, equipment and devices shall be tested and listed to ULC standards for use as part of a protective signaling (fire alarm) system. The Contractor shall provide, from the acceptable manufacturer's current product lines, equipment and components that comply, with the requirements of these Specifications. Equipment or components, which do not provide the performance and features, required by these specifications are not acceptable, regardless of manufacturer.

2.2 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 All equipment furnished for this project shall be new and unused. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on contract drawings and installation specifications shall be the best suited for the intended use and shall be the product of a single manufacturer.

2.3 FIRE ALARM DESIGN FEATURES

.1 The Fire Alarm System shall be a single stage, non-coded, electronically supervised, addressable, microprocessor based system. Supply complete with all hardware and software necessary for this installation.

.2 Manual override switches, Actions, Sequences, and Time Controls shall have the ability to be software disabled to prevent unauthorized operation during non alarm condition. Switches shall be automatically enabled during alarm condition to allow manual control by authorized personnel.

.3 When all active events that initiated the SET or RESET of an output have returned to normal, only then shall the output be allowed to restore.

.4 Visually indicate at the control panel LCD, the addressable device or the circuit of alarm initiation. When the control panel goes into the alarm condition the green NORMAL LED shall extinguish, the red ALARM LED shall light and the BUZZER shall pulsate. The first line of the 80 character LCD shall indicate the REAL TIME, the number of MESSAGES WAITING, the TYPE of ALARM, the ALARM ZONE NUMBER, and the TIME THAT THE ALARM OCCURRED. The second line shall display the user specified message.

.5 The system shall be capable of setting the sensitivity of all analog sensors by point and be capable of displaying the analog value of the sensor by device and/or traditional input and vectoring the value to the printer. The system shall automatically identify any analog sensor which becomes dirty (maintenance alert) prior to false alarming.

.6 The operator shall acknowledge the alarm by pressing the NEXT/ACK button, and the buzzer will silence providing there is not an additional alarm pending. If there are additional alarms waiting, the operator shall acknowledge all pending

alarms before the buzzer will silence. To silence audible devices, the operator shall press the ALARM SILENCE button. A new alarm shall cause the audibles to respond. To reset the system the operator shall press the RESET button.

.7 Wiring/Signal Transmission:

.1 Transmission shall be hard-wired, using separate individual circuits for each zone of alarm operation as required or addressable signal transmission, dedicated to fire alarm service only.

.2 System connections for initiating, signalling line circuits and notification appliance circuits shall be Class A for bedrooms, and notification appliance circuits shall be Class B in corridor.

.3 Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.

2.4 SEQUENCE OF OPERATION

.1 On activation of any alarm initiating device on the fire alarm system, the system shall go into alarm as follows:

.1 Signal all horns and strobes activate throughout the building.

.2 Annunciate the location of the alarm initiating device on the control panel.

.3 Shut down all fans, etc. in the building as indicated.

.4 The alarm signal continues to sound throughout the facility until:

.1 Tones are manually silenced; horns remain silenced until a subsequent zone is activated.

.2 Alarm initiating device / devices are reset / cleared and the system is reset.

.5 Other auxiliary functions as specified.

.2 If the system is being tested by staff, all annunciators and control panel shall display "TEST IN PROGRESS" in addition to the initiating devices being tested.

2.5 FIRE ALARM CONTROL PANEL (FACP)

.1 The fire alarm control panel shall be modular in construction with multi tasking microprocessor-based technology, distributed processing, and include a watchdog circuit per individual module processor to monitor the proper operation of every system processor. All components must be housed in an approved enclosure, behind a cylinder locked, removable hinge door with a viewing window. Opening of the panel door must not expose live components or wiring. The door must be easily removable without tools to prevent any obstruction to the operator during fire alarm management procedures or during system maintenance procedures.

.2 The system must be fully field programmable. Perform any required logical sequence for fan and damper control. Provide 99 software timers accurate to one second for any required timing functions. The timers may be individually programmed from one second to four hours.

.3 The system software must fully integrate all of the system functions including annunciation, alarm management sequence, fan and damper control.

.4 The system must be capable of providing alarm indication in degrade mode by activating the addressable loop alarm led.

.5 The total system one way response to an alarm shall be no more than 2.5 seconds on a system configured to the maximum capacity.

.6 The addressable loop must not be loaded more than 80% of full system capacity.

.7 The control panel shall have a two line by forty character backlit alphanumeric LCD display.

.8 The operator control panel must be intuitive in design. It must be fully bi-lingual in English and French and must have all the following standard indications and control buttons clearly labelled in English and French. A programmable key may be used to toggle the system prompts and printouts between the English and French languages.

.9 Detection line circuit monitoring shall be provided.

.10 An output circuit for operation of DC audible devices, or city tie, shall be provided by Controllable Signal Module.

.11 The system shall require no manual input to initialize in the event of a complete power down condition. It shall return to an on line state as an operating system performing all programmed functions upon power restoration. Systems requiring battery backed-up memory devices shall not be acceptable.

.12 Selectable history event logging shall be stored in flash memory and displayed, downloaded by classification for selective event reports.

.1 Audible and visual indications shall be generated when memory is 80% and 90% full to allow downloading of data. The system shall be programmable circular logging, assuring that at least the last 800 events will always be stored in non-volatile memory.

.13 The system shall support intelligent analog smoke detection, conventional smoke and heat detection, manual station, supervisory and status monitoring devices.

.14 The panel must be capable of measuring the sensitivity of connected intelligent analog ionization and photoelectric smoke detectors.

.1 The measurements shall be discrete voltage readings, accurate to .01 VDC. The readings shall be dynamic, providing a constant display of voltage shifts when in the sensitivity voltage list mode.

.2 The control panel shall provide a display and a printed list of these sensitivity measurements as a permanent record of the required sensitivity testing.

.3 When programmed, any system connected, ionization or light refraction style smoke detector shall be capable of automatic sensitivity drift compensation up or down. This adjustment shall keep the relationship between the sensing chamber voltage and the programmed alarm threshold voltage constant throughout the life of the detector to prevent false indications or failure to alarm in the presence of smoke.

.4 The control panel shall place each detector in the system in an alarm condition, transparent to the system user, every twenty four hours as a dynamic check of the accuracy of the alarm threshold setting. Upon reception of the alarm report, the system detector shall be restored to it's pretest state.

.5 The system shall be capable of recognizing that a detector has been cleaned, initiating a series of tests to determine if the cleaning was successful and display a detector cleaned message, readjusting that detectors normal sensitivity setting reference.

.15 The system shall be capable of reporting alarms from devices whether programmed or not. Alarm reports from these devices shall activate indicating appliance circuits.

.16 The system shall be complete with four (4) sets of output contacts for connection to the Central Station monitoring equipment. Respective signals to be programmed for “Alarm”, “Trouble”, “Supervisory”, “Carbon Monoxide” or other fire response functions. The Carbon Monoxide signal is to be programmed for latching supervisory only.

.17 The system shall be provided with two levels of password protection with up to forty passwords.

.18 The system must be capable of reading and displaying at the control panel the sensitivity of remote intelligent/analog ionization and photoelectric detection devices. Individual intelligent/analog detection device alarm threshold must be adjustable form the control panel.

.19 The detection system must remain 100% operational and capable of responding to an alarm condition while in either routine operator maintenance mode or during programming by the manufacturer.

.20 The control mode must permit the arming and disarming of individual detection or output devices. Status of these devices must be displayed upon command from the control panel.

.21 The address, type of device and sensitivity setting of each addressable device must be field setable by a simple programming device and stored in the addressable device in non-volatile memory.

.22 The system must be programmed in the field only via laptop computer. Burning of EPROMs is not acceptable. System programming must be password protected. The final system program must be available on hardcopy and included in the Departmental Representative's manuals.

.23 Enclosures:

.1 The control panel shall be housed in a ULC listed steel cabinet suitable for surface or semi flush mounting. The cabinet and front shall be corrosion protected, given a rust resistant prime coat, and manufacturer's standard finish.

.2 The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.

.3 The door shall provide a key lock and include a transparent opening for viewing all indicators. For convenience, the door shall have the ability to be hinged on either the right or left hand side.

.4 The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.

.5 Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure.

If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.

.24 The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:

.1 Fire alarm and detection operations

2.6 GRAPHIC ANNUNCIATOR - PASSIVE TYPE

.1 Graphic annunciator - to include footprint of entire system. Include all zones, devices, alarm and supervisory device or zone, etc..

.2 Enclosure: finish to match Fire Alarm Control Units. The locking cover/display assembly is hinged on the left. Key and lock shall be common to all secured fire alarm system enclosures.

.3 Provide graphic annunciators in the following locations:

.1 Alpine Cottage – Entrance Room 13.

2.7 POWER SUPPLY

.1 120 VAC, 60 Hz input, 24 VDC output standby power from sealed lead-acid or gel cell batteries sized as per National Building Code requirements.

.2 System to include system power supplies, including necessary transformers, rectifiers, regulators, filters and surge protection required for system operation. The system devices shall display normal and alarm conditions consistently whether operating from normal power or reserve (standby) power.

.3 The control unit shall receive AC power via a dedicated fused disconnect circuit. Provide three (3) 120V, 15A dedicated circuits per control unit. Circuits shall be labelled at the main power distribution panel as FIRE ALARM. Fire alarm breakers are to be RED in colour. Fire alarm control panel primary power wiring shall be minimum 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

.4 The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 120 minutes of alarm operation (High Rise Building), 60 minutes of alarm operation (Group B major occupancy), 30 minutes of alarm operation (any other building), 5 minutes of alarm operation (building not required to be equipped with an annunciator) at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.

.5 All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control unit.

.6 The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously at the user interface while incoming power is present.

.7 The system batteries shall be supervised so that a low battery or a depleted battery condition, or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.

.8 The system shall support NAC Lockout feature to prevent subsequent activation of Notification Appliance Circuits after a Depleted Battery condition occurs in order to make use of battery reserve for front panel annunciation and control.

.9 The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.

.10 Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

2.8 ADDRESSABLE MANUAL ALARM PULL STATIONS

.1 Manual alarm stations to be metal semi-flush or surface type, bilingual single stage, fully addressable series with addressable module housed within the pull station and not requiring special mounting boxes.

.2 Description: Addressable single- or double-action type, red LEXAN, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.

.3 Provide finished factory surface mounted boxes c/w trim kit for surface mounted manual alarm pull stations.

2.9 AUTOMATIC ALARM INITIATING DEVICES

.1 Heat detectors, fixed temperature, non- restorable, rated 57°C, addressable.

.2 Addressable thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 88°C, rate of rise 8.3°C per minute.

.1 Electronics to communicate detector's status to addressable module/transponder.

.2 Detector address to be set on detector base head in field.

.3 Thermal detector shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.

.4 Detector fixed temperature sensing shall be independent of rate-of-rise sensing and programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.

.5 Detector shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.

.3 Smoke Sensor: Photoelectric type, or combination photoelectric / heat type.

.1 General: Comply with ULC-S5529, "Smoke Detectors for Fire Alarm

Systems." Include the following features:

.2 Factory Nameplate: Serial number and type identification.

.3 Operating Voltage: 24 VDC, nominal.

.4 Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.

.5 Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.

.6 Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.

.7 Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.

.8 Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.

.9 The sensor's electronics shall be immune from false alarms caused by EMI and RFI.

.10 Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.

.11 Removal of the sensor head for cleaning shall not require the setting of addresses.

.12 Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base.

.4 Carbon Monoxide Detection.

.1 Addressable Carbon Monoxide (CO) Detector with audible sounder base or equal.

.2 Combination addressable smoke (photoelectric) & heat detector (fixed-temperature) with optional Carbon Monoxide (CO) sensor.

.3 Combination addressable smoke detector (photoelectric) with optional Carbon Monoxide (CO) sensor.

.4 Provide intelligent addressable Carbon Monoxide Detector with Temporal 4 Audible Base.

.5 The CO detection element shall indicate a trouble condition at the FACP

signaling end of life and the CO element of the detector shall be field replaceable. It shall be programmed at the main control panel as a supervisory indication and transmit a separate supervisory signal to the central station. The CO detector shall be ULC-S529 and CSA-6.19 as CO alarm device.

.6 Addressable Carbon Monoxide (CO) Detector supervisory signals are to be monitored by an off site central station (separate monitoring for CO detection).

.7 Self-diagnostics and History Log - Each Signature Series detector are to run self-checks to provide important maintenance information. The results of the self-check are to be automatically updated and permanently stored in the detector's non-volatile memory.

.8 Automatic Device Mapping - The loop controller is to learn where each device's serial number address is installed relative to other devices on the circuit. The mapping feature is to provide supervision of each device's installed location to prevent a detector from being reinstalled (after cleaning etc.) in a different location from where it was originally.

.9 Stand-alone Operation - A decentralized alarm decision by the detector is to be guaranteed. On-board intelligence is to permit the detector to operate in stand-alone mode. If loop controller CPU communications fail for more than four seconds, all devices on that circuit go into stand-alone mode. The circuit is to act like a conventional alarm receiving circuit.

.10 Fast Stable Communication - On-board intelligence equates to less information being sent between the detector and the loop controller. Other than regular supervisory polling response, the detector is to to communicate with the loop controller when it has something new to report.

2.10 DETECTOR BASES

.1 General

.1 Detector Bases shall be suitable for mounting on octagon box, or 4" square box.

.2 Isolator Base

.1 The isolator base shall support all detector types and have the following minimum requirements:

.1 The operation of the isolator base shall be controlled by its respective detector processor. Isolators which are not controlled by a detector processor shall not be accepted.

.2 The isolator shall operate within a minimum of 23 msec. of a short circuit condition on the communication line.

.3 Following a short circuit condition, each isolator/detector shall be capable of performing an internal self-test procedure to re-establish normal operation. Isolator/detectors not capable of performing independent self tests shall not be acceptable.

.2 When connected in Class A configuration the Loop Controller shall identify an isolated circuit condition and provide communications to all non isolated analog devices. Loop wiring shall be Class 'A'. Isolator bases to be provided when a loop is used between floors, between areas which

have fire separations. Do not exceed 12 devices on a branch without an isolator.

.3 Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.

2.11 MODULES

.1 Single Input Module

.1 The intelligent Single Input Module shall be capable of a minimum of 4 personalities, each with a distinct operation.

.2 The personality of the module shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Single function modules or modules requiring Eprom, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.

.3 The single input module shall support the following circuit types:

.1 Alarm Latching, Manual Station, Conventional Heat, Waterflow

.2 Delayed Waterflow

.3 Non-Latching Monitor

.4 Supervisory

.4 Input circuit wiring shall be supervised for open and ground faults.

.5 The input module shall be suitable for operation in the following environment:

.1 Temperature: 32F to 120F (0C to 49C)

.2 Humidity: 0-93% RH, non-condensing

.2 Dual Input Module

.1 The intelligent Dual Input Module shall provide two (2) supervised input circuits capable of a minimum of 4 personalities, each with a distinct operation.

.2 The personality of the module shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Single function modules or modules requiring Eprom, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.

.3 The dual input module shall support the following circuit types:

.1 Alarm Latching, Manual Station, Conventional Heat, Waterflow

.2 Delayed Waterflow

.3 Non-Latching Monitor

.4 Supervisory

.4 Input circuit wiring shall be supervised for open and ground faults.

.3 Single Input Signal Module

.1 The intelligent Single Input Riser/Signal Module shall provide one supervised output circuit. The output circuit shall be suitable for any of the following operations:

.1 24 vdc, polarized audible and visible signal appliances

.2 Circuit wiring shall be supervised for open and ground faults.

.3 The signal module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall

flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.

.4 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.

.5 The signal module shall be suitable for operation in the following environment:

.1 Temperature: 32F to 120F (0C to 49C)

.2 Humidity: 0-93% RH, non-condensing

.4 Control Relay Module

.1 The intelligent micro-processor based Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps. @ 24 Vdc. to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems.

.2 The position of the relay contact shall be confirmed by the system firmware.

.3 The control relay module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.

.4 The module shall be suitable for operation in the following environment:

.1 Temperature: 32F to 120F (0C to 49C)

.2 Humidity: 0-93% RH, non-condensing.

2.12 AUDIBLE SIGNAL DEVICES

.1 Horns: Tap horn output wattage to manufacturer’s requirements, to suit audibility requirements for area.

.2 Horns: Shall be ULC listed and operate on supervised alarm circuits.

.3 Provide high impact plastic red end of line plates with screw terminations as required for all signalling circuits as required.

.4 Shall be available for wall, ceiling, flush or surface mounting, as shown on plans.

.5 Provide finished factory surface mounted boxes c/w trim kit for surface mounted audible signal devices.

.6 NAC circuit loading must allow for 25% spare signal circuit expansion.

.7 Audible signal devices within a *dwelling unit* or a *suite* of *residential occupancy* shall be connected to the fire alarm system a) in a manner such that a single open circuit at one device will not impair the operation of other audible signal devices on that same circuit that serve the other *dwelling units* or *suites* of *residential occupancy* (Class A Loop), b) on separate signal circuits that are not connected to the devices in any other *dwelling unit, public corridor* or *suite* of *residential*.

.8 In a *building* or part thereof classified as *residential occupancy*, a) separate circuits shall be provided for audible signal devices on each *floor area*, and b) audible signal devices within *dwelling units* or *suites* of *residential occupancy* shall be wired on separate signal circuits from those not within *dwelling units* or *suites* of *residential occupancy.*

2.13 SIGNALLING DEVICES

.1 Strobes: shall be ULC listed (ULC-S526) and operate on supervised alarm circuits at 20 to 24V DC.

.1 Flashing, clear, 24 V dc. Candela output as shown on plans and to suit visibility requirements for area.

.2 The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with different minimum flash intensities of 15cd, 30cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.

.3 Shall provide ‘FACP’ tap setting to allow candela rating of 15, 30, 75, and 110 to be set by system programmer or if Addressable Signal Device Modules are used the contractor is to set the candela rating tap (to the setting indicated on the plans and to suit visibility requirements for area).

.4 Strobes shall be wired with minimum 2C #12AWG twisted, non-shielded (FAS Cable) addressable Notification Appliance SLC. Coordinate with Manufacturer and provide shielded FAS Cable as required.

.5 Strobe terminal block shall accept #18 - 12AWG conductors.

.6 Shall be capable of independent strobe operation utilizing intelligent addressable appliance technology.

.7 Shall be available for wall, ceiling, flush or surface mounting, as shown on plans.

.8 Provide finished factory surface mounted boxes c/w trim kit for surface mounted strobes.

.2 Horn/Strobe: shall be ULC listed and operate on supervised alarm circuits.

.1 See above for horn and strobe requirements.

.3 Provide high impact plastic red end of line plates with screw terminations as required for all signalling circuits as required.

.4 Notification Appliance Circuit provides synchronization of strobes at a rate of 1Hz and operates horns with operation. The circuit shall provide the capability to silence the audible signals, while the strobes continue to flash, over a single pair of wires. The capability to synchronize multiple notification appliance circuits shall be provided.

.5 NAC circuit loading must allow for 25% spare signal circuit expansion.

.6 Shall provide Isolators as required to create physical zone separations (ie: Floor Levels).

.7 Provide finished factory surface mounted boxes c/w trim kit for surface mounted horn/strobes.

2.14 CONDUIT AND WIRE

.1 Conduit:

.1 Conduit shall be in accordance with Canadian Electrical Code, local and provincial requirements.

.2 Where possible, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.

.3 Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors.

.4 Wiring for 24 volt control, alarm notification, emergency communication and similar power limited auxiliary functions may be run in the same conduit as initiating and signalling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.

.5 Conduit shall not enter the fire alarm control panel or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the FACP manufacturer.

.2 Wire:

.1 All fire alarm system wiring must be new.

.2 Wiring shall be in accordance with local, provincial and national codes and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for initiating device circuits and signalling line circuits, and 14 AWG (1.63 mm) for notification appliance circuits.

.3 All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signalling system.

.4 Wiring used for the multiplex communication circuit (DCL) shall be twisted and unshielded and support a minimum wiring distance of 12,500 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the DCL communication circuit.

.5 The system shall permit the use of IDC and NAC wiring in the same conduit with the multiplex communication loop.

.6 All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring, a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

.3 Terminal Boxes, Junction Boxes and Cabinets:

.1 All boxes and cabinets shall be CSA listed for their intended purpose.

.2 Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on Data Communication Link connected to intelligent reporting devices.

2.15 EMERGENCY POWER SUPPLY

.1 General: Components include battery, charger, and an automatic transfer switch.

.2 Battery: Sealed lead-acid or gel cell. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode. Refer to Power Requirements for minimum time periods.

2.16 AS-BUILT RISER DIAGRAM

.1 Fire alarm system riser diagram: in glazed frame on black lamacoid sheet with bevelled edges, white lettering and designations, minimum size 600 x 600 mm.

.2 To be mounted in Alpine Cottage - Entrance Room 13.

Part 3 Execution

3.1 INSTALLATION, GENERAL

.1 Install system components and all associated devices in accordance with applicable building code requirements, ULC Standards and manufacturer's recommendations.

.2 Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:

.1 Factory trained and certified personnel.

.2 Canadian Fire Alarm Association (CFAA) personnel.

.3 Personnel licensed or certified by provincial or local authority.

.3 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts (co-ordinate with Division 25 Heating & Ventilation as per codes and standards and the manufacturer's instructions).

3.2 EQUIPMENT INSTALLATION

.1 Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit, manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances,

wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.

.2 Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

3.3 WIRING INSTALLATION

.1 System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AHJ) and shall be installed in accordance with the appropriate articles from the current approved edition of the Canadian Electric Code (CEC).

.2 Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.

.3 Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.

3.4 VERIFICATION, DATA AND TESTING

.1 Contractor to pay and retain the services of a professional engineer that is licensed to practice in Alberta, to perform the fire alarm verification.

.2 Provide departmental representative with completed verification report and a stamped certification letter.

.3 System Verification

.1 Upon completion of all wiring and installation of all equipment, devices, etc., do complete verification of the fire alarm system. Verification shall be in accordance with current edition of Standard CAN/ULC-S537 "The Verification of Fire Alarm Systems" and following requirements. Even if permitted by Code and recognized standards and regulations, grade of work shall in no case be lower than specified in the project specifications. Verify all new initiating and signal/ solenoid zones and circuits, etc. Verify that every component installed, is working and functions as intended.

.2 Manufacturer with assistance of electrical contractor shall do a complete verification of system to ULC S-537 to ensure:

.1 That system is installed as per plans and specifications and is operative and acceptable to all authorities having jurisdiction.

.2 That system is installed as per recommendations of manufacturer.

.3 That system is electrically supervised. To accomplish this, manufacturer with assistance of electrical contractor shall:

.1 Remove each and every device from its applicable circuit by disconnecting circuit wiring

.2 Verify presence of the applicable trouble signal and indications at control panel and remote annunciators.

.4 That all devices are operative. Check each switch, device, ancillary device, etc. for proper operation.

.5 That all system functions are operating as intended, including:

.1 All main control circuits,

.2 All manual and automatic initiating devices,

.3 All audible and visual alarm signals,

.4 All ancillary controls, including fan shutdown, fire dampers, monitor modules, etc.

.1 Verification report shall include the actual operational test of all ancillary devices.

.5 When fire alarm system is verified, Contractor shall measure and record all loop or circuit resistance values at the fire alarm panel when end-of-line resistor is shorted. Contractor shall highlight all values which exceed the manufacturer's recommendations and report them to the Departmental Representative for action to correct this deficiency.

.3 Any necessary changes required to conform to the above shall be completed by the electrical contractor with technical assistance provided by the system manufacturer.

.4 Upon completion of the above inspection, including any changes required, the manufacturer shall submit the following documentation to the Departmental Representative.

.1 Certification of Verification

.2 A complete report of all equipment verified, including:

.1 automatic detectors

.2 alarm signals

.3 fan shutdown

.4 the number and type of devices connected to each circuit

.5 For each piece of equipment verified, the following information shall be included in the report:

.1 Catalogue number and type of device

.2 Location of device

.3 Zoning or circuit devices including ancillary devices

.4 Supervision test results

.5 Operation of device

.6 Inspection date

.7 Serial number of every smoke detector

.8 Sensitivity reading of every smoke detector, including duct detectors

.9 Zone circuit loop resistance

.10 Fire alarm system supplier shall verify that alarm descriptions match and are consistent at each of following reporting locations:

.1 Fire alarm control panel

.6 Report shall also indicate operation of ancillary functions such as remote alarm indicators, door release, fan shutdown, etc. which are required to be activated. Operation shall be verified by actual observation of the entire function (e.g. bells ringing, checking to ensure proper fans shut down, etc.). Observing a change of state in the fire alarm control panel (e.g. observing relay function) is not considered complete verification of the entire function. Verification shall include actual field checking of

proper operation of ancillary devices and equipment. Complete fire alarm system verification report shall be submitted to Departmental Representative.

.7 All costs necessary for this verification shall be included in electrical trade's tender price.

.8 Upon completion of this inspection, manufacturer shall demonstrate the operation of system to Departmental Representatives.

.9 Fire Alarm Technician:

.1 Individuals qualified to inspect, test and maintain fire alarm systems under the Alberta Fire Code shall perform fire alarm verifications. Installations of fire alarm systems must still be performed by a licensed electrician. Fire alarm verifications shall be conducted by a qualified person other than the installing contractor or designer.

.2 In addition to the name and contact information of the verifying organization, the verification report must include the printed name, the signature and the CFAA (Canadian Fire Alarm Association) certificate number of the primary technician conducting the verification.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

.2 Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:

.1 Factory trained, and certified and authorized.

.2 Canadian Fire Alarm Association (CFAA) fire alarm certified.

.3 Certified by a provincial or local authority.

.4 Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.

.3 Pre-testing: Determine, through pre-testing, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pre-testing. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.

.4 Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

.5 Minimum System Tests: Test the system according to the procedures outlined in CAN/ULC-S537.

.6 Retesting: 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.

.7 Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log.

.8 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. Refer to Life Safety Testing in Section 26 05 00.

3.6 TRAINING

.1 Provide the services of a factory-authorized service representative to demonstrate the system and train Departmental Representative's maintenance personnel as specified below.

.1 Train Departmental Representative's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours' training.

.2 Schedule training with the Departmental Representative at least seven days in advance.

END OF SECTION

LUMINAIRE SCHEDULE
COTTAGES

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FIXT. TYPE	LAMPS	VOLTAGE	DESCRIPTION	APPROVED MANUFACTURERS
AA	30W LED	120V	1220mm STRIP LED SURFACE MOUNTED FIXTURE 0-10V DIMMING 3000K COLOUR TEMP. 80 CRI	COOPER: 4SNLED LD5 18SL LC UNIV-L830 CD U OR APPROVED EQUAL
BB	18W LED	120V	24" MODULAR UNDERCABINET LED FIXTURE 3000K COLOUR TEMP. 90 CRI HARDWIRED C/W LINKING CORD	LITHONIA: RAZ 24IN 30K 90CRI UCD JB RAZLVCC OR APPROVED EQUAL
PA	12W LED	120V	6" RECESSED LED DOWN LIGHT 3000K COLOUR TEMP. 90 CRI MATTE WHITE FINISH	LITHONIA: 65BEMW LED 30K 90 CRI L7XLED T24 OR APPROVED EQUAL
PB	60W INCAND.	120V	18" SUSPENDED LED FIXTURE DARK GREY DRY LOCATION	EUREKA: MATTEO C58305DG
PC	16W LED	120V	12" SUSPENDED PENANDANT TYPE LED FIXTURE 3000K CCT 80 CRI DIMMABLE	EUREKA: 4256-12 4256-12LED 30 120 DV AC 60 RCA WHM ANTE WHM
PD	16W LED	120V	23" SUSPENDED LED FIXTURE 3000K COLOUR TEMP. 0-10V DIMMING	EUREKA: 4454B LED.10 30 120V DV AC 60 BLK WH
PE	13W LED	120V	16" SUSPENDED LED FIXTURE 3000K COLOUR TEMP. 0-10V DIMMING 80 CRI	EUREKA: 4230-RAP LED.13 30 120V DV C 60 RC WH WHE WH
RA	60W INCAND.	120V	WALL MOUNTED SCONCE DAMP RATED G16 INCANDESCENT BULB BRASS FINISH	SCHOOL HOUSE: ISAAC SCONCE-SHORT ARM, NATURAL BRASS OR APPROVED EQUAL
SA	24W LED	120V	14" SURFACE MOUNTED TYPE LED FIXTURE 3000K CCT 80 CRI	LITHONIA: FMLRL 14 20830 OR APPROVED EQUAL
XA	13W LED	120V	EXTERIOR WALL MOUNTED LED GOOSNECK FIXTURE STRAIGHT SHADE, BLACK 3000K CCT WEATHERPROOF, -40 DEGREES C RATED	RC LIGHTING: GNLED13YSBRCL STRAIGHT SHADE GOOSE1 BLACK
VA	33W LED	120V	4' VAPOUR TIGHT LED SUREFACE MOUNTED FIXTURE 3500 LUMENS 4000K COLOUR TEMP 80 CRI	LITHONIA: XVML L48 3500LM MVOLT 40K 80CRI OR APPROVED EQUAL
E-1	2.5W LED	120V	LED GREEN RUNNING MAN TYPE EXIT SIGN ONE PIECE ALUMINUM HOUSING AND FACE PLATES 6 TO 24 VDC SINGLE FACE, UNIVERSAL MOUNTING	LUMACELL: LA-1-A-U EMERGI LITE: EA-1-A-U OR APPROVED EQUAL

PANEL: **PANEL AC** LOCATION: ALPINE COTTAGE LAUNDRY 02
FED FROM: MAIN SERVICE LOCATION: POLE MOUNTED TRANSFORMER

Designation		Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)		Designation
BEDROOM RECEPTACLES 01	4R	800	15 AFCI	1	A	31	15 AFCI	500	1R	DISHWASHER
BEDROOM RECEPTACLES 16	4R	800	15 AFCI	2	B	32	20	200	1R	COUNTERTOP RECEPTACLE
BEDROOM RECEPTACLES 06	4R	800	15 AFCI	3	A	33	20	200	1R	COUNTERTOP RECEPTACLE
BUNK RECEPTACLES 07	4R	800	15 AFCI	4	B	34	15	200		CEILING FANS
BUNK RECEPTACLES 07	4R	800	15 AFCI	5	A	35	15	100		HWT-1 UTILITY 14
BUNK RECEPTACLES 09	4R	800	15 AFCI	6	B	36	15 AFCI	252	1R	HRV-1 UTILITY 14
BUNK RECEPTACLES 09	4R	800	15 AFCI	7	A	37	15	100		FU-1 UTILITY 14
BEDROOM RECEPTACLES 11	4R	800	15 AFCI	8	B	38	30 GFI	1176		P-1 CRAWLSPACE
CORRIDOR RECEPTACLES	4R	800	15 AFCI	9	A	39	15	696		EF-1 CRAWLSPACE
LIVING/DINING RM RECEPTACLES	3R	600	15 AFCI	10	B	40	15	250		FIRE ALARM PANEL
WASHROOM RECEPTACLE 15	1R	200	20	11	A	41	15	825		BEDROOM, BATHROOM, LAUNDRY, UTILITY, SM ALARM
WASHROOM RECEPTACLE 05	1R	200	20	12	B	42	15	500		CORRIDOR, KITCHEN, CRAWLSPACE LIGHTS
WASHROOM RECEPTACLE 10	1R	200	20	13	A	43	15	200		NIGHT LIGHTS/EXIT LIGHTS BATTERY BANK
OUTDOOR RECEPTACLE	1R	200	15 GFCI	14	B	44	15	150		EXTERIOR LIGHTS AND CONTACTOR PANEL
OUTDOOR RECEPTACLE	1R	200	15 GFCI	15	A	45	40	3000		RANGE
OUTDOOR RECEPTACLE	1R	200	15 GFCI	16	B	46	2P	3000		KITCHEN
OUTDOOR RECEPTACLE	1R	200	15 GFCI	17	A	47	15			SPARE
RECEPTACLE LAUNDRY 02	1R	200	15 AFCI	18	B	48	15	200	1R	CRAWLSPACE RECEPT. MOTORIZED DAMPER
TRAP PRIMER		50	15	19	A	49	20	1500		BASEBOARD HEATERS
LAUNDRY RECEPTACLE 02	1R	200	15 AFCI	20	B	50	2P	1500		CRAWLSPACE
DATA RECEPTACLE	1R	200	15 AFCI	21	A	51	15			SPARE
WASHING MACHINE LAUNDRY 02	1R	500	15 AFCI	22	B	52	15			SPARE
DRYING MACHINE LAUNDRY 02		1800	30	23	A	53	15			SPARE
		1800	2P	24	B	54	15			SPARE
FREEZER	1R	800	15	25	A	55	70	8517		PANEL BH
FRIDGE	1R	800	15	26	B	56	2P	8517		
SPARE			15	27	A	57	100	14403		PANEL SB
COUNTERTOP RECEPTACLE	1R	200	20	28	B	58	2P	14403		
COUNTERTOP RECEPTACLE	1R	200	20	29	A	59	30	875		PANEL BB
COUNTERTOP RECEPTACLE	1R	200	20	30	B	60	2P	875		

VOLTAGE: **120/240V,1Ø,3W** LOADS - PH.A 38766
CAPACITY: 400A PH.B 39523
MOUNTING: FLUSH
REMARKS: NEW TOTAL **78289**

CONNECTED LOAD: 78289 VA - 326A
ESTIMATED DEMAND: 42700 VA - 177.8A

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PANEL SCHEDULE PANEL AC

PROJECT: WLNP BARNS AND COTTAGE
FILE: 18-123-01
DATE: 12-Sep-18

PANEL: **PANEL BH** LOCATION: BUNK HOUSE UTILITY 08
FED FROM: ALPINE COTTAGE LOCATION: ALPINE COTTAGE LAUNDRY 02

Designation		Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
OUTDOOR RECEPTACLE			15				15		EF-2
	1R	200	GFCI	1	A	22		700	CRAWLSPACE
RECEPTACLES BUNK 01			15				30		P-2
	5R	1000	AFCI	2	B	23	GFI	1176	CRAWLSPACE
RECEPTACLE WASHROOM 02			20				15		LIGHTS CORRIDOR 10 AND
	1R	200		3	A	24		182	LIVING ROOM 06,CRAWLSPACE
RECEPTACLE WASHROOM 03			20				15		BEDROOM,WR,MUD RM, UTILITY
	1R	200		4	B	25		250	LIGHTS, SMOKE ALARMS
BUNKBED RECEPTACLES 04			15				15		EXTERIOR LIGHTS
	4R	800	AFCI	5	A	26		150	CONTACTOR PANEL
GENERAL RECEPTACLES 04			15				15		NIGHT LIGHTS
	4R	800	AFCI	6	B	27		24	
RECEPTACLES BUNK 05			15						
	5R	1000	AFCI	7	A	28	30	2000	RANGE 07
RECEPTACLES CORR. 10			15				2P		
09, 06	4R	800	AFCI	8	B	29		2000	
OUTDOOR RECEPTACLE			15						
	1R	200	GFCI	9	A	30	15	1000	BASEBOARD HEATERS
COUNTERTOP RECEPTACLE 07			20				2P		CRAWLSPACE
	1R	200		10	B	31		1000	
RECEPTACLE MOTORIZED DAMPER			15				15		SPARE
CRAWLSPACE	1R	250		11	A	32			
DISHWASHER 07			15				15		SPARE
	1R	800	AFCI	12	B	33			
FRIDGE 07			15				15		SPARE
	1R	800		13	A	34			
COUNTERTOP RECEPTACLE 07			20				15		SPARE
	1R	200		14	B	35			
COUNTERTOP RECEPTACLE 07			20				15		SPARE
	1R	200		15	A	36			
COUNTERTOP RECEPTACLE 07			20				15		SPARE
	1R	200		16	B	37			
TRAP PRIMER			15				15		SPARE
UTILITY 08		50		17	A	38			
DATA RECEPTACLE			15						
UTILITY 08	1R	200	AFCI	18	B	39			
HWT-2			15						
UTILITY 08		100		19	A	40			
FU-2			15						
UTILITY 08		100		20	B	41			
HRV-2			15						
UTILITY 08	1R	252	AFCI	21	A	42			

VOLTAGE: **120/240V,1Ø,3W** LOADS - PH.A 8084
CAPACITY: 100A PH.B 8950
MOUNTING: FLUSH
REMARKS: NEW TOTAL **17034**

CONNECTED LOAD: 17034 VA - 71A
ESTIMATED DEMAND: 13250 VA - 55A

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PANEL SCHEDULE PANEL BH

PROJECT: WLNP BARNS AND COTTAGES
FILE: 18-123-01
DATE: 12-Sep-18

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C117-17, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136/C136M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-63(2007)e2, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ;) (600 kN-m/m).

.5 ASTM D1557-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft) (2,700 kN-m/m).

.6 ASTM D4318-17e1, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.1 CSA-A3001-13, Cementitious Materials for Use in Concrete.

.2 CSA-A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

1.2 SITE CONDITIONS

.1 The complete Geotechnical Investigation report, including sub-surface soil boring logs is appended to this project manual.

1.3 UTILITY LINES

.1 Before commencing work, establish location and extent of underground utility lines in areas of excavation. Notify Departmental Representative of findings.

.2 Remove abandoned utility lines to distance of 1800 mm from foundations. Cap or otherwise seal lines at cut-off points.

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

.4 Make good and pay for damage to existing utility lines resulting from work.

1.4 PROTECTION

.1 Protect bottoms of excavations from softening. Should softening occur, remove softened soil and replace with fill as per Appendix C of the Geotechnical Evaluation report.
.2 Protect bottoms of excavations from freezing.
.3 Construct banks in accordance with local by laws.
.4 Provide adequate protection around bench marks, and geodetic monuments.
.5 Provide protection to ensure no damage to existing facilities and equipment situated on site.
.6 Effect approved measures to minimize dust as result of work.
.7 Do not stockpile excavated material to interfere with site operation or drainage.
.8 Provide shoring as required to protect adjacent property and structures. All shoring design and drawings to be submitted under seal for review and approval.

1.5 COMPACTION DENSITIES

.1 Compaction densities are percentages of maximum densities obtainable from ASTM D698 and correct as noted.

1.6 UNSATISFACTORY SOIL CONDITIONS

.1 Any unsatisfactory or questionable soil conditions revealed during excavation shall be reported immediately to the Departmental Representative.
.2 All foundation and sub-structural work shall cease until the condition has been examined and approval to proceed has been issued by the Departmental Representative.

1.7 MATERIAL UNSUITABLE FOR BACKFILL

.1 The Contractor shall be responsible for all costs associated with the excavation and removal of all materials unsuitable for backfill.

1.8 WATER

.1 Keep excavation free from water at all times. Provide drainage trenches and sumps as necessary and pump water well away from excavation. Do not discharge water onto private property.

1.9 INSPECTION AND TESTING

.1 Testing of materials and compaction will be carried out by testing laboratory designated by Departmental Representative and as described in Division 0.
.2 Sieve analysis: Proposed granular materials will be tested to confirm suitability for intended use and conformity with 2.1. Conduct one test per 500 tonnes of material used.
.3 Frequency of Tests

.1 Excavated surfaces: When undisturbed excavated surface is being prepared, make a series of 3 test of surface for each 500m2 area.

.2 Fills under floor or other slabs on grade: Make 3 tests for every 2 lifts of compacted fill.

Part 2 Materials

2.1 GRANULAR MATERIALS:

.1 Compacted Granular: Clean, angular crusher run natural stone, free from shale clay, friable materials, roots and vegetable matter and graded within the following limits:

Screen Size:	% Passing:
20 mm	100
16 mm	84 – 94
10 mm	63 – 86
5 mm	40 – 67
1.25 mm	20 – 43
630 um	14 – 34
315 um	9 – 26
160 um	5 – 18
80 um	2 – 10

% Fracture by Weight (2 faces) (All +5mm Particle Sizes)	60+
Plasticity Index (PI)	Non-plastic – 6
L.A. Abrasion Loss Percent Max.	50

.2 General Engineered Fill: Native soils free of organics, debris, frozen or wet soils, and particles greater than 75mm can be used as general engineered fill. All soils intended to be used as general engineered fill must be approved for use by the Departmental Representative.

2.2 STOCKPILING

.1 If required stockpile fill materials in areas designated by Departmental Representative. Stockpile granular materials in manner to prevent segregation. Protect stockpile fill materials from freezing.

.2 Protect fill materials from contamination.

Part 3 Execution

3.1 EXCAVATING (CRAWLSPACE CONCRETE SLAB ON GRADE)

.1 Excavate to elevations and dimensions indicated for installation, construction and inspection of work specified.

.2 Excavate to well defined lines to minimize quantity of fill material required.

.3 Once excavation has reached the design subgrade elevation, the subgrade should be inspected and approved by the Geotechnical Engineer.

.4 Following excavation the subgrade shall be prepared as follows:

- .1 The exposed native subgrade shall be scarified to a minimum depth of 150mm and moisture conditioned within 2% of the optimum moisture content
- .2 The scarified and conditioned subgrade shall be compacted to 98% of the Standard Proctor Maximum Dry Density (corrected, if required).

.5 The prepared subgrade shall be proof-rolled to identify any soft/weak soil pockets. Any weak/soft spots identified during proof-rolling should be over-excavated and replaced with general engineered fill, compacted to 98% of the Standard Proctor Maximum Dry Density (corrected, if required). Prior to final grading, the proof rolled subgrade should be inspected by the Departmental Representative.

.6 Final grade of the subgrade shall be restored as required by placing general engineered fill in maximum 150mm lifts compacted to 98% of the Standard Proctor Maximum Dry Density (corrected, if required) within 2% of the optimum moisture content.

.7 A 150mm leveling course of compacted granular shall be placed below the slab and rigid insulation, in maximum 150mm lifts and compacted to 100% of the Standard Proctor Maximum Dry Density (corrected, if required).

.8 Dispose of surplus and unsuitable excavated material off site.

.9 Do not obstruct flow of surface drainage or natural watercourses.

.10 Notify Departmental Representative when soil at bottom of excavation appears unsuitable and proceed as directed by Departmental Representative.

.11 Obtain Departmental Representative approval of completed excavation.

.12 Remove unsuitable material from the excavation to extent and depth directed by Departmental Representative.

.13 Correct unauthorized excavation at no extra cost as follows:

- .1 Fill with general engineered fill or mud slab concrete as directed by the Departmental Representative.

.14 Remove concrete, masonry, paving, walks, demolished foundations, and rubble and other obstructions encountered in the course of excavation.

.15 Provide shoring to Provincial Safety Standards.

.16 Protect the subgrade from frost, desiccation and inundation prior to, during, and after construction

3.2 BACKFILLING (FOUNDATION FOOTINGS)

.1 Do not commence backfilling until areas of work to be backfilled have been inspected and approved by Departmental Representative.

.2 Areas to be backfilled shall be free from debris, snow, ice, water or frozen ground. Backfill and filling material shall not be frozen or contain ice, snow or debris.

.3 Do not backfill around or over cast-in-place concrete within 7 days of placing.

.4 Do not commence final exterior backfill until after the main floor structure, including the subfloor is complete and fully installed.

.5 The backfill used shall be general engineered fill, placed in maximum 150mm lifts and compacted to 98% of the Standard Proctor Maximum Dry Density (corrected, if required) within +/- 2% of the optimum moisture content. Place and compact fill materials in continuous horizontal layers not exceeding 150 mm loose depth. Use methods to prevent disturbing or damaging buried services, insulation, damp-proofing. Make good any damage.

.8 Do not use frozen material for backfilling or filling.

.9 Control moisture content of the backfill material by adding water or drying the material, at the Contractor's expense.

.10 Keep heavy equipment at least 1.5m away from the foundation walls.

END OF SECTION