

**Life Safety System Replacement DFO
CCG Station**
Hay River, NT

Prepared for:
Public Services and Procurement Canada

CONSTRUCTION SPECIFICATIONS

Issued for Tender

Volume 1 of 1

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Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises Life Safety System Replacement for the Department of Fisheries and Oceans (DFO) Canadian Coast Guard (CCG) Station located at Hay River, NT. Work includes but is not limited to the following:
 - .1 Complete removal and replacement of Life Safety Systems including:
 - .1 Fire Alarm
 - .2 Emergency Lighting
 - .3 Exit Signs
 - .2 New Life Safety Systems as described above are to be provided for seven (7) buildings located on the project site and two (2) additional buildings on another nearby site including:
 - .1 Administration Building
 - .2 Fish Management Complex
 - .3 Carpenter Shop
 - .4 Flammable Storage
 - .5 Helicopter Operations
 - .6 DFO Storage Warehouse
 - .7 Store/Maintenance Shop
 - .8 Tx Building
 - .9 Welding Shop
 - .3 The new fire alarm system for the seven DFO site buildings is to be a campus style system with dedicated fire alarm panels in each building connected together via a Network Data Communication Link to a central control panel and workstation located in the Administration Building. The Tx Building and Welding Shop will have stand-alone fire alarm systems.
 - .4 Additional upgrades to the Flammable storage building including:
 - .1 Upgrading the dividing wall between the flammable liquids room and general storage area to a 2 hour fire separation.
 - .2 Ventilation and heating equipment upgrades to the flammable liquids half of the building
 - .3 Lighting replacement in the flammable liquids area with new explosion proof LED fixtures.
 - .5 Minor site work including trenching, conduit and wiring for the data communication link between buildings.

1.2 HERITAGE BUILDING REQUIREMENTS

- .1 Some of the buildings to be renovated within the scope of this project are over 40 years old and are to be designated as "recognized" heritage buildings. The work on these buildings shall follow the Standards and Guidelines for the Conservation of Historic Places in Canada (Second edition). Refer to the PSPC Heritage Conservation Advice Report attached to these specifications in Appendix A for further guidance and requirements.

1.3 PROTECTION OF THE EXISTING BUILDING

- .1 All Work is to be carried out by experienced workers and executed in a manner that minimizes impact and damage to the existing building and finishes. Proposed methods for demolition, removal, cutting and patching are to be reviewed with the Departmental Representative prior to the execution of the Work. A Departmental Representative will be available on site for two hours per day to facilitate the review of all proposed methods of Work (PSPC to comment).
 - .1 Run all Mechanical and Electrical services through existing openings where possible.
 - .2 New devices which are to be surface mounted or recessed into existing walls/ceilings are to be installed in a manner that minimizes the removal or disturbance of finishes. No trenching is permitted. Small holes and 'fishing' of wiring and cables is the required method.
 - .3 All existing flooring of occupied spaces requires protection at all times. If flooring is being removed to execute the Work, ensure these elements, as well as any remaining flooring, is protected.
 - .4 Notching, cutting or removing existing mouldings, trims or decorative elements or wall boards is not permitted.
 - .5 The use of reciprocating saws on any wall, ceiling or floor is not acceptable unless the Departmental Representative deems it the only acceptable tool to perform the Work.
 - .6 If the intent of a note, drawing or specification is not clear to the Contractor then clarification must be sought from the Departmental Representative prior to executing the Work relating to said item.
 - .7 Refer to the General Protection Notes located in Section 01 11 10 – Special Project Procedures for additional information on protection and execution.

1.4 CONTRACTOR USE OF PREMISES

- .1 Coordinate use of premises under direction of Departmental Representative.
- .2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .3 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .4 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.

1.5 OWNER OCCUPANCY

- .1 Owner will occupy premises during entire construction period for execution of normal operations.
- .2 Coordinate with Owner to minimize disturbance to normal operations.

1.6 PROTECTION OF EXISTING ELEMENTS

- .1 All selective demolition must be carried out in a manner sensitive to the historic elements of the building. No reciprocating saws, chainsaws or hammering devices.
- .2 Obtain Owner Representative's approval prior to all cutting and demolition procedures.

1.7 RELATED WORK

- .1 The following specification sections are referenced to indicate work responsibilities as specified and carried in other versions.
- .1 Section 26 05 00 – Common Work Requirements for Electrical.

1.8 CONTRACT DOCUMENTS

- .1 Legends and schedules in the Issued for Tender Drawings take precedence over the Technical Specifications with respect to products and materials identified.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

Ω END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Preconstruction Photographs:
 - .1 Photographically document existing project conditions prior to commencement of construction to the approval of the Departmental Representative.

Part 2 Products

2.1 POLYETHYLENE SHEET

- .1 Polyethylene film: to CAN/CGSB-51.34, 0.15 mm thick.

2.2 WOOD PRODUCTS

- .1 Plywood panels: to CAN/CSA-O325.0.
- .2 Douglas fir plywood (DFP): to CSA O121, standard construction.
- .3 Canadian softwood plywood (CSP): to CSA O151, standard construction.
- .4 Poplar plywood (PP): to CSA O153, standard construction.

2.3 FIBREBOARD

- .1 Molded, recycled post-consumer paper, cellulose fiber structural panel.
 - .1 Homosote or equivalent.

2.4 TAPE

- .1 Painter's tape for use on plaster surfaces.

Part 3 Execution

3.1 CATALOGUING OF MATERIALS

- .1 Photograph and record original location of the element to be removed and stored.
- .2 Remove element to be stored and wrap in foam to prevent pieces rubbing together.
- .3 Label all removed elements with room number and location it originated in.
- .4 Wrap in protective plastic and store in approved location for reinstallation.

3.2 PROTECTION OF FLOOR

- .1 Provide polyethylene sheeting over existing historic floor. Extend a minimum of 100mm above floor and tape to wall or wall protection. Overlap polyethylene sheets a minimum of 100mm and tape all joints.
- .2 Provide a sheet of soft fiberboard to serve as a cushion between the wooden covering and the historic floor. Tape all joints between fibreboards.
- .3 Provide temporary wood floor, cut from plywood, over the fibreboard. Tape all joints between boards.
- .4 Stagger all joints a minimum of 600mm between polyethylene, fibreboard and wood floor.
- .5 Refer to drawings for installation details.

3.3 PROTECTION OF WALLS

- .1 Provide wall protection constructed from plywood attached to wood framing. Assembly to be self-supporting and self-bracing, secured at its base to the floor protection assembly. Shore assembly, as required, to brace the assembly without installing fasteners into the historic wall finish.
- .2 Where wood framing, furring, or panels abut historic wall materials, the back side of the protective assembly is to be padded using strips of neoprene or strips of soft fibreboard, glued to the protective assembly member.
- .3 Use screw fasteners in order to eliminate hammering during assembly and ripping damage during disassembly.

3.4 PROTECTION OF DOORS AND WINDOWS

- .1 Historic doors, door surrounds, windows, window surrounds, and wall assemblies will also need to be protected from construction damage by combining the techniques described for floors and walls.
- .2 Horizontal surfaces should be protected as floors, and vertical assemblies treated as walls, with the major difference being the complexity of the framing required.

3.5 FIRE SAFETY REQUIREMENTS

- .1 References and Codes:
 - .1 Comply with the National Building Code of Canada 2015 (NBC) for fire safety in construction and the National Fire Code of Canada 2015 (NFC) for fire prevention, fire fighting and life safety in building in use.
 - .2 Minimize down time of life safety systems and ensure existing systems are not shut down until new systems are fully operational. Fire watch is not required for short duration shut downs.
- .2 Welding and cutting:
 - .1 Before welding, soldering, grinding and/or cutting work, obtain a permit from the Fire Prevention Unit as directed by Departmental Representative. Store flammable liquids in approved CSA containers inspected by the Fire Prevention Unit. No open flame shall be used unless authorized by the Fire Prevention Unit. In addition, no welding, torch cutting nor abrasive cutting may be performed at roof level where wood structure is to be exposed; only hand tools shall be used to make opening in roof for asbestos investigation.
 - .2 At least 48 hours prior to commencing cutting, welding or soldering procedure, provide to Departmental Representative:
 - .1 Notice of intent, indicating devices affected, time and duration of isolation or bypass.
 - .2 Completed welding permit to the approval of the Departmental Representative.
 - .3 Return welding permit to Departmental Representative immediately upon completion of procedures for which permit was issued.
 - .3 A firewatcher to the approval of the Departmental Representative shall be assigned when welding or cutting operations are carried out in areas where combustible materials within 10m may be ignited by conduction or radiation.
- .3 Fire Alarm, Fire Suppression, Extinguishing or Protection Systems

- .1 Where work requires interruption of fire alarms or fire suppression, extinguishing or protection systems:
 - .1 Minimize down time of existing life safety systems. Fire watch is not required for short duration interruptions.
 - .2 Retain services of manufacturer for fire protection systems on daily basis or as approved by Departmental Representative, to isolate and protect devices relating to:
 - .1 Modification of fire alarms, fire suppression, extinguishing or protection systems; and/or
 - .2 Cutting, welding, soldering or other construction activities which might activate fire protection systems.
- .2 Immediately upon completion of work, restore fire protection systems to normal operation and verify that devices are fully operational.
- .3 Inform fire alarm system monitoring agency and local Fire Department immediately prior to isolation and immediately upon restoration of normal operation. Burning rubbish and construction waste materials is not permitted on site.

Ω END OF SECTION

Part 1 General

1.1 ACCESS AND EGRESS

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

1.2 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Departmental Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.
- .5 Closures: protect work temporarily until permanent enclosures are completed.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

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

1.4 EXISTING SERVICES

- .1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.
- .3 Provide for pedestrian and vehicular traffic.
- .4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.5 SPECIAL REQUIREMENTS

- .1 Submit schedule in accordance with Section 01 32 16.19 - 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 Deliver materials outside of peak traffic hours 17:00 to 07:00 and 13:00 to 15:00 unless otherwise approved by Departmental Representative.

1.6 SECURITY

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

.2 Security clearances:

.1 Refer to Tender Instructions for security clearance requirements.

1.7 BUILDING SMOKING ENVIRONMENT

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

Ω END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.
- .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 and transmit to meeting participants and affected parties not in attendance.
- .8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and 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 5 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 16.19 - Construction Progress Schedule - Bar (Gantt) Chart.
 - .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
 - .5 Delivery schedule of specified equipment in accordance with Section 01 32 16.19 - Construction Progress Schedule - Bar (Gantt) Chart.
 - .6 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .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 4 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 10 days prior to meetings.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 5 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 which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Review proposed changes for affect on construction schedule and on completion date.
 - .12 Other business.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

Ω END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 ACTION AND INFORMATIONAL 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 resubmit within 5 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.5 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.
 - .4 Mobilization.
 - .5 Excavation.
 - .6 Backfill.
 - .7 Interior Architecture (Walls, Floors and Ceiling).
 - .8 Lighting.
 - .9 Emergency Lighting
 - .10 Electrical.
 - .11 Heating, Ventilating, and Air Conditioning.
 - .12 Fire Systems.
 - .13 Testing and Commissioning.
 - .14 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 impact with possible mitigation.

1.7 PROJECT MEETINGS

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

Ω END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 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.
- .3 Allow 10 days for Departmental Representative's review of each submission.
- .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, in duplicate, containing:
 - .1 Date.

- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.
- .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 that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .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.
- .15 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .16 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .17 Delete information not applicable to project.
- .18 Supplement standard information to provide details applicable to project.
- .19 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.
- .20 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic copy of colour digital photography in jpg format, standard resolution monthly with progress statement.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints: as required locations.
 - .1 Viewpoints and their location as determined by Departmental Representative.
- .4 Frequency of photographic documentation: weekly.

1.4 CERTIFICATES AND TRANSCRIPTS

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

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Northwest Territories and Nunavut
 - .1 Safety Act, R.S.N.W.T. - Updated 2015.

1.2 ACTION AND INFORMATIONAL 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 found in work plan.
- .3 Submit as required copies of Contractor's authorized representative's work site health and safety inspection reports to authority having jurisdiction, weekly.
- .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 Safety Data Sheets (SDS) in accordance with Section 02 81 00 - Hazardous Materials.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 10 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 10 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.

1.3 FILING OF NOTICE

- .1 File Notice of Project with Territorial authorities prior to beginning of Work.
- .2 Contractor shall be responsible and assume the Principal Contractor role for each work zone location and not the entire complex. Contractor shall provide a written acknowledgement of this responsibility with 3 weeks of contract award. Contractor to submit written acknowledgement to CSST along with Ouverture de Chantier Notice.
- .3 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

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

1.7 PROJECT/SITE CONDITIONS

- .1 Work at site will involve contact with:
 - .1 Multi-employer work site..
 - .2 Federal employees and general public..
 - .3 Energized electrical services.
 - .4 Working from heights
 - .5 Working in the open exposed to unpredictable weather.

1.8 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.

1.9 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, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.10 COMPLIANCE REQUIREMENTS

- .1 Comply with Safety Act, General Safety Regulations, R.R.N.W.T. 2021.
- .2 Comply with Federal and Territorial Guidance and Restrictions concerning COVID-19.

1.11 UNFORSEEN 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 Territory having jurisdiction and advise Departmental Representative verbally and in writing.
- .2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise Safety Officer and follow procedures in accordance with Acts and Regulations of Territory having jurisdiction and advise Departmental Representative verbally and in writing.

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 Territory 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 without prior receipt of written instruction by Departmental Representative.

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.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

Ω END OF SECTION

Part 1 General

1.1 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.

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 products and equipment and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit WHMIS Safety Data Sheets (SDS) in accordance with Section 02 81 00 - Hazardous Materials.
- .3 Submit Environmental Protection Plan (EPP) for review and approval by Departmental Representative before delivering materials to site or commencing construction activities.
- .4 EPP shall include comprehensive overview of known or potential environmental issues to be addressed on site during construction.
- .5 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .6 Include in Environmental Protection Plan (EPP):
 - .1 Names of persons responsible for ensuring adherence to EPP.
 - .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 Submit 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.
 - .6 Submit a site-specific Traffic Control Plan (TCP) including measures to reduce erosion of existing roadbeds by construction traffic, especially during wet weather.
 - .1 TCP to include measures to minimize amount of material transported onto paved public roads by vehicles or runoff.
 - .7 Submit a Site Work Plan (SWP) showing work areas for proposed activities in each portion of area and identifying areas of limited use or non-use.
 - .1 SWP to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.

- .8 Submit a Spill Control Plan (SCP) including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .9 Submit a Solid Waste Disposal Plan (SWDP) for non-hazardous solid wastes identifying methods and locations for solid waste disposal including clearing debris.
- .10 Submit an Air Pollution Control Plan (APCP) detailing provisions to ensure that dust, debris, materials, and trash, are contained within the project site.
- .11 Submit a site-specific Contaminant Prevention Plan (CPP) identifying the proper procedures and actions to be implemented to prevent potentially or expected hazardous substances due to the presence of any hazardous substances within the project site. The intent of the CPP is to:
 - .1 Prevent introduction of designated substances (DS) into air, water, or ground;
 - .2 Detail provisions for storage and handling of these materials in compliance with Federal, Provincial, and Municipal laws.
- .12 Submit a Wastewater Management Plan (WMP) 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.
- .13 Submit an Identification and Protection Plan (IPP) that defines procedures for identifying and protecting historical, archaeological, cultural and biological resources and wetlands.

1.3 FIRES

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

1.4 DRAINAGE

- .1 Ensure that the ESCP measures are provided and that its recommendations are followed on site, in accordance with the site-specific SPPP, at all times during construction.
- .2 Provide temporary drainage and pumping as required to keep excavations on site free of standing water.
 - .1 Obtain Departmental Representative approval before pumping standing water, which is free of suspended materials, into waterways, sewer or drainage systems.
 - .2 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with the site-specific SPPP in compliance with the requirements of authorities having jurisdiction.

1.5 WORK ADJACENT TO WATERWAYS

- .1 Construction equipment to be operated on land only.
- .2 Keep waterways free of excavated fill, waste material and debris.
- .3 Design and construct temporary crossings to minimize waterways erosion.
- .4 Do not skid logs or construction materials across waterways.

1.6 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this Contract in accordance with site-specific SPPP.
- .2 Control emissions from equipment and plant in accordance with local authorities' emission requirements. Check with local authorities for any environmental compliance 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.

1.7 HISTORICAL/ARCHAEOLOGICAL CONTROL

- .1 Refer to the site-specific IPP for procedures in identifying and protecting historical and archaeological resources previously known to be on project site or discovered during construction.
 - .1 Plan to include methods to ensure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.

1.8 NOTIFICATION

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial environmental laws and regulations or Municipal environmental bylaws, permits, and other elements of site-specific plans, such as EPP, SPPP, TCP, SCP, SWDP, APCP, CPP, WMP, PTP and IPP as applicable.
- .2 Contractor after receipt of such notice, shall inform Departmental Representative of proposed corrective action and take such action to obtain the approval of 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.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.

- .2 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .3 Proceed with final cleaning upon completion and removal of surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

Ω END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section references to laws, by laws, ordinances, rules, regulations, codes, orders of Authority Having Jurisdiction, and other legally enforceable requirements applicable to Work and that are; or become, in force during performance of Work.

1.2 REFERENCES TO REGULATORY REQUIREMENTS

- .1 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Specific design and performance requirements listed in specifications or indicated on Drawings may exceed minimum requirements established by referenced Building Code; these requirements will govern over the minimum requirements listed in Building Code
 - .1 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.3 HAZARDOUS MATERIAL DISCOVERY

- .1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Departmental Representative. Refer to Section 02 81 00 - Hazardous Materials.
- .2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Departmental Representative. Refer to Section 02 81 00 - Hazardous Materials.
- .3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Departmental Representative. Refer to Section 02 81 00 - Hazardous Materials.

1.4 BUILDING SMOKING ENVIRONMENT

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

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: Except as otherwise specified, Constructor shall apply for, obtain, and pay fees associated with, permits, licenses, certificates, and approvals required by regulatory requirements and Contract Documents, based on General Conditions of Contract and the following:
 - .1 Regulatory requirements and fees in force on date of Bid submission, and
 - .2 A change in regulatory requirements or fees scheduled to become effective after date of tender submission and of which public notice has been given before date of tender submission

Part 2 Products

2.1 NOT USED

- .1 Not Used.

2.2 EASEMENTS AND NOTICES

- .1 Departmental Representative will obtain permanent easements and rights of servitude that may be required for performance of Work.
- .2 Constructor shall give notices required by regulatory requirements.

2.3 PERMITS

- .1 Development Permit: Departmental Representative has applied for, obtained, and paid for development permit.
- .2 Building Permit:
 - .1 Constructor shall apply for, obtain and pay for building permit on behalf of Departmental Representative, and other permits required for Work and its various parts.
 - .2 Constructor shall display building permit and other permits in a conspicuous location at Place of Work.
- .3 Occupancy Permits:
 - .1 Constructor shall apply for, obtain, and pay for occupancy permits, including partial occupancy permits where required by authority having jurisdiction.
 - .2 Departmental Representative will issue appropriate instructions to Constructor for correction to Work where Contract Document deficiencies are required to be corrected in order to obtain occupancy permits, including partial occupancy permits.
 - .3 Constructor shall correct deficiencies in accordance with Departmental Representative 's instructions. Where deficiency is not corrected, Owner reserves the right to make correction and charge Constructor for costs incurred.
 - .4 Constructor shall turn occupancy permits over to Departmental Representative.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

Ω END OF SECTION

Part 1 General

1.1 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction.

1.2 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.

1.3 PROCEDURES

- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.4 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.

1.5 REPORTS

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

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

1.6 TESTS AND MIX DESIGNS

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

1.7 EQUIPMENT AND SYSTEMS

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

Ω END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL 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 which have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

1.3 SCAFFOLDING

- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain ladders, platforms, and scaffolding.

1.4 HOISTING

- .1 Provide, operate and maintain hoists cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
- .2 Hoists cranes to be operated by qualified operator.

1.5 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.

1.6 CONSTRUCTION PARKING

- .1 Parking will be permitted on site provided it does not disrupt performance of Work.
- .2 Provide and maintain adequate access to project site.

1.7 SECURITY

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

1.8 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.

1.9 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.
- .3 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building. Permanent facilities may be used on approval of Departmental Representative.

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.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

Ω END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

1.2 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs, and other areas where required.
- .2 Provide as required by governing authorities.

1.3 WEATHER ENCLOSURES

- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

1.4 DUST TIGHT SCREENS

- .1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- .2 Maintain and relocate protection until such work is complete.

1.5 ACCESS TO SITE

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

1.6 PUBLIC TRAFFIC FLOW

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

1.7 FIRE ROUTES

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

1.8 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.

1.9 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 with Departmental Representative locations and installation schedule 5 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

Ω END OF SECTION

Part 1 General

1.1 QUALITY

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.2 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify 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.

1.3 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber 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 name plates.

1.4 TRANSPORTATION

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

1.5 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.6 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify 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.

1.7 CO-ORDINATION

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.8 CONCEALMENT

- .1 In finished areas conceal pipes, ducts and 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.

1.9 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.

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

1.10 LOCATION OF FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Departmental Representative of conflicting installation. Install as directed.

1.11 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.12 FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.13 PROTECTION OF WORK IN PROGRESS

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

1.14 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

Ω END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Owner or separate contractor.
- .3 Include in request:
 - .1 Identification of project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Owner or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.2 MATERIALS

- .1 Required for original installation.
- .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

1.3 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.4 EXECUTION

- .1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Remove samples of installed Work for testing.

- .6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .10 Restore work with new products in accordance with requirements of Contract Documents.
- .11 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .12 Provide firestopping in accordance with Section 07 84 00 - Firestopping to maintain the integrity of fire separations, including:
 - .1 Protecting penetrations at fire-resistance rated wall, ceiling or floor construction.
 - .2 Using construction joint fire stops and building perimeter fire stops to protect gaps at fire separations and between fire separations and other construction assemblies.
- .13 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .14 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

Ω 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 Owner 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 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Provide on-site containers for collection of waste materials and debris.
- .5 Dispose of waste materials and debris off site.
- .6 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor 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 Owner 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, unless approved by Departmental Representative.
- .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 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .12 Remove dirt and other disfiguration from exterior surfaces.
- .13 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .14 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .15 Remove snow and ice from access to building.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

Ω END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
 - .2 Request Departmental Representative inspection.
 - .2 Departmental Representative Inspection:
 - .1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.
 - .2 Contractor to correct Work as directed.
 - .3 Completion Tasks: submit written certificates in English 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 Authority Having Jurisdiction: submitted.
 - .5 Operation of systems: demonstrated to Owner's personnel.
 - .6 Commissioning of mechanical systems: completed in accordance with 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS and electronic and copies of final Commissioning Report submitted to Departmental Representative.
 - .7 Work: complete and ready for final inspection.
 - .4 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.
 - .2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.
 - .5 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
 - .6 Commencement of Lien and Warranty Periods: date of Departmental Representative's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.
 - .7 Final Payment:

- .1 When Departmental Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.
- .8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.2 FINAL CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

Ω END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with 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 ACTION AND INFORMATIONAL 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, four final copies of operating and maintenance manuals in English.
- .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 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
 - .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.

1.4 CONTENTS - PROJECT RECORD DOCUMENTS

- .1 Table of Contents for Each Volume: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
 - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
 - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- .6 Training: refer to Section 01 79 00 - Demonstration and Training.

1.5 AS -BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, 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 Report, System Components List C/W Commissioning Verification Forms and Check Sheets and Commissioning Issues/Resolution Log.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 Referenced Standards to related shop drawings and modifications.
- .5 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.
- .6 Other Documents: maintain manufacturer's certifications, required by individual specifications sections.
- .7 Provide digital photos, if requested, for site records.

1.7 EQUIPMENT AND SYSTEMS

- .1 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
 - .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 REQUIREMENTS.
- .15 Additional requirements: as specified in individual specification sections.

1.8 MATERIALS AND FINISHES

- .1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
 - .1 Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional requirements: as specified in individual specifications sections.

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

1.10 DELIVERY, STORAGE AND HANDLING

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review by Departmental Representative.

1.11 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 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include alarm systems.
 - .3 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.
 - .4 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.
 - .5 Procedure and status of tagging of equipment covered by extended warranties.
 - .6 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.

1.12 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.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

Ω END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 This Section specifies roles and responsibilities of Owner Training, related to Cx.

1.2 TRAINEES

- .1 Trainees: personnel selected for operating and maintaining this facility. Includes Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.
- .2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

- .1 Departmental Representative will provide:
 - .1 Descriptions of systems.
 - .2 Instruction on design philosophy, design criteria, and design intent.
- .2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:
 - .1 Start-Up, operation, 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.
- .3 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.
- .3 Project Manager, Commissioning Manager and Facility Manager will review training manuals.
- .4 Training materials to be in a format that permits future training procedures to same degree of detail.
- .5 Supplement training materials:
 - .1 Multimedia presentations.
 - .2 Manufacturer's training videos.
 - .3 Equipment models.
- .6 Training materials with agendas to be made available prior to scheduling training sessions.

1.6 SCHEDULING

- .1 Include in Commissioning Schedule time for training.
- .2 Deliver training during regular working hours, training sessions to be adequate in length for each system to meet the training objectives.
- .3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

- .1 Be responsible for:
 - .1 Implementation of training activities,
 - .2 Coordination among instructors,
 - .3 Quality of training, training materials,
- .2 Commissioning Manager will evaluate training and materials.
- .3 Upon completion of training, provide written report, signed by Instructors, witnessed by Departmental Representative.

1.8 TRAINING CONTENT

- .1 Training to include demonstrations by Instructors using the installed equipment and systems.
- .2 Content includes:
 - .1 Review of facility and occupancy profile.
 - .2 Functional requirements.
 - .3 System philosophy, limitations of systems and emergency procedures.
 - .4 Review of system layout, equipment, components and controls.
 - .5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
 - .6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.
 - .7 Maintenance and servicing.

- .8 Trouble-shooting diagnosis.
- .9 Inter-Action among systems during integrated operation.
- .10 Review of 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.

Ω END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 General project commissioning requirements.
- .2 Related Requirements
 - .1 Section 01 79 00.13 - Demonstration and Training for Building Commissioning.
 - .2 Section 01 91 13.13 - Commissioning Plan
 - .3 Section 01 91 13.16 - Commissioning Forms
- .3 Acronyms:
 - .1 BMM - Building Management Manual.
 - .2 Cx - Commissioning.
 - .3 CxPM – Commissioning Process Manager
 - .4 EMCS - Energy Monitoring and Control Systems.
 - .5 O&M - Operation and Maintenance.
 - .6 PI - Product Information.
 - .7 PV - Performance Verification.

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.
- .3 Design Criteria: as per client's requirements or determined by designer. Construction Documents 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 Departmental Representative will issue Interim Acceptance Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
 - .2 Equipment, components and systems have been fully commissioned and functional as per design intent to meet project functional and operational requirements.
 - .3 Final O&M and Training Manual receive, review and approve by Departmental Representative for suitability.
 - .4 Completion of Training session to Operational and Maintenance staffs
 - .5 Successful completion of integrated system tests, life safety support systems tests and after meeting all requirements of the authority having jurisdiction
 - .6 Equipment, components and systems have been commissioned.
 - .7 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Departmental Representative, to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review Contract Documents, confirm by writing to Departmental Representative.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, 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 Departmental Representative.

- .7 Have Cx schedules up-to-date.
- .8 Ensure systems have been cleaned thoroughly.
- .9 Ensure "As-Built" system schematics are available.
- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 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 Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
 - .3 Submit proposed Cx procedures to Departmental Representative 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 Departmental Representative at least 8 weeks prior to start of Cx.

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 Departmental Representative to review and approve Cx documentation.
- .3 Provide completed and approved Cx documentation to Departmental Representative.

1.9 COMMISSIONING SCHEDULE

- .1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.
- .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 following project meetings: Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart and as specified herein.
- .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. Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart. Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
 - .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
 - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Cx Agent, 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 Departmental Representative 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 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Provide testing documentation for approval by Departmental Representative.
 - .3 Arrange for Departmental Representative to witness tests.
 - .4 Obtain written approval of test results and documentation from Departmental Representative before delivery to site.
- .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative
 - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
 - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

- .3 Integrity of warranties:
 - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.
- .4 Qualifications of manufacturer's personnel:
 - .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

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 PI report forms.
 - .2 Visual inspection of quality of installation.
 - .2 Start-up: follow accepted start-up procedures.
 - .3 Operational testing: document equipment performance.
 - .4 System PV: include repetition of tests after correcting deficiencies.
 - .5 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.
- .4 Document require 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 Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
 - .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
 - .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
 - .1 Rejected equipment to be remove from site and replace with new.
 - .2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP DOCUMENTATION

- .1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.

- .3 Signed installation/start-up check lists.
- .4 Start-up reports,
- .5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit Departmental Representative for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 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.

1.18 START OF COMMISSIONING

- .1 Notify Departmental Representative at least 21 days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.19 INSTRUMENTS/EQUIPMENT

- .1 Submit to Departmental Representative for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, 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.

1.20 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.
- .4 EMCS trending to be available as supporting documentation for performance verification.

1.21 WITNESSING COMMISSIONING

- .1 Provide 14 business days' notice prior to commencement.
- .2 Departmental Representative to witness activities and verify results.
- .3 Contractor's Cx Agent to be present to certify tests are performed and documented.

1.22 AUTHORITIES HAVING JURISDICTION

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies to Departmental Representative within 5 days of test and with Cx report.

1.23 COMMISSIONING CONSTRAINTS

- .1 Since access into secure or sensitive areas will be very difficult after occupancy it is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems in these areas before issuance of the Interim Certificate, using, if necessary, simulated thermal loads.

1.24 EXTRAPOLATION OF RESULTS

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

1.25 EXTENT OF VERIFICATION

- .1 Provide manpower and instrumentation to verify up to 100 % of reported results
- .2 Number and location to be at discretion of Departmental Representative.
- .3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .4 Review and repeat commissioning of systems if inconsistencies found in more than 20 % of reported results.
- .5 Perform additional commissioning until results are acceptable to Departmental Representative.

1.26 REPEAT VERIFICATIONS

- .1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive Departmental Representative's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Departmental Representative deems Contractor's request for second verification was premature.

1.27 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.

1.28 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.
- .2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.29 COMPLETION OF COMMISSIONING

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.
- .3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.30 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.

1.31 TRAINING

- .1 In accordance with Section 01 79 00 - Demonstration and Training for Building Commissioning.

1.32 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

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

1.33 OCCUPANCY

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

1.34 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:
 - .1 Accuracy complies with these specifications.
 - .2 Calibration certificates have been deposited with Departmental Representative.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.35 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application tolerances:

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

1.36 OWNER'S PERFORMANCE TESTING

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

Ω END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Description of overall structure of Plan and roles and responsibilities of commissioning team.

1.2 REFERENCE STANDARDS

- .1 CSA Building Commissioning Standard Z320
- .2 CAN/ULC S536
- .3 CAN/ULC S537

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 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.
 - .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 CxPM - Commissioning Process Manager.
 - .3 PI - Product Information.
 - .4 PV - Performance Verification.
- .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 This section includes the Initial Project Commissioning Plan, describing the overall commissioning process along with the roles and responsibilities of the commissioning team.
- .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 completed Cx Plan to Departmental Representative 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 At each revision, indicate revision number, date and a general description of changes.
- .3 Each revision shall be submitted to the CxPM and Departmental Representative for review and obtain written approval.

1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

- .1 Commissioning Process Manager (CxPM): Overall responsible for the planning and implementation of project commissioning.
- .2 Departmental Representative, as assigned by PSPC, has overall responsibility for managing the project on behalf of the User Group (Public Services and Procurement Canada {PSPC}), and will select Cx Team consisting of following members:
 - .1 Departmental Representative Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
 - .2 Departmental Representative Quality Assurance Commissioning Manager: ensures Cx activities are carried out to ensure delivery of a fully operational project including:
 - .1 Review of Cx documentation from operational perspective.
 - .2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
 - .3 Protection of health, safety and comfort of occupants and O&M personnel.
 - .4 Monitoring of Cx activities, training, development of Cx documentation.
 - .5 Work closely with members of Cx Team.

- .3 Design Consultants (Departmental Representative)
 - .1 Has the responsibility for producing the project basis of design and construction documents, including testing and start-up specifications.
 - .2 Provides related clarifications, directives and reviews the progress of construction.
 - .3 Reviews all Contractor submittals.
 - .4 Work closely with members of Cx Team.
- .4 Commissioning Process Manager (CxPM) is responsible for:
 - .1 Organizing Cx.
 - .2 Monitoring Cx activities.
 - .3 Witnessing and/or approving contractor and vendor tests.
 - .4 Witnessing and/or approving accuracy of reported results.
 - .5 Review and oversight of the final Cx Plan.
 - .6 Performing verification of performance of installed systems and equipment.
 - .7 Monitor planning and implementation of Training Plan.
- .5 Construction Team: contractor, subcontractors, suppliers and support disciplines, is responsible for construction/installation in accordance with Contract Documents, including:
 - .1 Testing and systems adjustments.
 - .2 Performance of Cx activities.
 - .3 Planning and delivery of training and Cx documentation.
 - .4 Assigning one person as point of contact with CxPM and PWGSC Cx Manager for administrative and coordination purposes.
- .6 Contractor's Cx agent implements specified Cx activities including:
 - .1 Completion of Cx Forms.
 - .2 Testing.
 - .3 Preparation and submission of associated documentation.
 - .4 Demonstrations.
 - .5 Training.
- .7 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:
 - .1 Receiving facility upgrades.
 - .2 Day-To-Day operation and maintenance of facility.
 - .3 Provides input to the Cx process as may be required.

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 where a specialty equipment vendor is required.

- .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 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 Redistribution of electrical services.
 - .2 Modifications of fire alarm systems.
- .5 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.

1.8 RISK ASSESSMENT

- .1 Not used.

1.9 EXTENT OF CX

- .1 General
 - .1 The Department of Fisheries and Oceans (DFO) Canadian Coast Guard (CCG) Base in Hay River, NT includes seven existing buildings that require replacement of the building life safety systems. The systems to be replaced include emergency lighting, exit signs and fire alarm.
 - .1 The emergency lighting and exit signage Cx will include installation, operational / performance reviews.
 - .2 The fire alarm verification is completed with the Electrical Engineer of Record. The accompanying FAVI reporting will be confirmed with no outstanding issues.
 - .3 Demonstration and training will be required for all new and relocated equipment and systems.
 - .2 Systems to be commissioned, for each building include:
 - .1 Emergency Lighting
 - .2 Exit Signs
 - .3 Fire Alarm System - Duplication of the Fire Alarm VI is not required, as witnessed and signed-off by the Electrical Engineer. Final FAVI Reporting shall be provided to confirm functionality and integration, with no outstanding issues of note.

1.10 DELIVERABLES RELATING TO O&M PERSPECTIVES

- .1 General requirements:
 - .1 Compile complete and signed-off Cx forms and associated reporting. Submit along with O&M data as specified elsewhere.
 - .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 WHMIS Safety Data Sheets (SDS).

1.11 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 Contractors Cx Agent to coordinate and document activities with the Cx Team, as directed by the CxPM.
- .3 Electrical Engineer to witness and certify Fire Alarm Verification. Reporting of results shall be provided to the CxPM.
- .4 Deliverables: provide:
 - .1 Pre-Cx associated submittal documentation
 - .2 100% Cx Plan, and subsequent updates as required
 - .1 Contact information for Contractor Cx participants
 - .2 Indexed descriptions / narratives to execute Cx activities for each building system.
 - .1 Completed installation checklists (ICL).
 - .2 Completed product information (PI) report forms.
 - .3 Completed performance verification (PV) report forms.
 - .4 Results of Performance Verification Tests and Inspections.
 - .3 Fire Alarm Verification Report
 - .4 Training Plans.
 - .5 Commissioning Schedule
 - .6 Cx Reports.
 - .7 Prescribed or deferred activities during warranty period where required

1.12 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Items listed in this Cx Plan include the following:
 - .1 Pre-Start-Up inspections: Design Consultant progress reviews are completed prior to energization / start up. Resolve deficiencies to the Design Consultant and Project Teams' satisfaction.
 - .2 CxPM will monitor project reporting.
 - .3 Finalized equipment submittals, updated to address reviewer comments, are to be appended to approved check lists for each equipment type. Submittals to include equipment type(s), make, model and quantities. Installation, operation and maintenance manuals are to be available upon request.

- .4 Proposed testing procedure narratives.
- .5 Include all finalized submittal documentation with Cx report.
- .2 Pre-Cx activities for each building, to be completed for:
 - .1 Electrical Systems:
 - .1 Emergency lighting and Exit Signage Systems

1.13 START-UP

- .1 Contractors to start up components, equipment, and systems.
 - .1 Equipment manufacturer, supplier, installing specialist sub-contractor, to start-up / energize equipment under Contractor's direction where appropriate:
- .2 Contractors Cx Agent to monitor these start-up activities.
 - .1 Ensure start-up deficiencies are resolved to satisfaction of the Cx Team.
- .3 Performance Verification (PV):
 - .1 Approved Contractors' to perform:
 - .1 Emergency lighting and Exit Signage Systems:
 - .1 Testing includes verification of sufficient lighting levels and coverage, along with egress wayfinding.
 - .2 Functionality to be reviewed under normal power operation, then under emergency power conditions.
 - .2 Repeat when necessary until results are acceptable to the CxPM
 - .2 Use procedures to suit project requirements.
 - .3 Contractors Cx Agent to witness and certify reported results using approved PI and PV forms.
 - .4 Contractors to provide signed and complete PV reports to CxPM
 - .5 CxPM will verify a sampling of reported results at random.
 - .6 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.14 CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Perform Cx using procedures developed by the Contractors Cx Agent and approved by the CxPM.
- .2 Contractors to complete Cx forms and provide to CxPM for review prior to onsite demonstrations and verification.
- .3 Final FAVI Report as signed off by the Electrical Engineer of Record, to be provided to confirm functionality with no outstanding deficiencies
- .4 CxPM reserves right to verify a percentage of reported results at no cost to contract.
- .5 Upon satisfactory completion, CxPM will prepare Cx Report verifying satisfactory completion of approved PV forms.

1.15 CX OF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION

- .1 Integrated systems include all those operationally interlocked with the fire alarm system. Systems interlock functions will be tested as part of the fire alarm verification accordingly.

- .2 Emergency lighting and signage is continuously operational on normal and emergency power.
- .3 Identification:
 - .1 In later stages of Cx as required, Contractors Cx Agent and CxPM to provide assistance to PWGSC with MMS systems identification.

1.16 INSTALLATION CHECK LISTS (ICL)

- .1 Refer to Section 01 91 13.16 - Commissioning Forms: Installation Check Lists and Product Information (PI)/Performance Verification (PV) Forms.

1.17 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Refer to Section 01 91 13.16 - Commissioning Forms: Installation Check Lists and Product Information (PI)/Performance Verification (PV) Forms.

1.18 PERFORMANCE VERIFICATION (PV) REPORT

- .1 Refer to Section 01 91 13.16 - Commissioning Forms: Installation Check Lists and Product Information (PI)/Performance Verification (PV) Forms.

1.19 DELIVERABLES RELATING TO ADMINISTRATION OF CX

- .1 General:
 - .1 Commissioning forms are to be fully completed and signed off prior to total completion, and before building occupancy.

1.20 CX SCHEDULES

- .1 Commissioning activities shall be included as line items in the Construction Schedule. The following activities shall be included in the critical path:
 - .1 Updated Cx Plan
 - .2 Completion of Pre-Startup Cx documentation
 - .3 Onsite Cx Verification(s)
 - .4 O&M Manual Submittal
 - .5 Owner Training
 - .6 Deferred Cx Activities where applicable
- .2 CxPM will monitor progress of Cx against this schedule.

1.21 CX REPORTS

- .1 Submit reports of tests, and completed forms, witnessed and certified by Contractors Cx Agent to the CxPM who will verify reported results.
- .2 Include completed and certified PV reports in properly formatted, indexed Cx Reports.
- .3 Before reports are accepted, results are subject to verification by the CxPM.

1.22 PRELIMINARY AND FINAL CX

- .1 An updated Cx Plan is to be provided and approved prior to executing onsite commissioning..
- .2 Completed forms are to be provided for review in a timely manner as commissioning progresses.

- .3 A final Cx Plan complete with related requirements and forms shall be submitted to the CxPM prior to onsite verifications, and Owner Training.

1.23 ACTIVITIES DURING WARRANTY PERIOD

- .1 Cx activities must be completed before issuance of Interim Certificate, it is not anticipated that Cx activities will be necessary during Warranty Period.

1.24 TESTS TO BE PERFORMED BY OWNER/USER

- .1 None is anticipated on this project.

1.25 TRAINING PLANS

- .1 Refer to Section 01 79 00.13 - Demonstration and Training for Building Commissioning.

1.26 FINAL SETTINGS

- .1 Not used.

1.27 PAYMENTS FOR CX

- .1 The total cost estimate based on the present commissioning scope is ≈ \$2,500.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

Ω END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Commissioning forms to be completed for the following list of systems components per building:
 - .1 New Emergency Exit Signs
 - .2 New Emergency Lights (battery packs & remote heads)
 - .3 FAVI Completion and Report Verification

1.2 INSTALLATION/START-UP CHECK LISTS

- .1 Include the following supplemental data were appropriate:
 - .1 Product manufacturer's installation instructions and recommended checks.
 - .2 Special procedures as specified in relevant technical sections.
 - .3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.
- .2 Equipment manufacturer's installation/start-up check lists are acceptable for supplemental use.
- .3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.
- .4 Installer to sign check lists upon completion, certifying checks and inspections have been performed. Return completed check lists to CxPM. Check lists will be required during Commissioning and for inclusion in the Building Maintenance Manual (BMM).

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the BMM at completion of work.
- .2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain CxPM approval.

1.4 PERFORMANCE VERIFICATION (PV) FORMS

- .1 PV checklist forms to be used when running dynamic tests to confirm correct operation, and that systems run efficiently and function independently and interactively with other systems as intended with project requirements.
- .2 PV report forms shall be supplemented with proposed procedures / narratives developed by Contractor. These shall include for additional measured data and readings taken during functional testing and Performance Verification procedures where required.
- .3 Prior to PV of integrated system, complete PV forms of related systems and obtain CxPM approval.

1.5 SAMPLES OF COMMISSIONING FORMS

- .1 CxPM has prepared the following Contractor required Commissioning forms for use:
 - .1 Emergency Signage, to be complete for each building
 - .2 Emergency Lighting (battery packs & remote heads), to be used for each building
 - .3 FAVI Report Verification
 - .4 Cx Issues & Resolution Log
- .2 Revise items on Commissioning forms to suit project requirements.
- .3 Samples of Commissioning forms identified will be attached to this section.

1.6 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

- .1 When additional forms are required, but are not available from CxPM develop appropriate verification forms and submit to CxPM for approval prior to use.
 - .1 Additional commissioning forms to be in similar format, and to contain all relevant requirements and verifications.

1.7 COMMISSIONING FORMS

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
 - .1 CxPM provides Contractor project-specific Commissioning forms for use.
 - .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
 - .3 Identify variances between design and operation and reasons for variances.
 - .4 Verify operation in normal and emergency modes.
 - .5 Verify reported results.
 - .6 Form to bear signatures of recording technician, to be reviewed and signed off by the CxPM.
 - .7 Submit immediately after tests are performed.
 - .8 Reported results in true measured SI unit values.
 - .9 Provide CXPM with originals of completed forms.
 - .10 Maintain copy on site during start-up, testing and commissioning period.

1.8 LANGUAGE

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

Life Safety System Replacement
DFO CCG Station
Hay River, NT
Job No: EW038-210713

Issued for Tender

August 6, 2021

SECTION 01 91 13.16
Commissioning forms

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Ω END OF SECTION

Cx Issues & Resolutions Log



Project Name / Building:

Issue ID#	Date Identified	Identified By	Action By	Issue Description	Date Resolved	Contractor Cx Agent Sign-Off	CxPM Verification

Cx Issues & Resolutions Log



Project Name / Building:

COMMENTS:

Emergency Lighting Verification Checkout Form



PROJECT INFORMATION		
Project Name / Building:	Dwg / Spec Reference:	Date:

EQUIP./ LOCATION INFO		CHECKS							SIGN OFF
Battery Pack ID / Area Served	Light Type Make/Model	Installed as Per Dwgs/Specs?	Clean & Undamaged	Auto-Charge Operates	Indicator Lights Operate	Lamp Aiming Correct	Remote Head(s) Operational	Allotted Time Tested?	Checked / Signed-By

COMMENTS / ISSUES:

Exit Signage Verification Checkout Form



PROJECT INFORMATION		
Project Name / Building:	Dwg / Spec Reference:	Date:

EQUIPMENT / LOCATION INFO			CHECKS							SIGN OFF
Corridor / Room	Exit Light Type Make/Model	Quantity Checked	Mounting as Per Drawings?	Wiring Complete & Correct?	Light Clean & Undamaged?	Exit Direction Correctly Orientated?	Operating on AC Correctly	Operating on DC Correctly	Clearly Visible on Back-Up Power?	Checked / Signed By

COMMENTS / ISSUES:

Fire Alarm VI - Cx Verification Form



PROJECT INFORMATION		
Project Name / Building:	Dwg / Spec Reference:	Date:

Fire Alarm VI Date:

Participants:

FAVI Report Date:

FAVI Signed-off by the Electrical Engineer: Y / N

FAVI Clear of any outstanding issues or deficiencies: Y / N

Contractor Cx Agent Sign-Off Date & Signature:

CxPM Sign-Off Date & Signature:

COMMENTS / ISSUES:

Part 1 General

1.1 SUMMARY

- .1 This Section includes the following:
 - .1 Demolition and removal of existing electrical systems as indicated on the drawings.

1.2 REFERENCE STANDARDS

- .1 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2015 (NBC).
 - .2 National Fire Code of Canada 2015 (NFC).

1.3 DEFINITIONS

- .1 Demolition: rapid destruction of building following removal of hazardous materials.
- .2 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, may include but not limited to: asbestos PCB's, CFC's, HCFC's poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly.
- .3 Waste Management Coordinator (WMC): Contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .4 Construction Waste Management Plan (CWM Plan): Written plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19- Construction Waste Management and Disposal.
- .5 Construction Waste Management Report (CWM Report): Written report identifying actual materials that formed CWM Plan for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19- Construction Waste Management and Disposal

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate with Departmental Representative for the material ownership including but not limited to:
 - .1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner 's property, demolished materials shall become Contractor 's property and shall be removed from Project site.
 - .2 Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during demolition remain Owner 's property.
- .2 Pre-Demolition Meetings:
 - .1 Convene pre-installation meeting 1 week prior to beginning work of this Section, with Departmental Representative in accordance with Section 01 31 19 - Project Meetings.
- .3 Scheduling:
 - .1 In event of unforeseen delay notify Departmental Representative in writing.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: Ensure Work is performed in compliance with applicable Federal, Provincial/Territorial and Municipal regulations.
- .2 Comply with hauling and disposal regulations of Authority Having Jurisdiction.
- .3 Standards: Comply with ANSI A10.6 and NFPA 241.

1.6 SITE CONDITIONS

- .1 Review "Designated Substance Report" and take precautions to protect environment.
- .2 If material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Departmental Representative immediately.
 - .1 Proceed only after receipt of written instructions have been received from Departmental Representative.
- .3 Notify Departmental Representative before disrupting building access or services.
- .4 Environmental protection:
 - .1 Ensure Work is done in accordance with Section 01 35 43 - Environmental Procedures.

1.7 EXISTING CONDITIONS

- .1 Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - .1 Hazardous materials will be as defined in the Hazardous Materials Act.

Part 2 Products

2.1 EQUIPMENT

- .1 Machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

Part 3 Execution

3.1 EXAMINATION

- .1 Survey existing conditions and correlate with requirements indicated to determine extent of demolition required.
- .2 Inventory and record the condition of items being removed and salvaged.
- .3 When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element.
- .4 Promptly submit a written report to Departmental Representative.
- .5 Verify that hazardous materials have been remediated before proceeding with demolition operations.

3.2 PREPARATION

- .1 Protection of In-Place Conditions:
 - .1 Keep noise, dust, and inconvenience to occupants to minimum.

- .2 Protect building systems, services and equipment.
- .3 Provide temporary dust screens, covers, railings, supports and other protection as required.
- .4 Do Work in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .2 Demolition/Removal:
 - .1 Demolish systems as indicated.
 - .2 At end of each day's work, leave Work in safe and stable condition.
 - .3 Protect interiors of parts not to be demolished from exterior elements at all times.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 WHMIS Safety Data Sheets (SDS).
- .2 National Research Council Canada (NRC)
 - .1 National Fire Code of Canada 2015 (NFC).

1.2 DEFINITIONS

- .1 Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
- .2 Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into environment.
- .3 Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS Safety Data Sheets (SDS) in accordance with Section 01 35 29.06 - Health and Safety Requirements to Departmental Representative for each hazardous material required prior to bringing hazardous material on site.
 - .3 Submit hazardous materials management plan to Departmental Representative that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.
 - .4 Hazardous waste classification: identify waste codes applicable to each hazardous waste material based on applicable federal and provincial acts, regulations, and guidelines. Waste profiles, analyses, and classification submitted to contract offices for review and approval.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with 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 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.

- .1 When exporting hazardous waste to another country, ensure compliance with Export and Import of Hazardous Waste and Hazardous Recyclable Materials Regulations.
- .4 Storage and Handling Requirements:
 - .1 Co-ordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.
 - .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
 - .3 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada (NFC) requirements.
 - .4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.
 - .1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.
 - .2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Departmental Representative.
 - .5 Transfer of flammable and combustible liquids is prohibited within buildings.
 - .6 Transfer flammable and combustible liquids away from open flames or heat-producing devices.
 - .7 Solvents or cleaning agents: non-flammable or have flash point above 38 degrees C.
 - .8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
 - .9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.
 - .10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
 - .1 Store hazardous materials and wastes in closed and sealed containers.
 - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
 - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
 - .4 Segregate incompatible materials and wastes.
 - .5 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.
 - .6 Store hazardous materials and wastes in secure storage area with controlled access.
 - .7 Maintain clear egress from storage area.
 - .8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.
 - .9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.

- .10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.
- .11 When hazardous waste is generated on site:
 - .1 Co-ordinate transportation and disposal with Departmental Representative.
 - .2 Comply with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.
 - .3 Use licensed carrier authorized by provincial authorities to accept subject material.
 - .4 Before shipping material obtain written notice from intended hazardous waste treatment or disposal facility it will accept material and it is licensed to accept this material.
 - .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.
 - .6 Only trained personnel handle, offer for transport, or transport dangerous goods.
 - .7 Provide photocopy of shipping documents and waste manifests to Departmental Representative.
 - .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide photocopy of completed manifest to Departmental Representative.
 - .9 Report discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate provincial authority. Take reasonable measures to control release.
- .12 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
- .13 Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within 24 hours of incident.

Part 2 Products

2.1 MATERIALS

- .1 Description:
 - .1 Bring on site only quantities hazardous material required to perform Work.
 - .2 Maintain WHMIS Safety Data Sheets (SDS) in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.
 - .3 Spill Response Materials: provide spill response materials which can be used for absorbing/shoveling and containing hazardous materials.
 - .4 Provide personal protective equipment.

Part 3 Execution

3.1 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

Ω END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 09 21 16 .08 - Gypsum board assemblies for minor works.
- .2 Fires topping and smoke seals required for all joints and penetrations to fire rated assemblies.
- .3 Firestopping for existing partition upgrade to 2 hr FRR in flammable storage building

1.2 REFERENCE STANDARDS

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (SDS).
- .2 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2015 (NBC).
- .3 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC-S115-1995, Fire Tests of Fire stop Systems.
- .4 ASTM
 - .1 ASTM E2174-19, Standard practice for On Site Inspection of Installed Fire Stops.
 - .2 ASTM G21-15. Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
 - .3 ASTM E2393-10a (2015) Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- .5 Standards Council of Canada
 - .1 CAN/ULC - S101-07, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN/ULC - S102.1: 2018, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and miscellaneous materials and assemblies.

1.3 DEFINITIONS

- .1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit two copies of WHMIS SDS - Material Safety Data Sheets in accordance with Section 02 81 00 - Hazardous Materials.
- .3 Shop Drawings:
 - .1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.
 - .2 Construction details should accurately reflect actual job conditions.
- .4 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures and storage requirements.
 - .4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company specializing in fire stopping installations approved by manufacturer.
- .2 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with Departmental Representative in accordance with Section 01 45 00 to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
- .3 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
- .2 Storage and Protection:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended and conforming to specified special requirements described in PART 3.
 - .2 Fire stop system rating: Meet the requirements of ULC-S115.
- .2 Service penetration assemblies: systems tested to CAN-ULC-S115.
- .3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .10 Sealants for vertical joints: non-sagging.
- .11 Sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT):
 - .1 Intumescent firestop sealant.
 - .2 Firestop silicone sealant self-leveling.
 - .3 Fire foam.
 - .4 Flexible firestop sealant.
 - .5 Firestop silicone sealant gun grade.

- .12 Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
 - .1 Firestop silicone sealant gun grade.
 - .2 Flexible firestop sealant.
 - .3 Intumescent firestop sealant.
 - .4 Firestop silicone sealant self-leveling.
- .13 Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:
 - .1 Firestop joint spray
 - .2 Firestop silicone sealant gun grade
 - .3 Flexible firestop sealant
 - .4 Firestop silicone sealant self-leveling
- .14 Pre-formed mineral wool designed to fit flutes of metal profile deck; as a backer for spray material.
 - .1 Speed plugs.
 - .2 Speed strips.
- .15 Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
 - .1 Intumescent firestop sealant.
- .16 Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
 - .1 Intumescent firestop sealant.
 - .2 Fire foam.
 - .3 Firestop silicone sealant gun grade.
 - .4 Flexible firestop sealant.
- .17 Non curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
 - .1 Firestop putty stick
 - .2 Firestop plug
- .18 Wall opening protective materials for use with cUL /ULC listed metallic and specified non-metallic outlet boxes, the following products are acceptable:
 - .1 Firestop putty pad
 - .2 Firestop box insert
- .19 Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems) tested to 50 pa. Differential, the following products are acceptable:
 - .1 Firestop collar
 - .2 Firestop collar
 - .3 Wrap strips

- .20 For combustible pipe penetrations through a Fire Separation provide a firestop system with a "F" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.
- .21 Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction joint assembly.
- .22 Identification:
 - .1 Provide warning sign or self-adhesive sticker at each fire stop location, containing the following information:
 - .1 The words "Fire Rated Assembly" or similar warning that the opening has been fire stopped.
 - .2 Fire stop system used (ULC or cUL).
 - .3 Fire stop system rating.
 - .4 Product(s) used.
 - .5 Name and phone number of initial installer.
 - .6 Date of initial installation.
 - .7 Date, name and phone number of person or company responsible for re-penetration of assembly (allow several lines).

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
 - .1 Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

- .1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

3.4 SEQUENCES OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by Departmental Representative.
- .2 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.
- .3 Mechanical pipe insulation: certified fire stop system component.
 - .1 Ensure pipe insulation installation precedes fire stopping.

3.5 FIELD QUALITY CONTROL

- .1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.7 SCHEDULE

- .1 Fire stop and smoke seal at:
 - .1 Penetrations through upgrades 2hr fire-resistance rated gypsum board partition in flammable stores building.
 - .2 Top of fire-resistance rated gypsum board partition.
 - .3 Intersection of fire-resistance rated gypsum board partition and metal liner panel on exterior walls.
 - .4 Around mechanical and electrical assemblies penetrating fire separations.
 - .5 Rigid ducts: greater than 129 cm²: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.
 - .6 Fire dampers to be installed on any duct penetrations, refer to Mechanical for details.

Ω END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 84 00 - Firestopping.
- .2 Upgrade of existing Gypsum Wallboard assembly to provide a 2hr Fire Resistance rating.
 - .1 Existing GWB to remain. Install 2 new layers of 15.9mm Type X GWB to each side of existing partition.

1.2 REFERENCE STANDARDS

- .1 ASTM International (ASTM)
 - .1 ASTM C1396/C1396M-09a, Standard Specification for Gypsum Wallboard.
 - .2 ASTM C475/C475M-02 (2007), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .3 ASTM C514-04 (2009)e1, Standard Specification for Nails for the Application of Gypsum Board.
 - .4 ASTM C645-09a, Standard Specification for Nonstructural Steel Framing Members.
 - .5 ASTM C754-09a, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - .6 ASTM C840-08, Standard Specification for Application and Finishing of Gypsum Board.
 - .7 ASTM C954-10, 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 0.122 in. (2.84 mm) in Thickness.
 - .8 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.
 - .9 ASTM C1047-10, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- .2 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1168- A2005, Adhesives and Sealants Applications.
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102- 07, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum, framing, sealants and include product characteristics, performance criteria, physical size, finish and limitations.

- .3 Test and Evaluation Reports: submit test reports in accordance with Section 01 45 00 - Quality Control, from approved independent testing laboratory, certifying partition system complies with sound transmission rating, fire-resistance rating as specified.

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 materials inside, level, under cover. Protect from weather, damage from construction operations and other causes, in accordance with manufacturer's printed instructions.
- .3 Handle materials to prevent damage to edges or surfaces. Protect metal accessories and trim from being bent or damaged.
- .4 Store and protect partition materials from nicks, scratches, and blemishes.
- .5 Replace defective or damaged materials with new.
- .6 Protect gypsum board from direct exposure to rain, snow, sunlight, or other excessive weather conditions.
- .7 Protect ready mix joint compounds from freezing, exposure to extreme heat and direct sunlight.

Part 2 Products

2.1 MATERIALS

- .1 Performance/Design Criteria:
- .1 Partition assembly to be upgraded to 2hr fire resistance rated.
- .2 Existing partition assembly is unknown. The wall separating the building into two separate spaces requires a 2hr FRR. The existing assembly shall remain and the following be added to each side of the partition:
- 2 layers of 15.9mm Type X Gypsum Wall Board.
 - Firestop all penetrations through assembly in accordance with Section 07 84 00.
 - Provide fire dampers for any ducts passing through this rated partition.
- Location: Flammable Stores - Refer to Drawing E440.
- .2 Non-structural Metal Framing:
- .1 Existing to remain. Secure new GWB to existing studs.
- .3 Gypsum Board:
- .1 Standard board: to ASTM C1396/C1396M , 1200 mm wide x maximum practical length, ends square cut, edges tapered.
- .1 Type X 15.9mm thick

- .2 Metal furring runners, hangers, tie wires, inserts, anchors: to as required for install of new board.
- .3 Steel drill screws: to ASTM C1002.
- .4 Sealants: in accordance with Section 07 84 00 - Firestopping.
- .5 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, Zinc, 0.5 mm base thickness, perforated flanges, one piece length per location.
- .6 Joint Compound: to ASTM C475/C475M-17 - Asbestos free.
- .7 Finishes: Texture finish: asbestos free standard white texture coating and primer sealer, recommended by Gypsum Board manufacturer.
- .1 Provide paint finish, colour to match existing.

2.2 ACCESSORIES

- .1 Insulation: Existing to remain.
- .2 Sealants: in accordance with Section to ASTM C475.
- .1 VOC limit 250 g/L maximum to SCAQMD Rule 1168.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions prior to partition installation.
 - .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 ERECTION OF GYPSUM BOARD AND ACCESSORIES

- .1 Do application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.
- .2 Install wall furring for gypsum board wall finishes in accordance with ASTM C840, except where specified otherwise.
- .3 Install gypsum boards in direction that will minimize number of end-butt joints. Stagger end joints 250 mm minimum.

3.3 APPLICATION

- .1 Apply double layer gypsum board to metal furring or framing using screw fasteners. Maximum spacing of screws 300 mm on centre.
- .2 Do application and finishing of gypsum board to ASTM C840-20 except where specified otherwise.

3.4 INSTALLATION

- .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. Secure using contact adhesive for full length.
- .2 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with firestopping.
- .3 Install insulating strips continuously at edges of gypsum board
- .4 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.
- .5 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.
- .6 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .7 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

3.6 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by partition installation.

3.7 SCHEDULES

- .1 Construct fire rated assemblies where indicated.
 - .1 2 hr fire resistance rated partition upgrade to existing GWB partition.

Ω END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Work Included: Provide labour, materials and equipment necessary to complete the work of this section, including, but not limited to:
 - .1 Resilient wall base to both sides of upgraded 2hr GWB partition in flammables Store, Refer to Drawing E440 for location.

1.2 REFERENCE STANDARDS

- .1 ASTM International (ASTM)
 - .1 ASTM F1861- 16, Standard Specification for Resilient Wall Base

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets for base, adhesive, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures .

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 resilient flooring for incorporation into manual, including:
 - .1 WHMIS Safety Data Sheets (SDS)
 - .2 Product data and manufacturer's installation, maintenance and cleaning instructions for each product used on this project.
- .3 Record Documentation:
 - .1 Submit a list of all materials installed, including adhesives, accessories and bases clearly indicating material and manufacturer's names, type, pattern and colour name and numbers for Owner's future reference.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Provide extra materials for maintenance use in accordance with Section 01 78 00 - Closeout Submittals.

1.6 QUALITY ASSURANCE

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

- .2 All preparation, materials and workmanship in accordance with NFCAQAP requirements. Repair or replace deficient work in accordance with NFCAQAP requirements at no additional cost to Owner.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, temperature-controlled, well-ventilated area.
 - .2 Store and protect resilient wall base from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
 - .4 Coordinate delivery of materials with scheduled installation to allow minimum conditioning time on site.
 - .5 Comply with recommended procedures, precautions and measures described in WHMIS SDS.

Part 2 Products

2.1 BASES

- .1 Resilient base: continuous, top set , complete with premoulded end stops :
 - .1 Product: Pinnacle Rubber Base by Roppe
 - .2 Thickness: 3.0 mm.
 - .3 Style: cove to ASTM F1861.
 - .4 Height: 101.6 mm.
 - .5 Lengths: cut lengths minimum 2400 mm.
 - .6 Colour: from manufacturer's standard colour range..
 - .7 Acceptable Alternate: Armstrong Wall Base

Part 3 Execution

3.1 EXAMINATION

- .1 Examine conditions, substrates and work to receive work of this Section, coordinate with Section 01 71 00 - Examination and Preparation.
- .2 Verification of Conditions:
 - .1 Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for resilient sheet and tile flooring installation in accordance with manufacturer's written instructions.
 - .1 Ensure that paint, varnish, dust, oils, release agents, waxes, sealers and curing and hardening compounds not compatible with adhesives employed have been removed.

- .2 Proceed with installation only after any defective surface and conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

- .1 Surface Preparation
 - .1 Substrate surface preparation: in accordance with , manufacturer's instructions and as follows:
 - .1 Remove existing wall base.
 - .2 Ensure work by other trades is acceptable before beginning installation of all materials.

3.3 APPLICATION: BASE

- .1 Install base in longest practical lengths minimum 2400 mm long. Lay out base to keep number of joints at minimum.
- .2 Clean substrate and prime with one coat of adhesive.
- .3 Apply adhesive to back of base, in accordance with manufacturer's instructions.
- .4 Set base against floor and vertical surfaces, tightly by using 3 kg hand roller.
- .5 Install straight and level to variation of 1:1000.
- .6 Complete and finish all seams in accordance with NFCA Floor Covering Reference Manual of Canada and flooring manufacturer's recommendations for the specified flooring.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.
 - .1 Remove excess adhesive from base and wall surfaces without damage

Ω 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 all HVAC equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .2 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
 - .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.

1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for mechanical equipment and systems for incorporation into manual.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .2 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.
 - .3 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.
- .4 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.
- .5 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.
- .6 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
 - .1 Contractor 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 weekly 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.
- .8 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.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

- .2 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products - 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 proper installation in accordance with manufacturer's written instructions.
 - .1 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PAINTING REPAIRS AND RESTORATION

- .1 Prime and touch up marred finished paintwork to match original.
- .2 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.
- .2 Cleaning activities are specified in Section 01 74 00 - Cleaning, however, provide special emphasis on HVAC equipment and duct systems to remove contaminants from the systems prior to operation of any permanent ventilation equipment.

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 00 - 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 00 - Cleaning.

3.6 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .2 CSA Group (CSA)
- .3 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-11-2008, 2nd Edition, Environmental Standard for Paints and Coatings.
- .4 National Research Council Canada (NRC)
 - .1 National Fire Code of Canada 2015 (NFC).
- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1113-A2007, Architectural Coatings.
 - .2 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

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 datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 QUALITY ASSURANCE

- .1 Sustainability Standards Certification:
 - .1 Low-Emitting Materials: provide listing of coatings used in building, comply with VOC and chemical component limits or restriction requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 MATERIAL

- .1 Paint: zinc-rich to CAN/CGSB-1.181.
 - .1 Paints, Primers and Coatings: Apply in accordance with manufacturer's recommendations for surface conditions.
 - .2 Primer: maximum VOC limit 250 g/L to Standard GS-11.
 - .3 Paints: maximum VOC limit 150 g/L to Standard GS-11.

- .2 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
 - .1 Sealants: maximum VOC limit to GSES GS-36.
- .3 Sealants: maximum VOC limit to GSES GS-36.
- .4 Adhesives: maximum VOC limit to GSES GS-36.
- .5 Fire Stopping: in accordance with Section 07 84 00 - Fire Stopping.

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 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of Canada.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer without interrupting operation of other system, equipment, components.

3.4 DRAINS

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain.
 - .1 Discharge to be visible.
- .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.5 AIR VENTS

- .1 Install manual air vents to vent at high points.
- .2 Install isolating valve at each automatic air valve.
- .3 Install drain piping to approved location and terminate where discharge is visible.

3.6 DIELECTRIC COUPLINGS

- .1 General: compatible with system, to suit pressure rating of system.
- .2 Locations: where dissimilar metals are joined.

- .3 NPS 2 and under: isolating unions or bronze valves.
- .4 Over NPS 2: isolating flanges.

3.7 PIPEWORK INSTALLATION

- .1 Install pipework to CAN/CSA B139.
- .2 Screwed fittings jointed with Teflon tape.
- .3 Protect openings against entry of foreign material.
- .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .5 Assemble piping using fittings manufactured to ANSI standards.
- .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .9 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .10 Group piping wherever possible and as indicated.
- .11 Ream pipes, remove scale and other foreign material before assembly.
- .12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .13 Provide for thermal expansion as indicated.
- .14 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use ball valves at branch take-offs for isolating purposes except where specified.
 - .7 Install ball valves for glycol service.
- .15 Check Valves:
 - .1 Install silent check valves in vertical pipes with downward flow and as indicated.
 - .2 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

3.8 SLEEVES

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: schedule 40 black steel pipe.
- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.

- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
 - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
 - .2 Other floors: terminate 25 mm above finished floor.
 - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
- .6 Sealing:
 - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere:
 - .1 Provide space for fire stopping.
 - .2 Maintain the fire-resistance rating integrity of the fire separation.
 - .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
 - .4 Ensure no contact between copper pipe or tube and sleeve.

3.9 ESCUTCHEONS

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: one piece type with set screws.
 - .1 Chrome or nickel plated brass or type 302 stainless steel..
- .3 Sizes: outside diameter to cover opening or sleeve.
 - .1 Inside diameter to fit around pipe or outside of insulation if so provided.

3.10 PREPARATION FOR FIRE STOPPING

- .1 Coordinate the installation of fire stopping around pipes, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Pipes subject to movement: conform to fire stop system design listing to ensure pipe movement without damaging fire stopping material or installation.
- .3 Insulated pipes: ensure integrity of insulation and vapour barriers.

3.11 FLUSHING OUT OF PIPING SYSTEMS

- .1 Flush system in accordance with Section 23 08 16 - Cleaning and start-up of HVAC piping systems.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 00 - Cleaning supplemented as specified in relevant mechanical sections.
- .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.

- .2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of Departmental Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

3.13 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by Departmental Representative.
- .2 Request written approval by Departmental Representative 14 days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.

3.14 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - .1 ANSI/ASME B1.20.1-1983 (R2006), Pipe Threads, General Purpose (Inch).
 - .2 ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 ASTM International (ASTM)
 - .1 ASTM A276-08, Standard Specification for Stainless Steel Bars and Shapes.
 - .2 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .3 ASTM B283-08a, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
 - .4 ASTM B505/B505M-08a, Standard Specification for Copper-Base Alloy Continuous Castings.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
 - .1 MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
 - .2 MSS-SP-80-2008, Bronze Gate Globe, Angle and Check Valves.
 - .3 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit data for valves specified in this Section.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 MATERIALS

- .1 Valves:
 - .1 Except for specialty valves, to be single manufacturer.
 - .2 Products to have CRN registration numbers.
- .2 End Connections:
 - .1 Connection into adjacent piping/tubing:
 - .1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.
 - .2 Copper tube systems: solder ends to ANSI/ASME B16.18.
- .3 Lockshield Keys:
 - .1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.
- .4 Silent Check Valves:
 - .1 NPS 2 and under:
 - .1 Body: cast high tensile bronze to ASTM B62 with integral seat.
 - .2 Pressure rating: Class 125.
 - .3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders.
 - .4 Disc and seat: renewable rotating disc.
 - .5 Stainless steel spring, heavy duty.
 - .6 Seat: regrindable.
- .5 Ball Valves:
 - .1 NPS 2 and under:
 - .1 Body and cap: cast high tensile bronze to ASTM B62.
 - .2 Pressure rating: Class 125, 860 kPa steam.
 - .3 Pressure rating: Class 600.
 - .4 Connections: solder ends to ANSI.
 - .5 Stem: tamperproof ball drive.
 - .6 Stem packing nut: external to body.
 - .7 Ball and seat: replaceable stainless steel solid ball and Teflon seats.
 - .8 Stem seal: TFE with external packing nut.
 - .9 Operator: removable lever handle.
- .6 Drain Valves:
 - .1 Minimum 13Ø, class 600, bronze body, full bore, forged brass, ball, brass gland and PTFE Teflon seat, steel lever handle, screwed, male hose end c/w cap and chain.
 - .2 Acceptable Material: Kitz/Toyo
- .7 Radiator Globe Valves
 - .1 Class 100, bronze body, globe radiator valve c/w piggy back drain valve.
 - .2 Acceptable Material: Dahl.

Part 3 Execution

3.1 INSTALLATION

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Remove internal parts before soldering.
- .3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.
- .4 Install to manufacturer's recommendations.
- .5 Maintain proper clearance to permit service and maintenance.
- .6 Should deviations beyond allowable clearances arise, request and follow Engineer's directive.
- .7 Install specified valves at all branch take-offs and as indicated.
- .8 Install flow measuring stations and flow balancing valves at locations as indicated. Provide required straight pipe to manufacturers recommendations.
- .9 Provide silent check valves in vertical pipes with downward flow and as indicated.
- .10 Provide swing check valves on discharge of pumps as indicated.

3.2 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1-07, Power Piping.
- .2 ASTM International (ASTM)
 - .1 ASTM A125-1996 (2007), Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM)
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .5 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada 2015 (NPC).
- .6 Underwriter's Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings for:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
- .4 Manufacturers' Instructions:
 - .1 Provide manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

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

- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
 - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
 - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.
- .2 Performance Requirements:

2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP58. ANSI B31.1 and
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Use electro-plating galvanizing process.
 - .3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut carbon steel retaining clip.
 - .1 Rod: 9 mm UL listed.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.

- .4 Upper attachment to concrete:
 - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS SP69.
- .5 Hanger rods: threaded rod material to MSS SP58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22 mm or 28 mm rod.
- .6 Pipe attachments: material to MSS SP58:
 - .1 Attachments for steel piping: carbon steel galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.
- .7 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .8 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.
- .9 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
 - .1 Finishes for steel pipework: galvanized.
 - .2 Finishes for copper, glass, brass or aluminum pipework: epoxy coated.
- .10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.4 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.
- .2 Insulated hot piping:
 - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

2.5 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

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 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .3 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .4 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.
- .5 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: to National Plumbing Code of Canada (NPC).
- .2 Copper piping: up to NPS 1/2: every 1.5 m.
- .3 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.
- .4 Within 300 mm of each elbow.
- .5 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 00 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1-04, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 ASTM International (ASTM)
 - .1 ASTM B209M-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - .2 ASTM C335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .3 ASTM C411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.
 - .6 ASTM C553-02e1, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .7 ASTM C612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .8 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .9 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-36-00, Commercial Adhesives.
- .5 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.
- .6 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).
- .7 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.2 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 previously defined.
- .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
- .2 TIAC Codes:
 - .1 CRD: Code Round Ductwork,
 - .2 CRF: Code Rectangular Finish.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.
 - .1 Description of equipment giving manufacturer's name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 To CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.

- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).
- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to ASTM C553.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

- .1 Canvas:
 - .1 220 gm/m²cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .2 Lagging adhesive: compatible with insulation.
 - .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.

2.4 ACCESSORIES

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
 - .1 Maximum VOC limit 200 g/L to SCAQMD Rule 1168.
- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
- .4 ULC Listed Canvas Jacket:
 - .1 220 gm/m²cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .5 Tape: self-adhesive, aluminum, plain, 75 mm wide minimum.
- .6 Contact adhesive: quick-setting
 - .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.
- .7 Canvas adhesive: washable.
 - .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.
- .8 Tie wire: 1.5 mm stainless steel.
- .9 Banding: 19 mm wide, 0.5 mm thick stainless steel.
- .10 Facing: 25 mm stainless steel hexagonal wire mesh stitched on one face of insulation with expanded metal lath on other face.
- .11 Fasteners: 4 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

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 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure test ductwork systems complete, witness and certify.
- .2 Ensure surfaces are clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and as indicated.
- .3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Ensure hangers, and supports are outside vapour retarder jacket.
- .5 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
 - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thicknesses: conform to following table:
 - .1 E/A & O/A:
 - .1 Type: C-1
 - .2 Thickness: 50mm
 - .3 Vapor Retarder
 - .4 Canvas Jacket

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

Ω END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).
- .2 ASTM International (ASTM)
 - .1 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .2 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .3 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .4 ASTM C547-2003, Mineral Fiber Pipe Insulation.
 - .5 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (SDS).
- .6 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).
- .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings

- .4 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as specified.
 - .3 "INSULATION SYSTEMS" - insulation material, fasteners, jackets, and other accessories.
- .2 TIAC Codes:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 Contractor will make available an electronic copy of systems supplier's installation instructions.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
- .2 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.
- .3 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:

- .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102.
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Maximum "k" factor: to CAN/ULC-S702.

2.3 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.
- .6 Facing: 25 mm galvanized steel hexagonal wire mesh on one face of insulation.
- .7 Fasteners: 4 mm diameter pins with 35 mm diameter or square clips. Length of pin to suit thickness of insulation.

2.4 CEMENT

- .1 Thermal insulating and finishing cement:
 - .1 Hydraulic setting on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².

2.7 OUTDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m².

2.8 JACKETS

- .1 Canvas:
 - .1 220 gm/m²cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
 - .2 Lagging adhesive: compatible with insulation.

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 PRE-INSTALLATION REQUIREMENT

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
 - .1 Hot equipment: To TIAC code 1503-H.
 - .2 Cold equipment: to TIAC code 1503-C or 1503-CA.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 PIPE INSULATION SCHEDULE

- .1 Water or Glycol Heating Pipes:
 - .1 Insulation: TIAC code A-1 with mechanical fastenings or wire or bands and 13 mm cement reinforced with one layer of reinforcing mesh.
 - .2 Thickness: 50mm

.3 Jacket: Canvas

3.5 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

Ω END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Procedures and cleaning solutions for cleaning mechanical piping systems.

1.2 REFERENCE STANDARDS

- .1 ASTM International (ASTM)
 - .1 ASTM E202-00, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (SDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Instructions: submit manufacturer's installation instructions.
 - .1 Contractor will make available 1 copy of systems supplier's installation instructions.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.

Part 2 Products

2.1 CLEANING SOLUTIONS

- .1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.
- .2 Sodium carbonate: 0.40 kg per 100 L water in system.
- .3 Low-foaming detergent: 0.01 kg per 100 L water in system.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 CLEANING HYDRONIC AND STEAM SYSTEMS

- .1 Timing: systems operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.
- .2 Cleaning procedures:
 - .1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:
 - .1 Cleaning procedures, flow rates, elapsed time.
 - .2 Chemicals and concentrations used.
 - .3 Inhibitors and concentrations.
 - .4 Specific requirements for completion of work.
 - .5 Special precautions for protecting piping system materials and components.
 - .6 Complete analysis of water used to ensure water will not damage systems or equipment.
- .3 Conditions at time of cleaning of systems:
 - .1 Systems: free from construction debris, dirt and other foreign material.
 - .2 Control valves: operational, fully open to ensure that terminal units can be cleaned properly.
 - .3 Strainers: clean prior to initial fill.
 - .4 Install temporary filters on pumps not equipped with permanent filters.
 - .5 Install pressure gauges on strainers to detect plugging.
- .4 Report on Completion of Cleaning:
 - .1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.
- .5 Hydronic Systems:
 - .1 Fill system with water, ensure air is vented from system.
 - .2 Fill expansion tanks 1/3 to 1/2 full, charge system with compressed air to at least 35 kPa (does not apply to diaphragm type expansion tanks).
 - .3 Use water metre to record volume of water in system to +/- 0.5%.
 - .4 Add chemicals under direct supervision of chemical treatment supplier.
 - .5 Closed loop systems: circulate system cleaner at 60 degrees C for at least 36 h. Drain as quickly as possible. Refill with water and inhibitors. Test concentrations and adjust to recommended levels.
 - .6 Flush velocity in system mains and branches to ensure removal of debris. System pumps may be used for circulating cleaning solution provided that velocities are adequate.

- .7 Add chemical solution to system.
- .8 Establish circulation, raise temperature slowly to 82 degrees C minimum. Circulate for 12 h, ensuring flow in all circuits. Remove heat, continue to circulate until temperature is below 38 degrees C. Drain as quickly as possible. Refill with clean water. Circulate for 6 hours at design temperature. Drain and repeat procedures specified above. Flush through low point drains in system. Refill with clean water adding to sodium sulphite (test for residual sulphite).
- .6 Glycol Systems:
 - .1 In addition to procedures specified above perform specified procedures.
 - .2 Test to prove concentration will prevent freezing to minus 40 degrees C. Test inhibitor strength and include in procedural report. Refer to ASTM E202.

3.3 START-UP OF HYDRONIC SYSTEMS

- .1 After cleaning is completed and system is filled:
 - .1 Establish circulation and expansion tank level, set pressure controls.
 - .2 Ensure air is removed.
 - .3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
 - .4 Clean out strainers repeatedly until system is clean.
 - .5 Commission water treatment systems as specified in Section 23 25 00 - HVAC Water Treatment.
 - .6 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.
 - .7 Repeat with water at design temperature.
 - .8 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.
 - .9 Bring system up to design temperature and pressure slowly.
 - .10 Adjust pipe supports, hangers, springs as necessary.
 - .11 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.
 - .12 Re-tighten bolts using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.
 - .13 Check operation of drain valves.
 - .14 Adjust valve stem packings as systems settle down.
 - .15 Fully open balancing valves (except those that are factory-set).
 - .16 Check operation of over-temperature protection devices on circulating pumps.
 - .17 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

Ω END OF SECTION

Part 1 General

1.1 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect electric and electronic control systems from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 WIRING

- .1 To requirements of Canadian Electrical Code and Division 26.

2.2 TERMINAL BOXES

- .1 To requirements of Canadian Electrical Code and Division 26.

2.3 CONDUIT

- .1 To requirements of Canadian Electrical Code and Division 26.

2.4 TRANSFORMERS

- .1 Provide CSA approved transformers of required kVa and voltage.

2.5 RELAYS AND CONTACTS

- .1 CSA approved, contacts and throws as required.
- .2 Break/make on time delay as required.
- .3 Acceptable Material: Square D, Allen Bradley.

2.6 CURRENT SENSOR

- .1 Provide sealed current sensor/relay 0-24Vac SPST, open on failure.
- .2 Sensor to measure current of three phases where applicable.

2.7 THERMOSTAT (LINE VOLTAGE-HEATING AND COOLING)

- .1 Line voltage, wall-mounted thermostat, for heating with:
 - .1 Full load rating: 16 A at 120 V.
 - .2 Temperature setting range: 0 degrees C to 30 degrees C.
 - .3 Thermometer range: 5 degrees C to 30 degrees C.
 - .4 Markings in 5 degree increments.

- .5 Differential temperature fixed at 1.1 degrees C.
- .6 Explosion Proof, rated for use in hazardous CSA Zone 1, Group IIC.

2.8 CONTROL VALVES - UNIT HEATERS

- .1 Two position, 24V, 60Hz, 7.7VA power consumption during valve position change, aluminized case and cover, bronze body, sweat or union fitting.
- .2 Size: to flow requirements
- .3 Acceptable Material: Honeywell V8043D.

2.9 VALVE AND DAMPER ACTUATORS - GENERAL USE

- .1 All automatically controlled devices, unless specified otherwise elsewhere, shall be provided with electronic actuators sized to operate their appropriate loads with sufficient reserve power to provide smooth modulating action or two-position action and tight close-off.
- .2 Where two or more actuators are to be operated in sequence with each other, sequencing shall be by digital sequencing with separate analog outputs, as specified in the sequence of operation.
- .3 Provide spring return for "fail-safe" in NC/NO positions as required.
- .4 Dampers: Direct coupled to drive shafts only. Connection by drive linkages to dampers is not acceptable.

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 electric and electronic control systems installation in accordance with manufacturer's written instructions.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative .

3.2 INSTALLATION

- .1 Install all systems and hardware in accordance with the requirements of this specification, good controls practice and the requirements of Canadian Electrical Code.
- .2 Install all equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.
- .3 Follow building lines.
- .4 Run all systems exposed and do not pass thru or touch un-heated ducts or enclosures.
- .5 Locate thermostat sensors 1500 mm above floor as indicated. When conflict occurs follow Engineer's instructions.
- .6 All wiring to be in conduit. Wiring, conduit connections and fittings to be as per the requirements of Canadian Electrical Code.
- .7 Wiring of line voltage mechanical equipment as Canadian Electrical Code.

- .8 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.
- .9 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

3.3 ELECTRIC - GENERAL

- .1 Complete installation in accordance with requirements of:
 - .1 Division 26, this specification.
 - .2 Electrical safety Code of Province/Territory having jurisdiction.
 - .3 ANSI/NFPA 70-1996SB
 - .4 ANSI C2-1997.
- .2 Fully enclose or properly guard electrical wiring, terminal blocks, all high voltage above 70 V contacts and mark to prevent accidental injury.
- .3 Conform to all manufacturer's recommendations for storage, handling and installation.
- .4 Check all factory connections and joints. Tighten where necessary to ensure continuity.
- .5 Install electrical equipment between 1000 and 2000 mm above finished floor wherever possible and adjacent to related equipment.
- .6 Shield and mark all live parts "LIVE 120 VOLTS" or other appropriate voltage.
- .7 Holes through exterior wall and roofs: flash and make weatherproof.
- .8 All PLC to be connected to dedicated surge and transient protected power supply. Reference Division 26.

3.4 START-UP

- .1 Provide representative to assist in Building Start Up as specified in Section 23 05 00.
- .2 Representative is to be on site when Start Up testing is performed. Adjust equipment to suit balancing of systems.

3.5 TESTING - GENERAL

- .1 Testing to include.
 - .1 Testing and verification of all systems.
- .2 Perform work under direction of, and in presence of, Owner or their representative where indicated.
- .3 Provide all test equipment, two-way radios.
- .4 Inform, and obtain approval from Owner in writing at least 14 days prior to tests. Indicate:
 - .1 Testing procedures, anticipated results.
 - .2 Names of testing personnel.
- .5 Co-ordinate with all other trades.
- .6 Correct deficiencies, re-test in presence of Owner until satisfactory performance is obtained.
- .7 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

3.6 ACCEPTANCE TESTS

- .1 Upon completion of installation perform operational test of entire system under direction of Owner or their representative.
- .2 Provide:
 - .1 At least one technical personnel capable of adjusting field hardware and devices.
- .3 Purpose: to demonstrate that control system functions in accordance with all contract requirements.
- .4 Test to last at least 2 consecutive 24 hour days.
- .5 Tests to include:
 - .1 Demonstration of correct operation of all controlled devices.
 - .2 Demonstration of operation of all sequences and alarms as per design control logic.
 - .3 Testing and calibration all devices.
 - .4 Testing and calibration of each controller using calibrated instruments.
- .6 System is accepted if:
 - .1 Control system and devices operate as per intent of specifications and drawings to the satisfaction of the Owner.
- .7 Correct all defects when they occur and before resuming test.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American Society of Mechanical Engineers (ASME)
- .2 ASTM International (ASTM)
 - .1 ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
 - .2 ASTM B61-08, Standard Specification for Steam or Valve Bronze Castings.
 - .3 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .4 ASTM E202-10, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.
- .3 Manufacturer's Standardization of the Valve and Fittings Industry (MSS)
 - .1 MSS-SP-80-08, Bronze Gate, Globe, Angle and Check Valves.

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 hydronic systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate on drawings:
 - .1 Components and accessories.

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 hydronic systems for incorporation into manual.
 - .1 Include special servicing requirements.

Part 2 Products

2.1 PIPE

- .1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
 - .1 To NPS 6: Schedule 40.

2.2 PIPE JOINTS

- .1 NPS 2 and under: screwed fittings with PTFE tape.

2.3 FITTINGS

- .1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.

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 hydronic systems installation in accordance with manufacturer's written instructions.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PIPING INSTALLATION

- .1 Install pipework in accordance with Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

3.3 CLEANING, FLUSHING AND START-UP

- .1 In accordance with Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems.

3.4 TESTING

- .1 Test system in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2 For glycol systems, retest with glycol/water mixture as specified to ASTM E202, inhibited for use in building system after cleaning. Repair leaking joints, fittings or valves.

3.5 BALANCING

- .1 Balance water systems to within plus or minus 5 % of design output.

3.6 GLYCOL CHARGING

- .1 Retest for concentration to ASTM E202 after cleaning.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

3.8 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by hydronic systems installation.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 ASME
 - .1 ASME Boiler and Pressure Vessel Code (BPVC), Section VII-2013.
- .2 ASTM International (ASTM)
 - .1 ASTM A47/A47M-99 (2009), Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .3 CSA Group (CSA)
 - .1 CSA B51-09, Boiler, Pressure Vessel, and Pressure Piping Code.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for expansion tanks, air vents, separators, valves, and strainers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

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 hydronic specialties for incorporation into manual.
- .3 Submit electronic copies of operation and maintenance 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 hydronic specialties from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 AUTOMATIC / MANUAL AIR VENTS

- .1 Type: dual automatic and manual operated air vent.
- .2 Construction: Brass body and cover, silicone rubber vent seal, temperature resistant polyethylene float, suitable for use with glycol systems.
- .3 Min Working Pressure: 10 kPa
- .4 Max Working Pressure: 1034 kPa.
- .5 Temperature Range: 5°C to 116°C
- .6 Acceptable Material: Watts DuoVent.

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 hydronic specialties installation in accordance with manufacturer's written instructions.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.3 GENERAL

- .1 Run drain lines and blow off connections to terminate above nearest drain.
- .2 Maintain adequate clearance to permit service and maintenance.
- .3 Should deviations beyond allowable clearances arise, request and follow Departmental Representative's directive.
- .4 Check shop drawings for conformance of tappings for ancillaries and for equipment operating weights.

3.4 AIR VENTS

- .1 Install at high points of systems.
- .2 Install gate valve on automatic air vent inlet.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

Life Safety System Replacement
DFO CCG Station
Hay River, NT
Job No: EW038-210713

Issued for Tender

August 6, 2021

SECTION 23 21 16
Hydronic piping specialties

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Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 ASME
 - .1 ASME Boiler and Pressure Vessel Code (BPVC), Section VII-2013.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (SDS).

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 HVAC water treatment systems and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements. Indicate VOC's for adhesive and solvents during application and curing.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for HVAC water treatment systems for incorporation into manual.
- .3 Include following:
 - .1 Log sheets as recommended by manufacturer.

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 HVAC water treatment systems from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MANUFACTURER

- .1 Equipment, chemicals, and service provided by one supplier.

2.2 PROPYLENE GLYCOL

- .1 Factory premixed with demineralized distilled, deionized or reverse osmosis filtered water. Acceptable water quality to have trace quantities of chloride and sulfate within manufacturers specifications and total hardness of <100ppm CaCO₃.
- .2 Inhibited, low toxicity, high temperature propylene glycol with advanced inhibitor package for copper components, suitable for film temperatures to 160°C and freeze protection to - 51°C
- .3 Virgin glycol only.
- .4 Acceptable material: premixed Dow Chemicals DowFrost HD.

2.3 HYDRONIC PIPING AND EQUIPMENT DEGREASANT & DETERGENT

- .1 Refer to Section 23 08 16 - Cleaning and Start-up of HVAC Piping Systems.
- .2 Neutral cleaner, compatible with all metals, non-hazardous solution which is capable of removing oil, grease, and rust from metal surfaces of system and passivating cleaned metal surfaces of system. Cleaning solution shall include:
 - .1 Low foaming non-ionic surfactant for penetrating oily and greasy deposit surfaces.
 - .2 Solvent for dissolving oil and grease.
 - .3 Dispersant for dissolving rust.
 - .4 Reducing agent for corrosion control.
 - .5 Ferrous and non-ferrous metal corrosion inhibitors.
- .3 Acceptable material: Ferroquest FQ7103.

2.4 FLUSH & CLEANING WATER

- .1 All water for system flush and clean to be clean local water. Adjust water to ensure pH to neutral.

2.5 TEST KITS

- .1 Provide standard water treatment test kit for as follows:
 - .1 Battery operated PH tester, range 0-14pH, resolution 0.2pH, accuracy 0.1pH:
 - .1 Acceptable Material: pH PockeTester model 2.
 - .2 Total Alkalinity test kit with 100 BCG MR tablets, 100 Phenolphthalein tablets, 50ml alkalinity titration reagent B, 1 titration tube and 1 plain pipe.
 - .1 Acceptable material: Mereck.
 - .3 Phosphate test kit with all required reagents and pipette.
 - .1 Acceptable material: LaMotte model VM-12
 - .4 Glycol level tester, battery operated, vinyl housing, lighted with eyepiece.
 - .1 Acceptable Material: SAI MISCO-78C.

- .5 Hardness test kit with direct reading titrator, indicator tablets and all required reagents.
 - .1 Acceptable material: LaMotte hardness test kit with Model PHT-DR titrator.
- .6 Conductivity Meter, multi range with cell cups, self contained, temperature compensating, battery powered, 2% accuracy, 1% repeatability.
 - .1 Acceptable material: Myron.
- .2 Provide carrying case, reagents for chemicals, and additional specialized or supplementary equipment.

2.6 CHEMICALS

- .1 Provide 1 years supply.
- .2 Obtain chemicals from manufacturer with existing valid contract with DND.

2.7 TEST EQUIPMENT

- .1 Provide one set of test equipment for each system to verify performance.
- .2 Complete with carrying case, reagents for chemicals, specialized or supplementary equipment.

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 HVAC water treatment systems installation in accordance with manufacturer's written instructions.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.3 INSTALLATION

- .1 Install HVAC water treatment systems in accordance with ASME Boiler and Pressure Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.
- .2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

3.4 CLEANING OF MECHANICAL SYSTEM

- .1 Provide copy of recommended cleaning procedures and chemicals for approval by Departmental Representative.

- .2 Flush mechanical systems and equipment with approved cleaning chemicals designed to remove deposition from construction such as pipe dope, oils, loose mill scale and other extraneous materials. Use chemicals to inhibit corrosion of various system materials that are safe to handle and use.
- .3 Examine and clean filters and screens, periodically during circulation of cleaning solution, and monitor changes in pressure drop across equipment.
- .4 Drain and flush systems until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.
- .5 Disposal of cleaning solutions approved by authority having jurisdiction.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- .2 ASTM International (ASTM)
 - .1 ASTM A480/A480M-12, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A635/A635M-09b, 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-11, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Green Seal Environmental Standards (GS)
 - .1 GS-36-11, Standard for Adhesives for Commercial Use.
- .4 National Fire Protection Association (NFPA)
 - .1 NFPA 90B-12, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- .5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, 2012.
 - .3 IAQ Guideline for Occupied Buildings Under Construction 2007.
- .6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

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 metal ducts and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Test and Evaluation Reports:
 - .1 Certification of Ratings:
 - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

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 metal ducts from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SEAL CLASSIFICATION

- .1 Classification as follows:
- .2 Seal classification:
 - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
 - .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.
 - .3 Class C: transverse joints and connections made air tight with sealant. Longitudinal seams unsealed.
 - .4 Unsealed seams and joints.

2.2 SEALANT

- .1 Sustainability Characteristics:
 - .1 Adhesives and sealants: VOC limit 250 g/L maximum to SCAQMD Rule 1168.
- .2 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 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

- .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.5 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
 - .1 Rectangular: standard radius.
 - .2 Round: smooth radius, centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 407 mm: with single thickness turning vanes.

- .2 Over 407 mm: with double thickness turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch: with 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 as indicated.
- .7 Obstruction deflectors: maintain full cross-sectional area.
 - .1 Maximum included angles: as for transitions.

2.6 FIRE STOPPING

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Coordinate with 07 84 00 - Fire Stopping to ensure fire stopping materials and installation does not distort duct.

2.7 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to ASHRAE.
- .3 Joints: to ASHRAE. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

2.8 HANGERS AND SUPPORTS

- .1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
 - .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
 - .1 Maximum size duct supported by strap hanger: 500.
 - .2 Hanger configuration: to ASHRAE.
 - .3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE :
 - .4 Upper hanger attachments:
 - .1 For concrete: manufactured concrete inserts.
 - .2 For steel joist: manufactured joist clamp.
 - .3 For steel beams: manufactured beam clamps:

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 metal duct installation in accordance with manufacturer's written instructions.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 GENERAL

- .1 Do work in accordance with ASHRAE, SMACNA and NFPA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
 - .1 Ensure diffuser is fully seated, Insulate strap hangers 100 mm beyond insulated duct.
- .3 Support risers in accordance with ASHRAE and SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.3 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNA

3.4 SEALING AND TAPING

- .1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.5 LEAKAGE TESTS

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .2 Do leakage tests in sections.
- .3 Make trial leakage tests as instructed to demonstrate workmanship.
- .4 Do not install additional ductwork until trial test has been passed.
- .5 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.
- .6 Complete test before performance insulation or concealment Work.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 2005.

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 air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate:
 - .1 Flexible connections.
 - .2 Duct access doors.
 - .3 Turning vanes.
 - .4 Instrument test ports.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect air duct accessories from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

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 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.
- .2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3 Gaskets: neoprene.
- .4 Hardware:
 - .1 Up to 300 x 300 mm: two sash locks complete with safety chain.
 - .2 301 to 450 mm: four sash locks complete with safety chain.
 - .3 451 to 1000 mm: piano hinge and minimum two sash locks.
 - .4 Doors over 1000 mm: piano hinge and two handles operable from both sides.
 - .5 Hold open devices.

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 air duct accessories installation in accordance with manufacturer's written instructions.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .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 Size:
 - .1 900 x 900 mm for person size entry.
 - .2 600 x 600 mm for servicing entry.

- .3 300 x 300 mm for viewing.
- .4 As indicated.
- .2 Locations:
 - .1 Control dampers.
 - .2 Devices requiring maintenance.
 - .3 Required by code.
 - .4 Elsewhere as indicated.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 ASTM International (ASTM)
 - .1 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

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 dampers 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 dampers 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 dampers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MULTI-LEAF DAMPERS

- .1 Opposed or parallel blade type as indicated.
- .2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.
- .3 Pressure fit self-lubricated bronze bearings.
- .4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.
- .5 Operator: to Section 23 09 33 - Electric and Electronic Control System for HVAC.
- .6 Performance:
 - .1 Leakage: in closed position less than 2% of rated air flow at 1000 Pa differential across damper.

- .2 Pressure drop: at full open position less than 0.004 Pa differential across damper at 5.08 m/s.
- .7 Insulated aluminum dampers:
 - .1 Frames: insulated with extruded polystyrene foam with RSI 0.88.
 - .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.

2.2 BACK DRAFT DAMPERS

- .1 Automatic gravity operated, multi leaf, aluminum construction with nylon bearings, centre pivoted, spring-assisted and counterweighted as required..

2.3 RELIEF DAMPERS

- .1 Automatic multi-leaf aluminum dampers with ball bearing centre pivoted and counterweights.

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 damper installation in accordance with manufacturer's written instructions.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant.
- .4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
- .5 Ensure dampers are observable and accessible.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)
 - .1 ANSI/AMCA Standard 99-2010, Standards Handbook.
 - .2 ANSI/ASHRAE 51-07 (ANSI/AMCA 210-07), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - .3 ANSI/AMCA Standard 300-2008, Reverberant Room Method for Sound Testing of Fans.
 - .4 ANSI/AMCA Standard 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .2 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
 - .1 MPI #18, Primer, Zinc Rich, Organic.

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 HVAC fans and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Provide:
 - .1 Fan performance curves showing point of operation, kW and efficiency.
 - .2 Sound rating data at point of operation.
 - .2 Indicate:
 - .1 Motors, sheaves, bearings, shaft details .
 - .2 Minimum performance achievable with variable speed controllers.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Provide:
 - .1 Matched sets of belts.
 - .2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:
 - .1 Bearings and seals.
 - .2 Addresses of suppliers.
 - .3 List of specialized tools necessary for adjusting, repairing or replacing.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect HVAC fans from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

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 in force.
 - .2 Capacity: flow rate, static pressure, W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
 - .3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99.
 - .4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300. Supply unit with ANSI/AMCA certified sound rating seal.
 - .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210. Supply unit with ANSI/AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

2.2 FANS GENERAL

- .1 Motors:
 - .1 Sizes as indicated.
- .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 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

2.3 CENTRIFUGAL FANS

- .1 Fan wheels:
 - .1 Welded aluminum construction.
 - .2 backward inclined blades, as indicated.
- .2 Bearings: split pillow-block grease lubricated ball or roller self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 100,000 hours.
- .3 Housings:

- .1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, aluminum, for smaller wheels, braced, and with welded supports.
- .2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.
- .3 Provide bolted airtight access doors with handles.

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 HVAC fans installation in accordance with manufacturer's written instructions.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 FAN INSTALLATION

- .1 Install fans as indicated, complete with resilient mountings, and Equipment, flexible electrical leads and flexible connections.
- .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 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

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 diffusers, registers and grilles and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate following:
 - .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Include:
 - .1 Keys for volume control adjustment.
 - .2 Keys for air flow pattern adjustment.

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 diffuser, registers and grilles from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

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 as indicated.
- .2 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board.
 - .3 Concealed fasteners.
- .3 Concealed manual volume control damper operators.
- .4 Colour: as indicated.

2.3 MANUFACTURED UNITS

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.4 RETURN AND EXHAUST GRILLES AND REGISTERS

- .1 General: with opposed blade dampers.
- .2 Type RC: aluminum, 19 mm border, 25 x 25 mm egg crate type face bars. Finish: standard. Model: Price 80 series.

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 diffuser, register and grille installation in accordance with manufacturer's written instructions.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install in accordance with manufacturers instructions.
- .2 Install with stainless steel screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 ASTM International (ASTM)
 - .1 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .2 National Fire Protection Association (NFPA)
- .3 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2015 (NBC).
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .5 Society of Automotive Engineers (SAE)

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 louvers, intakes and vents and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate following:
 - .1 Pressure drop.
 - .2 Face area.
 - .3 Free area.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Test Reports: submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

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 louvers, intakes and vents from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

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 WALL HOODS

- .1 Thickness: to ASHRAE and as indicated on drawings whichever is more stringent.
- .2 Fabrication: to ASHRAE and as indicated on drawings whichever is more stringent.
- .3 Joints: to ASHRAE. Proprietary manufactured flanged duct joint shall be considered to be a class A seal and as indicated on drawings, whichever is more stringent.
- .4 Supports: as indicated.
- .5 Complete with integral bird screen of 2.7 mm diameter ss wire. Use 12 mm mesh on exhaust.
- .6 Vertical backdraft dampers where indicated on drawings.
- .7 Screen: as per this section and as indicated on drawings.
- .8 Finish:
 - .1 Wall hoods: shop primed.

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 louvres, intakes and vents installation in accordance with manufacturer's written instructions.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .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.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 ASTM International (ASTM)
 - .1 ASTM E84-11a, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .2 ASTM C916-1985 (R2007), Standard Specification for Adhesives for Duct Thermal Insulation.
 - .3 ASTM C1071-05e1, Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 90B-2012, Standard for the Installation of Warm Air Heating and Air Conditioning Systems (ANSI).
- .3 Underwriters' Laboratories (UL) Inc.

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 unit heaters and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate on drawings:
 - .1 Equipment, capacity and piping connections.
 - .2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.

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 unit heaters 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.
- .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 unit heaters from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 HORIZONTAL UNIT HEATERS

- .1 Horizontal Unit Heaters: to UL 2021.
- .2 Casing: 1.6 mm thick cold rolled steel, gloss enamel finish, with threaded connections for hanger rods.
- .3 Coils: hydrostatically test to 1 MPa.
 - .1 Hot water coil: copper tube, mechanically bonded aluminum fins spaced 25 mm maximum rated 1378 kPa minimum working pressure and 104 degrees C maximum entering-water temperature. Include manual air vent and drain.
- .4 Fan: direct drive propeller type, factory balanced, with anti-corrosive finish and fan guard.
- .5 Motor: speed as indicated continuous duty, built-in overload protection, and resilient motor explosion proof supports.
- .6 Air outlet: two-way adjustable louvres.
- .7 Capacity: as per drawing schedules
- .8 Explosion Proof, rated for use in hazardous CSA Zone 1, Group IIC.

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 unit heaters installation in accordance with manufacturer's written instructions.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Include double swing pipe joints as indicated.
- .3 Check final location with Departmental Representative if different from that indicated prior to installation.
 - .1 Should deviations beyond allowable clearances arise, request and follow Departmental Representative's directive.
- .4 Hot water units: for each unit, install ball valve on inlet and lockshield globe balancing valve on outlet of each unit. Install drain valve at low point.
 - .1 Install manual air vent at high point.
- .5 Clean finned tubes and comb straight.
- .6 Provide supplementary suspension steel as required.
- .7 Install thermostats in locations indicated.
- .8 Before acceptance, set discharge patterns and fan speeds to suit requirements.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by unit heaters installation.

Ω END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This Section covers items common to Sections of Divisions 26 and 28. This section supplements requirements of Division 1.
- .2 For the proper execution of work, cooperate with other trades and contracts as needed.
- .3 To avoid installation conflicts, thoroughly examine the complete set of contract documents. Resolve conflicts with Departmental Representative prior to installation.
- .4 Prior to installation of electrical connections to equipment, examine the manufacturer's shop drawings, wiring diagrams, product data and installation instructions. Verify that the electrical characteristics detailed in the contract documents are consistent with the electrical characteristics of the actual equipment being installed. When inconsistencies occur request clarification from Departmental Representative.
- .5 Examine the entire set of contract documents to avoid conflicts with other systems. Determine exact route and installation of electrical wiring and equipment with conditions of construction.
- .6 Should the electrical documents indicate a condition conflicting with the governing codes or regulations, refrain from installing that portion of the work until clarified by Departmental Representative.
- .7 Definitions:
 - .1 Provide - To furnish and install complete and ready for intended use.
 - .2 Furnish - Supply and deliver to project site, ready for unpacking, assembly and installation.
 - .3 Install - Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operation at the project site to complete items of work furnished.
- .8 All correspondence and documents shall be submitted in English. Copies in other languages shall be provided where indicated.
- .9 The entire bid package is considered related to all disciplines and shall be examined prior to bid and followed throughout construction and thereafter. Related sections listed hereinafter in this specification shall not be considered as relieving any Division from the above-indicated responsibility.
- .10 Equivalent or equal products: Where either of these terms are used to reference acceptable material, proof of equality in the form of manufacturer representative's supplied itemized table or letter, to illustrate or certify that the product meets or exceeds each and every specification item is required for review prior to approval. Manufacturer's raw catalog pages and the like are not acceptable substitute for the above-indicated table or letter and will be returned as insufficient for review.
- .11 Sufficiency of drawings and specifications:
 - .1 Hold the Drawings and Specifications to determine the general character and general arrangement of the Work.
 - .2 Drawings and Specifications indicate the general scope of the Project in terms of the dimensions of the Work, the type of structural, mechanical, electrical utility systems and the architectural elements of construction. The Drawings and Specifications do not necessarily indicate or describe all Work required for the full

- performance and completion of the requirements of the Contract Documents. On the basis of the general scope indicated, stated, described or implied, furnish all items required for the proper execution and completion of the Work.
- .3 The Contract Documents are issued to facilitate construction by expressing the design intent. The Drawings and Specifications do not necessarily contain all of the details required to construct the project, and contractor supplied detail in the form of detailed construction documents (referred to in the Contract Documents as the Contractors supplied shop drawings, submittals, and field coordination drawings) is required for construction of the Work; all of which set out the specific and final details required for placing and constructing the finished Work. By contrast, the Drawings and Specifications are provided to reflect the finished design of the Work. The Drawings and Specifications are not intended to be used as a set of detailed instructions on how to construct the Work. Construction means, methods, techniques, sequences, procedures, and site safety precautions are the responsibility of the Contractor.
- .4 Shop Drawings, Product Data, Samples and similar submittals provided by the Contractor are not Contract Documents. The purpose of these submittals is to demonstrate the way by which the Contractor proposes to conform to the design intent expressed in the Contract Documents.
- .5 Examine the Drawings and Specifications to satisfy yourself regarding the design intent and the extent of the proposed Work, and by personal examination of the site and surroundings make your own estimate of the facilities condition and difficulties attending the performance and completion of the Work.
- .12 Make known in writing to the Departmental Representative ten (10) days prior to the tender closing date any materials specified or is required to complete the work, which are not currently available or will not be available for use as called for herein or on drawings. Failing to do so, it will be assumed that the most expensive compliant alternate has been included in the tender price.
- .13 For the sake of clarity, electrical symbols are typically shown larger than they would be at the actual scale of the drawing. Therefore, do not scale electrical drawings. Where exact dimensions are required, refer to dimensioned architectural plans or civil drawings. Failing to do so, bear all resulted costs and make good of the work.
- .14 The general contractor who has a contractual relationship with the Departmental Representative shall be responsible for providing complete and workable systems as outlined on drawings and in specifications. The Departmental Representative will not recognize any sub-contractor as such, but will consider all persons engaged on the work to be under the control of General Contractor. The Departmental Representative will not under any circumstances, enter into discussions concerning the responsibility of sub-trades or the apportionment of work. No claim based on the division of work between specification sections or subtrades will be considered.

1.2 REFERENCE STANDARDS

- .1 CSA Group
- .1 CSA C22.1-18, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.
- .2 CAN/CSA-C22.3 No.7, Underground Systems.
- .3 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

- .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.
- .3 Unless otherwise indicated, all references to standards and codes throughout this specification is to the latest applicable edition at the time of bid closing.
- .4 Do complete installation in accordance with CSA C22.1, Canadian Electrical Code, Part 1. In case of a conflict between the code requirements and the contract documents, request clarification prior to proceeding with the work.
- .5 Do underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.
- .6 Coordinate with other disciplines and provide plenum rated equipment and devices and plenum rated raceway, wiring and installation methods in all plenum spaces.
- .7 Material and installations shall comply with the requirements of the following codes and standards, codes and standards mentioned in other sections of this specification, as well as other applicable codes and standards to the satisfaction of the Authorities Having Jurisdiction (AHJ):
 - .1 Canadian Electrical Code (CEC).
 - .2 National Building Code of Canada (NBCC)
 - .3 National Fire Code of Canada (NFCC).
 - .4 CAN/ULC-S524, Installation of Fire Alarm Systems.
 - .5 CAN/ULC-S537, Verification of Fire Alarm Systems.
- .8 Provide the site office with a current copy of the following documents, codes and standards. These documents shall remain on site throughout the duration of construction for electricians and others reference and use. The maintenance of these codes on site may be checked at each site visit. Absence of one or more such documents will be indicated on the field review report as deficiency and non-compliance with contract requirements.
 - .1 Project's electrical specifications, drawings and any addenda.
 - .2 Project's up to date electrical RFIs and responses, SIs and CCNs.
 - .3 Canadian Electrical Code (CEC).
 - .4 National Building Code of Canada (NBCC)
 - .5 CAN/ULC-S524, Installation of Fire Alarm Systems.
 - .6 CAN/ULC-S537, Verification of Fire Alarm Systems.

1.3 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 Abbreviations for electrical terms: to CSA Z85 - Abbreviations for Scientific and Engineering Terms.

1.4 QUALITY ASSURANCE

- .1 Conform to the requirements of CEC with amendments by local Authorities Having Jurisdiction (AHJ).
- .2 Conform to the requirements of the NBCC with amendments by local AHJ.
- .3 Obtain and pay for the electrical permits, plan review and inspection from local AHJ.

- .4 Conform to the requirements of the serving electric and telephone utilities.

1.5 PERMITS, FEES AND INSPECTION

- .1 Submit to Electrical Inspection Department necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees.
- .3 Provide drawings and specifications required by Electrical Inspection Department at no cost.
- .4 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making such changes.
- .5 Furnish Certificates of Acceptance from Authorities Having Jurisdiction on completion of work to Departmental Representative.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to the Departmental Representative for review, shop drawings, product data and samples called for by the contract documents and for such other items as the Departmental Representative may request. Do not proceed with work until related submission has been reviewed by the Departmental Representative.
- .3 Shop drawings and product data shall be submitted only in International System of Units (SI). Submittals in Imperial will be returned to the contractor not reviewed until they are submitted in Metric Units (SI).
- .4 Product Data:
 - .1 Product data means standard printed information describing materials, products, equipment and systems, not specially prepared for work of this contract, other than the designation of selections.
 - .2 Product data consisting of manufacturers' standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and descriptive data will be accepted in lieu of shop drawings provided that:
 - .1 Information not applicable to the work of this contract is deleted, or the applicable information is clearly marked.
 - .2 Standard information is supplemented with information specifically applicable to work of this contract.
 - .3 Submit manufacturer's instructions, printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .5 Submit for review fire alarm riser diagram, plan and zoning of building in glazed frames at fire alarm control panel and annunciator.
- .6 Shop drawings:
 - .1 Shop drawings means technical data specially prepared for work of this contract including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information not in standard printed form.
 - .2 Submit shop drawings presented in a clear and thorough manner to appropriately illustrate the work.

- .3 Shop drawings shall represent existing conditions where new work is tied into existing systems and or surfaces. Shop drawings shall indicate all existing condition which affect the work. Identify field dimensions on drawings.
- .4 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.
- .5 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
- .6 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .7 Identify shop drawings by appropriate references to sheet, detail, schedule or room number. Maximum allowable drawing size 280mm x 425mm (11" x 17"). Provide a clear area of 100mm x 75mm (4" x 3") on each shop drawing for Departmental Representative's review stamp.
- .7 Certificates:
 - .1 Provide CSA certified material and equipment.
 - .2 Where CSA certified material and equipment is not available, submit such material and equipment to authority having jurisdiction for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract.
 - .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

1.7 CONTRACT BREAKDOWN

- .1 Provide separate material and labour breakdown for the total electrical sub-contract as indicated below. This breakdown is to meet the satisfaction of the Departmental Representative and is to be submitted within 14 days of contract award.
- .2 The breakdown will be used in computing of progress claims. Progress claims are to be itemized with separate labour and material listing against each item of the contract breakdown. Progress claims will not be reviewed if they are not presented as per the following breakdown:
 - .1 Mobilization
 - .2 Fire Alarm System
 - .3 Fire Alarm System Verification
 - .4 Emergency and Exit Lighting
 - .5 Lighting
 - .6 Mechanical Equipment Provisions
 - .7 Training, O&M Manuals, Reports and Record Documents and Closeout
 - .8 For out of town projects, include an averaged cost per day for meals and accommodations per person. Include per trip costs based on vehicle or airfare costs.

1.8 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

- .2 Operation and Maintenance Data: Provide the Departmental Representative with the greater of five (5) copies of operation and maintenance data, or as called for in the contract Documents, made up as follows:
 - .1 Punched and ready to bind in vinyl hard cover, variable capacity, expanding binder with full metal hinge and slide lock mechanism for 8.5" x 11" size paper.
 - .2 Enclose title sheet, labeled "Operating and Maintenance Data Manual", project name, date and list of contents.
 - .3 Organize contents into applicable sections of work to parallel project specifications section breakdown. Identify each section with tabs of laminated Mylar plastic.
 - .4 Ensure that the manuals comply with the requirements of all other sections of the contract documents.
 - .5 Include the following information on a trade scope specific basis plus data specified:
 - .1 Maintenance instructions for finished surfaces, materials and equipment.
 - .2 Name, addresses and phone numbers of subcontractors and suppliers.
 - .3 Guarantees, warranties and bonds indicating:
 - .1 Name and address of project.
 - .2 Warranty/Guarantee/Bond commencement date and duration.
 - .3 Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.
 - .4 Signature and seal of Trade Contractor.
 - .4 Include in Operation and Maintenance Data:
 - .1 Component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
 - .2 Wiring and schematic diagrams indicating all connections, terminals and wire numbers.
 - .3 All manufacturer's operating and maintenance information prepared for any installed equipment.
 - .4 Reviewed shop drawings & product data of all installed equipment.
 - .5 Results of all tests performed.
 - .6 Spare parts list.
 - .7 All studies, test reports, testing certificates and Inspection Department acceptances.
 - .8 One set of full size prints of record drawings.
 - .9 One copy of all panel directories.
 - .6 Neatly type lists and notes. Use clear drawings diagrams or manufacturers' literature.
 - .7 Submit operation and maintenance manuals before or with request for final field review.
- .3 Record Drawings:

- .1 Provide 1 set of marked up electrical site record drawings. Provide sets of white prints of the construction drawings and use for record drawings. Mark thereon all changes as work progresses and as changes occur. This shall include changes to all electrical systems as constructed, including any revisions from addenda or change orders. Ensure that items marked correspond to the drawing title.
- .2 Use different colour waterproof ink for each service on a per drawing basis.
- .3 Make mark-ups available for reference purposes and inspection at all times.
- .4 Present finalized record drawings to Departmental Representative at time of substantial completion site review.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect equipment and materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates for control items in English.

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 or 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 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems as shown on mechanical drawings.

2.4 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction.

2.5 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
- .1 Nameplates: lamicoid 3 mm melamine, 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 to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate.
- .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 Transformers: indicate capacity, primary and secondary voltages.

2.7 WIRING IDENTIFICATION

- .1 Maintain phase sequence and colour coding throughout.
- .2 Colour coding: to CSA C22.1.
- .3 Use colour coded wires in communication cables, matched throughout system.

2.8 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
- .2 Clean and touch up surfaces of devices and equipment scratched or marred during shipment or installation, to match original paint.

- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
- .4 All electrical fittings, supports hanger rods, pull boxes, channel frames, conduit racks, outlet boxes, brackets, clamps, etc. to have galvanized finish or enamel paint finish over corrosion-resistant primer.
- .5 All panelboards, distribution centres, transformers, motor control centres, etc. to be factory finished in gloss air dry enamel applied over corrosion-resistant primer. Matte or flat type finish paint not acceptable. Factory finished units that are scratched or marked during installation or shipping to be touched up with matching spray-on air dry lacquer or, if required to provide a satisfactory job, completely refinished.
- .6 Fire alarm pull boxes and junction boxes to be finished in red.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electrical installation in accordance with manufacturer's written instructions.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.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 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .2 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

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.
 - .1 Local switches: 1050 mm.
 - .2 Panelboards: as required by Code or as indicated.
 - .3 Fire alarm stations: 1050 mm.
 - .4 Fire alarm audio/visual devices: 2100mm, and no less than 300mm below finished ceiling
 - .5 Fire alarm bells: 2100 mm.
 - .6 Exit signs: 2150mm to bottom of device
 - .7 Emergency lighting battery pack: 2100mm to bottom of device
 - .8 Emergency lighting remote head: 2100mm to bottom of device

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.8 FIELD QUALITY CONTROL

- .1 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
 - .1 Circuits originating from branch distribution panels.
 - .2 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .3 Systems: fire alarm, emergency lighting, exit signs.
 - .4 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Check resistance to ground before energizing.
- .2 Carry out tests in presence of Departmental Representative.
- .3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

3.9 SYSTEM STARTUP

- .1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 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.

3.10 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

Ω END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section includes requirements for selective demolition and removal of electrical systems and components including removal of conduit, junction boxes, and panels to source (home run removal) and incidentals required to complete work described in this Section ready for new construction.

1.2 REFERENCE STANDARDS

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

1.3 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .3 Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
- .4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.
- .6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Action Submittals: Provide in accordance with Section 01 33 00– Submittal Procedures before starting work of this Section:
 - .1 Landfill Records: Indicate receipt and acceptance of selective demolition waste and hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: Perform work of this Section in accordance with:

- .1 Provincial/Territorial Workers' Compensation Boards/Commissions
- .2 Provincial/Territorial Occupational Health and Safety Standards and Programs

1.7 SITE CONDITIONS

- .1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition at time of site examination before tendering.
- .2 Discovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in Work; immediately notify Departmental Representative if materials suspected of containing hazardous substances are encountered and perform following activities:
 - .1 Refer to Section 01 41 00– Regulatory Requirements for directives associated with specific material types.
 - .2 Hazardous substances will be as defined in Hazardous Products Act.
 - .3 Stop work in area of suspected hazardous substances.
 - .4 Take preventative measures to limit users' and workers' exposure, provide barriers and other safety devices and do not disturb.
 - .5 Hazardous substances will be removed by Departmental Representative under a separate contract or as a change to Work.
 - .6 Proceed only after written instructions have been received from Departmental Representative.

1.8 SALVAGE AND DEBRIS MATERIALS

- .1 Demolished items become Contractor's property and will be removed from Project site; except for items indicated as being reused, salvaged, or otherwise indicated to remain Owner's property.

Part 2 Products

2.1 MATERIALS

- .1 Electrical Repair Materials: Use only new materials, CSA or ULC labelled as appropriate and matching components remaining after work associated with components identified for removal or demolition are completed.
- .2 Fire stopping Repair Materials: Use fire stopping materials compatible with existing fire stopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before tendering the Bid; Departmental Representative will not consider claims for extras for work or materials necessary for proper execution and completion of the contract that could have been determined by a site visit.

3.2 PREPARATION

- .1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:
 - .1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.
 - .2 Prevent debris from blocking drainage inlets.
 - .3 Protect mechanical systems that will remain in operation.
- .2 Protection of Building Occupants: Sequence demolition work so that interference with the use of the building by the Owner and users is minimized and as follows:
 - .1 Prevent debris from endangering safe access to and egress from occupied buildings.
 - .2 Notify Departmental Representative and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

3.3 EXECUTION

- .1 Removal: Coordinate requirements of this Section with information contained in Section 02 41 00.08 and as follows:
 - .1 Disconnect electrical circuits and panel feeders; maintain electrical service and main distribution panel as is, ready for subsequent Work.
 - .2 Remove existing luminaires, electrical devices and equipment including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.
 - .3 Disconnect and remove existing fire alarm system including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.
 - .4 Perform demolition work in a neat and workmanlike manner:
 - .1 Remove tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.
 - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.
 - .5 Remove existing conduits, boxes, cabling and wiring associated with removed luminaires, electrical devices and equipment.
 - .6 Grind off conduits and make flush with surface of concrete where conduits are cast into concrete; seal open ends of conduit with silicone sealant and leave in place.
 - .7 Seal open ends of conduit with silicone sealant and leave in place where they are inaccessible or cannot be removed without damaging adjacent construction.

3.4 CLOSEOUT ACTIVITIES

- .1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) except where explicitly noted otherwise for materials being salvaged for re use in new construction .
- .2 Hazardous Substances Disposal: Arrange for disposal of hazardous substances in accordance with requirements of Section 02 81 00.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CAN/CSA-C22.2 No.18- , Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CAN/CSA-C22.2 No.65, Wire Connectors.
- .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.
- .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 EEMAC 1Y-2 to consist of:

- .1 Connector body and stud clamp for stranded or round solid copper conductors as required.
- .2 Clamp for stranded or round copper conductors.
- .3 Stud clamp bolts.
- .4 Bolts for copper conductors.
- .5 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable, as required to: CAN/CSA-C22.2 No.18.
- .5 Explosion proof connectors as required for the hazardous area classification where indicated on the drawings.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Remove insulation carefully from ends of conductors cables and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
 - .2 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
 - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.
- .2 CAN/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 In accordance with Section 26 05 00 - Common Work Results for Electrical.

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 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Non Jacketted.

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:, 600 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: aluminum.
- .6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.
- .7 Fastenings:
 - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables at 1500 mm centers.
 - .3 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
 - .1 Watertight, explosion-proof approved for TECK cable.

2.3 ARMOURED CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.

- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Connectors: anti short connectors.

2.4 CONTROL CABLES

- .1 Type PLTC: Multiconductor controls cable
 - .1 Conductors: PVC insulated, PVC jacketed, copper , unshielded pair, overall shield, minimum size to be #16 AWG.
 - .2 Insulation: 105 degrees C Flame retardant PVC
 - .3 Aluminum foil/polyester shield with tinned copper drain wire.
 - .4 Jacket to be UL listed, sunlight and moisture resistant, sequentially marked, nylon ripcord for jacket removal. FT-4 Flame spread minimum, FT-6 for return air plenums.
 - .5 Conductors are to be black/white number coded, rated for [300V] [600V] at 105 degrees C.

2.5 FIRE ALARM CABLE

- .1 Conductors: multiconductor, insulated, copper, minimum size to be #18 AWG for device loops and #14 for signal circuits.
- .2 Insulation: 105 degrees C Flame retardant PVC.
- .3 Outer Jacket: 105 degrees C Flame retardant PVC Red. FT-4 Flame spread minimum, FT-6 for return air plenums.
- .4 Armour: Interlocking Aluminium without overall Jacket. For drops to devices in suspended ceilings from conduit system.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

- .1 All wiring to be installed in conduit except where otherwise identified in these contract documents.
- .2 Install cable in trenches in accordance with Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts.
- .3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .4 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .5 Conductor length for parallel feeders to be identical.
- .6 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .7 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.

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.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

- .1 Group cables wherever possible on channels.
- .2 Install cable exposed, securely supported by straps and hangers.

3.5 INSTALLATION OF ARMoured CABLES

- .1 Armoured cables are only permitted where it is demonstrated by the contractor that installation of conduit is impractical, and only with prior written approval from the Departmental Representative.
- .2 Group cables wherever possible on channels.

3.6 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit.
- .2 Ground control cable shield.

3.7 INSTALLATION OF FIRE ALARM WIRING

- .1 Install fire alarm wiring in conduit.
- .2 Provide grounding conductor throughout.
- .3 Use listed, armoured cable, only for drops to a device in suspended ceiling space from conduit system and for tamper and flow switches exposed wiring.

Ω 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 grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 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.

1.3 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 EQUIPMENT

- .1 Insulated grounding conductors: green, copper conductors, size as indicated.
- .2 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Bonding jumpers, straps.
 - .5 Pressure wire connectors.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION GENERAL

- .1 Install equipment grounding conductor, code sized minimum unless noted otherwise on drawings, in all non-metallic and metallic raceway system.

- .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 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.3 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, cable trays.

3.4 COMMUNICATION SYSTEMS

- .1 Install grounding connections for telephone, sound, fire alarm, security systems, intercommunication systems as follows:
 - .1 Fire alarm and detection 1 #6 AWG RW90-XLPE in 21 mm conduit to nearest ground bus.
 - .2 Fire alarm systems as indicated.

3.5 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.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

Ω 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.

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted and suspended.

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 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Secure equipment to hollow masonry, tile and plaster surfaces with nylon shields.
- .2 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .3 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .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 1.5 m on centre spacing.
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of 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 00 - 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 00 - Cleaning.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1.

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.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 In accordance with Section 01 61 00 - Common Product Requirements.

Part 2 Products

2.1 JUNCTION AND PULL BOXES

- .1 Code gauge metal construction and/or cast corrosion-resistant type, conforming to Canadian Electrical Code.
- .2 Construction:
 - .1 16 Gauge welded steel construction
 - .2 Through holes in back for wall mounting.
 - .3 Embossed grounding location with green grounding screw and raised wire catch.
- .3 Covers:
 - .1 Screw-on flat covers for surface mounting. Keyhole slots for removing cover while leaving screws captive.
 - .2 Where indicated; hinged cover with screw-tight hasp.
 - .3 25mm minimum extension all around, for flush-mounted pull and junction boxes.
- .4 Materials:
 - .1 Painted steel, gauge as indicated. (indoors).
 - .2 Stainless steel. (outdoors)
 - .3 Galvanized steel. (where indicated)

2.2 JUNCTION AND PULL BOXES (HAZARDOUS LOCATIONS)

- .1 Construction: Feraloy iron alloy or copper free aluminum. Epoxy coated where installed in corrosive environments.
- .2 Screw tight cover with tapered threads and neoprene gasket.
- .3 Cast mounting ears with predrilled slots or holes.
- .4 Number of hubs, sizes to suit application. Suitable for use as splice or pull box.

- .5 CSA approved: C22.2 No. 30. Suitable for use in Zone 1 or Zone 2 locations.

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 or as indicated.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1.

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.

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.

2.2 GALVANIZED STEEL OUTLET BOXES

- .1 One-piece electro-galvanized construction.
- .2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .5 Extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONDUIT BOXES

- .1 Cast FS boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.5 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.

- .3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

2.6 BOXES FOR HAZARDOUS LOCATIONS

- .1 Boxes used in hazardous locations, as defined in CEC Section 18, shall be explosion proof, and rated for use in Zone 0, 1 or 2 locations as applicable and as shown and sized as indicated on drawings or as required to suit the conditions in which they are located and to accommodate the conduit layout. Rated for use in Group IIA, B & C atmospheres.
- .2 Boxes shall be copper free aluminium and/or malleable iron, cadmium or zinc finish. All fittings shall have sufficient room for insulated joints, wires and bushings.

Part 3 Execution

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

3.2 ADDITIONAL REQUIREMENTS FOR HAZARDOUS INSTALLATIONS

- .1 The seals and sealing connectors shall be filled with conduit sealing compound on-site after all components are finally positioned to avoid cracking. Conduit sealing compound and fiber shall be placed in seals as per manufacturer's recommendations
- .2 Thread lubricant shall be used at all threaded locations.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CAN/CSA C22.2 No. 18- , Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45- , Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56- , Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83- , Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2- , Rigid PVC (Unplasticized) Conduit.

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 In accordance with Section 01 61 00 - Common Product Requirements

Part 2 Products

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .3 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Minimum 6 mm stranded nylon (polypropylene) pull rope, tensile strength 5 kN. Leave pull rope in any spare conduit exceeding 3 metres in length, or 90 degrees of bend.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in unfinished areas and in mechanical and electrical service rooms.
- .3 Use rigid galvanized steel threaded conduit except where specified otherwise.
- .4 Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical injury.
- .5 Use rigid pvc conduit underground.
- .6 Use flexible metal conduit for connection to motors in dry areas.
- .7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .8 Use explosion proof flexible connection for connection to explosion proof motors.
- .9 Install conduit sealing fittings in hazardous areas.
 - .1 Fill with compound.
- .10 Minimum conduit size for lighting and power circuits: 19 mm.
- .11 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .12 Mechanically bend steel conduit over 19 mm diameter.

- .13 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .14 Install fish cord in empty conduits.
- .15 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .16 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on surface or suspended channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.

3.5 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA Group (CSA)
- .2 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.

Part 2 Products

2.1 CABLE PROTECTION

- .1 38 x 140 mm planks pressure treated with clear, or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

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 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 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 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 100 % of original factory test voltage in accordance with manufacturer's recommendations.
- .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.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

3.5 PROTECTION

- .1 Repair damage to adjacent materials caused by cables installation.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C78.377, Electric Lamps - Specifications for the Chromaticity of Solid State Lighting (SSL) Products
- .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 United States of America, Federal Communications Commission (FCC):
 - .1 FCC (CFR47) EM and RF Interferences Suppression.
- .5 CSA Group (CSA)
- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 UL 8750, Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products
- .7 Illuminating Engineering Society of North America (IESNA)
 - .1 IESNA LM-79, Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products
 - .2 IESNA LM-80, Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules
 - .3 IESNA TM-21, Projecting Long Term Lumen Maintenance of LED Light Sources

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.
- .3 Quality assurance submittals: provide following in accordance with Section 01 45 00 - Quality Control.
 - .1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, cleaning procedures and maintenance.

1.3 QUALITY ASSURANCE

- .1 Not used.

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 Disposal and recycling of fluorescent lamps as per local regulations.
- .4 Disposal of old PCB filled ballasts.

Part 2 Products

2.1 LED LIGHTING FIXTURES

- .1 LED Light Sources and Luminaires to: ANSI/ANSLG C78.377, IESNA LM-79, IESNA LM-80, IESNA TM-21 and UL 8750.
- .2 Luminaire Efficiency. Allow for thermal and optical losses. Efficiency to be determined on a "delivered lumens per watt" basis for comparison of each luminaire using input drive current. Minimum initial delivered lumens per watt required to be verified with independent testing lab certification and in no case to be less than 70 lumens per Watt.
- .3 Depreciation:
 - .1 As a minimum, average delivered lumens over 50,000 hours of operation to be a minimum of 95% of initial delivered lumens.
 - .2 Life-span rating shall be based on L70 in units of hours as defined by IESNA standard LM-80.
- .4 Warranty: Manufacturer's warranty of a minimum of 5 years on LED's and drivers.
- .5 Manufacturer: Must have verifiable history of having been in the business of manufacturing LED light fixtures for a minimum of 7 years.
- .6 LED Drivers:
 - .1 Electronic.
 - .2 Input voltage tolerance of rated voltage +/- 10%.
 - .3 Power factor >90% at full load.
 - .4 THD
 - .5 Load regulation: +/- 1% from no load to full load.
 - .6 Exterior fixtures to be rated for -40 through +40 degrees Celsius ambient temperature.
 - .7 Integral overheating protection.
 - .8 Integral overload protection.

2.2 FINISHES

- .1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.
- .2 Refer to Luminaire Schedule on drawings.

2.3 OPTICAL CONTROL DEVICES

- .1 As indicated in luminaire schedule.

2.4 LUMINAIRES

- .1 As indicated in luminaire schedule.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate and install luminaires as indicated.
- .2 Provide adequate support to suit ceiling system.

3.2 WIRING

- .1 Connect luminaires to lighting circuits:
 - .1 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA C22.2 No.141- , 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.

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: 120 V, AC.
- .3 Output voltage: 24 V DC.
- .4 Operating time: Minimum of 30 minutes or as indicated in battery pack schedule on drawings. To produce not less than 87.5% of nominal DC system voltage with AC supply 'off'.
- .5 Battery: sealed, 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 Automatic self-diagnostic circuitry identifying battery failure, battery disconnected, charger failure, lamp failure, service alarm.
- .9 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

- .10 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.
- .11 Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, 6 W.
- .12 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.
- .13 Finish: White.
- .14 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 RFI suppressors.
- .15 Battery Charger:
 - .1 Automatically maintain battery in fully charged state while main power available. Maintain DC float voltage within plus or minus 1% of setting, no load to full load, during main voltage variations of plus 10% to minus 10% and frequency variations of plus or minus 5%.
 - .2 Equalize charging rate such that after battery has provided full power output for specified duration, charger returns battery to 95% of fully charged state in 12 h.
 - .3 Automatic cycle test providing monthly, semi-annual and annual tests with annual test being for 30 minutes.
- .16 LED indicators:
 - .1 Amber LED: unit ready and trouble free and Audible Alarms (flashing); charging mode failure (on); master card failure (off).
 - .2 Green LED Test in progress: delay TDR; equalize mode.
 - .3 Red LED: battery low.
 - .4 Audible alarm: Any failure shall be followed by a pulsating audible alarm on for 3 seconds every two and one half minutes (2 1/2) until the failure is repaired.

2.2 ZONE MONITORING MODULES

- .1 Zone Monitoring Modules: Modules for monitoring multiple a.c. input circuits. The failure of any connected a.c. circuit will cause the emergency battery system to activate. To be capable of monitoring a minimum of six (6) a.c. circuits. To be of same manufacturer as emergency lighting battery pack.

2.3 HAZARDOUS LOCATION COMBO UNIT

- .1 To CSA C22.2 No.141 and NRCAN/CSA C860, packaged in accordance with the Canadian Code for Preferred Packaging guidelines.
- .2 Combination Emergency and Exit lighting unit.
- .3 PVC frame with built-in gasket to prevent water infiltration
- .4 Faceplate: sealed, polycarbonate, vandal-resistant

- .5 Heavy-duty aluminum back plate with key holes for wall mount installation
- .6 Lamps: Long life Light Emitting Diode (LED) warrantied for 10 years
- .7 Pictogram exit sign with films and directional arrows as indicted on drawings
- .8 Listed and approved for Zone 2 locations (Class I Division 2, Groups A, B, C and D)
- .9 Two LED lamps shielded by a clear polycarbonate cover: MR16 LED, 5W.
- .10 Sealed, maintenance-free Nickel-Cadmium batteries
- .11 Auto-test, non-audible.
- .12 Magnetic test switch with bi-colour LED pilot light.
- .13 120/347VAC input, 6VDC output, 36W.

2.4 REMOTE HEADS

- .1 Remote Heads: surface mount vandal resistant polycarbonate base, clear UV-resistant polycarbonate cover, fully adjustable, double heads. c/w MR16, LED, glare free.
 - .1 Standard heads: dual 4 Watt;
 - .2 High power heads: dual 6 Watt, weatherproof;
- .2 Complete with wire guards to the unit and remote heads in gymnasium and similar areas where subject to physical damage.

2.5 WIRING OF REMOTE HEADS

- .1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Conductors: RW90 XLPE type in accordance with Section 26 05 21 - Wires and Cables (0-1000 V), sized #10 AWG minimum.

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 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Identify conductors for polarity and voltage.
- .2 Install with conductors sized to maintain current flow with maximum 3% voltage drop.
- .3 Install central and remote heads per CEC rule 46-304 and as indicated on drawings and make all required connections to heads.
- .4 Direct light heads to suit site condition and check operation.

3.3 WIRING OF ZONE MONITORING MODULES

- .1 Provide lighting branch circuit wiring to zone monitoring modules as necessary to trigger operation of unit equipment should any lighting circuit in the areas covered by that unit equipment fail.
- .2 Zone monitoring module shall be wired between all lighting loads and the branch circuit panel.

3.4 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Include: Performance test for duration of system specified herein with all loads connected and functional.
- .3 Include a copy of the test report in the O&M manuals.
- .4 Units will be tested by the contractor during the substantial completion field review and witnessed by the Departmental Representative. Schedule the work at the outset of the construction so that work schedules are properly coordinated to guarantee this. Coordinate with other subtrades involved to ensure attendance at the time of tests.
- .5 Pretest the units prior to request for substantial completion field review and troubleshoot all deficiencies. Coordinate with other subtrades involved to ensure their components and systems are installed, tested and ready for pretesting at the time of the pretests.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

3.6 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by emergency lighting installation.

Ω END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.2 No.141- , Emergency Lighting Equipment.
 - .2 CSA C860-11 , Performance of Internally-Lighted Exit Signs.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 101- , Life Safety Code.
- .3 International Organization for Standardization (ISO)
 - .1 ISO 3864-1 , Graphical symbols - Safety colours and safety signs - Part 1: Design principles for safety signs and safety markings.
 - .2 ISO 7010 , Safety colours and safety signs - Registered safety signs.

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 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures and maintenance.

Part 2 Products

2.1 SELF-POWERED UNITS

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860.
- .2 Housing: extruded aluminum housing, brush aluminum finish.
- .3 Face and back plates: extruded aluminum.
- .4 Light source: LED, 10 year warranty.
- .5 Pictogram: ISO Standard green pictogram in accordance with NBCC and CEC requirements.
- .6
- .7 Face plate to remain captive for relamping.
- .8 Supply voltage: 120 V, ac.
- .9 Output voltage: 24 V dc.
- .10 Operating time: 60 minimum.
- .11 Battery: sealed, maintenance free.
- .12 Mounting: suitable for universal mounting directly on junction box and c/w knockouts for conduit.

- .1 Removable or hinged front panel for easy access to batteries.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.
- .2 Connect fixtures to exit light circuits.
- .3 Lock exit light circuit breaker in on position.
- .4 Do not contain any other loads with exit lights on the same AC circuit.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Units will be tested by the contractor during the substantial completion field review and witnessed by the Engineer. Schedule the work at the outset of the construction so that work schedules are properly coordinated to allow this. Coordinate with other subtrades involved to ensure attendance at the time of tests.
- .3 Pretest the units prior to request for substantial completion field review and troubleshoot all deficiencies. Coordinate with other subtrades involved to ensure their components and systems are installed, tested and ready for pretesting at the time of the pretests.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

Ω END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for fire alarm systems.
 - .2 Control panel to carry out fire alarm and protection functions including receiving alarm signals, initiating general alarm, supervising system continuously, actuating zone annunciators, and initiating trouble signals.
 - .3 Trouble signal devices.
 - .4 Power supply facilities.
 - .5 Manual alarm stations.
 - .6 Automatic alarm initiating devices.
 - .7 Audible signal devices.
 - .8 Audible/visual signal devices.
 - .9 End-of-line devices.
 - .10 Loop isolation modules
 - .11 Annunciators.
 - .12 Visual alarm signal devices.
 - .13 Ancillary devices.
 - .1 Future systems to be signalled. Provide 4 sets of NO and NC contacts.
 - .2 Digital Alarm Communicator Transponders (DACT's).
 - .3 Fan shut down.

1.2 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.1, Canadian Electrical Code.
- .2 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2015 (NBC).
- .3 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S524- , Standard for the Installation of Fire Alarm Systems.
 - .2 CAN/ULC-S525- , Audible Signal Device for Fire Alarm Systems.
 - .3 CAN/ULC-S526- , Visual Signal Devices for Fire Alarm Systems.
 - .4 CAN/ULC-S527- , Control Units.
 - .5 CAN/ULC-S528- , Manual Pull Stations for Fire Alarm Systems.
 - .6 CAN/ULC-S529- , Smoke Detectors for Fire Alarm Systems.
 - .7 CAN/ULC-S530- , Heat Actuated Fire Detectors for Fire Alarm Systems.
 - .8 CAN/ULC-S531- , Standard for Smoke Alarms.
 - .9 CAN/ULC-S536-S537- , Burglar and Fire Alarm Systems and Components.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Include:
 - .1 Detailed assembly of the control panel(s), battery cabinets and annunciator enclosures and components, including dimensions.
 - .2 Overall system riser wiring diagram identifying control equipment, initiating zones, signaling circuits, ancillary devices, monitoring inputs, zone isolators.
 - .3 Technical details for all devices.
 - .4 Details and performance specifications for all system components with item-by-item cross reference to specification for compliance.
 - .5 Step-by-step operating sequence, cross referenced to logic flow diagram.
 - .6 Battery capacity calculations indicating compliance with the applicable codes and these specifications.
 - .7 Manufacturer-recommended testing material, devices, equipment and methods for smoke and heat detectors.
 - .3 Shop drawings to be stamped by manufacturer to ensure equipment/design is in accordance with ULC standards.
- .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .3 Manufacturer's Field Reports: manufacturer's field reports specified.
- .4 Closeout Submittals:
 - .1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals in accordance with ANSI/NFPA 20.
 - .2 Include:
 - .1 Operation and maintenance instructions from the manufacturer for complete fire alarm system to permit effective operation and maintenance.
 - .2 Technical data - illustrated parts lists with parts catalogue numbers.
 - .3 Copy of approved shop drawings.
 - .4 Certificate of verification.
 - .5 List of manufacturer recommended spare parts.
 - .6 Provide drawing of zone plan showing all fire alarm zones. As described in Section 26 05 00 - Common Work Results for Electrical.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company or person specializing in fire alarm system installations approved by manufacturer.
- .2 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.
- .3 System:
 - .1 To approval and final acceptance of Public Services and Procurement Canada's Fire Protection Engineer.
 - .2 System components: listed by ULC, bear the ULC label and comply with applicable provisions of National Building Code with Local and Territorial amendments, CAN/ULCS524 standard for the installation of fire alarm systems, Canadian Electrical Code C22.1; part I and meet requirements of local authority having jurisdiction.
- .4 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .5 Maintenance Service:
 - .1 Provide one year's free maintenance with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Departmental Representative.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

Part 2 Products

2.1 MATERIALS

- .1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.
- .2 Power supply: to CAN/ULC-S524.
- .3 Audible signal devices: to CAN/ULC-S525.
- .4 Visual signal devices: to CAN/ULC-S526.
- .5 Control unit: to CAN/ULC-S527.
- .6 Manual pull stations: to CAN/ULC-S528.
- .7 Thermal detectors: to CAN/ULC-S530.
- .8 Smoke detectors: to CAN/ULC-S529.

2.2 SYSTEM OPERATION

- .1 Fully supervised, addressable, Class A, single-stage, microprocessor-based, fire alarm system, utilizing digital techniques for data control and digital multiplexing techniques for data transmission.
- .2 Campus style system with stand-alone fire alarm control panels located at each building as shown on drawings. All building control panels to be connected on a Style C Network Data Communication Loop to main control panel and central control station located as indicated on drawings.
- .3 Single stage operation. Operation of any alarm initiating device to :
 - .1 Cause audible and visual signal devices to operate continuously throughout building, at fire alarm panel and annunciators.
 - .2 Initiate DACT or directly transmit signal to central monitoring facility. Contact information to be provided by Owner and programmed by this Division.
 - .3 Cause zone and unique identification of alarm device to be indicated on control panel.
 - .4 Cause air handling fans to shut down.
 - .5 Cause fire doors and smoke control doors, if normally held open, to close automatically.
 - .6 Cause door locking devices to release.
- .4 Capability to program smoke detector status change confirmation on any or zones in accordance with CAN/ULC-S527, Appendix C.

2.3 CONTROL PANEL

- .1 Class A.
- .2 Single stage operation.
- .3 Zoned.
- .4 Non-coded.
- .5 For use with addressable devices.
- .6 Enclosure:
 - .1 CSA Enclosure 1, c/w lockable concealed hinged door, full viewing window, flush lock and 2 keys.
- .7 Supervised, modular design with plug-in modules:
 - .1 Alarm receiver with trouble and alarm indications, for class A initiating circuit.
 - .2 Spare zones: compatible with smoke detectors and open circuit devices.
 - .3 Space for future modules.
 - .4 Latching type supervisory receiver circuits. Discrete indication for both off-normal and trouble.
- .8 Visual indication:
 - .1 Liquid crystal display capable of simultaneously displaying minimum 8 events at the same time.
- .9 Components:
 - .1 Coded alarm receiver panel with trouble and alarm indications for class A initiating circuit.

- .2 Audible signal control panel with initiating control circuits complete with terminals for wiring and 2 plug-in modules for dc signals up to 2.0 A load with trouble indication with class A connections.
- .3 Common control and power units:
 - .1 Control panel containing following indications and controls:
 - .1 "Power on" LED (green) to monitor primary source of power to system.
 - .2 "Power trouble" indication.
 - .3 "Ground trouble" indication.
 - .4 "Remote annunciator trouble" indication.
 - .5 "System trouble" indication.
 - .6 "System trouble" buzzer and silence switch c/w trouble resound feature.
 - .7 System reset switch.
 - .8 "LED test" switch if applicable.
 - .9 "Alarm silence" switch to silence signals manually. If new alarm occurs after signals have been silenced, signals to resound.
 - .10 "Signals silenced" indication.
 - .2 Master power supply panel to provide 24 V dc to system from 120 V ac, 60 Hz input.
- .4 Auxiliary relays: plug-in type, dust cover, supervised against unauthorized removal by common trouble circuit and c/w individual bypass switch.
 - .1 Contacts: 2.0 A, 120 V ac, for functions such as release of door holders or initiation of fan shut down.
 - .2 Contact terminal size: capable of accepting 22-12 AWG wire.

2.4 POWER SUPPLY

- .1 120 V, ac, 60 Hz input, 24 V dc output from rectifier to operate alarm and signal circuits, with standby power of gell cell batteries minimum expected life of 5 years, sized in accordance with NBC to operate system under supervisory load conditions without recharging for 24 consecutive hours and have sufficient power left to operate sounding devices for 30 minutes. Battery bank and charger to be integrally mounted in main fire alarm control panel.

2.5 MANUAL ALARM STATIONS

- .1 Manual alarm stations: pull lever, wall mounted semi-flush type, non-coded, single-pole, normally-open contacts, English signage.
- .2 Designed for single stage operation.
- .3 Fully addressable with address settings on device.
- .4 Key-lock reset feature.
- .5 Hazardous location rated for Zone 2 location where indicated on drawings.

2.6 AUTOMATIC ALARM INITIATING DEVICES

- .1 Addressable fixed temperature thermal fire detectors: restorable fixed temperature element with fixed temperature of 57°C or 93°C, as indicated on drawings.
 - .1 Electronics to communicate detector's status to addressable module/transponder.
 - .2 Detector address to be set on detector head in field.
- .2 Addressable thermal fire detectors: combination fixed temperature and rate of rise, restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57 °C, rate of rise 9°C per minute.
 - .1 Electronics to communicate detector's status to addressable module/transponder.
 - .2 Detector address to be set on detector head in field.
- .3 Addressable smoke detector.
 - .1 Photoelectric type.
 - .2 Electronics to communicate detector's status to addressable module/transponder.
 - .3 Detector address to be set on detector head in field.
 - .4 Detectors used with protective cages shall be approved for that purpose.
 - .5 Layouts are based on 83 m² coverage detector. Adjust if different coverage is used.
- .4 Addressable Duct Smoke detector: Photo-electric air duct type with sampling tubes and protective housing.
 - .1 Twist-in type with fixed base.
 - .2 Wire-in base assembly with integral red alarm LED and terminals for remote relay alarm LED.
 - .3 Electronics to communicate detector's status to addressable module/transponder.
 - .4 Detector address to be set on detector head in field.
 - .5 Provide remote LED and test button for duct detectors installed outside designated service rooms.
- .5 Hazardous location thermal fire detector: combination fixed temperature and rate of rise, restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57 °C, rate of rise 9°C per minute. Rated for Zone 2 locations.

2.7 AUDIO/VISUAL SIGNAL DEVICES

- .1 Integral Strobe: flashing, output candela rating as indicated on drawing. Minimum 15 cd output rating. Field adjustable to 30, 75 or 110 cd.
- .2 Horn: temporal output, high-low adjustable up to 99 dB. Factory built to 99 dB, which could be field changed to 94 dB by cutting a circuit board jumper.
- .3 Designed for surface mounting on walls as indicated, 24V dc, Red housing.

2.8 HAZARDOUS LOCATION AUDIBLE AND VISUAL DEVICES

- .1 Horn: Grill type hazardous location horn, temporal output, high-low adjustable 100/90dB, rated for Zone 2 locations.

- .2 Strobe: flashing, white LED, minimum 15 cd output rating or as indicated on drawings. Rated for Zone 2 locations.

2.9 END-OF-LINE DEVICES

- .1 End-of-line devices to control supervisory current in alarm circuits, sized to ensure correct supervisory current for each circuit. Open , short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.10 REMOTE ANNUNCIATOR PANELS

- .1 Provide and install Fire alarm annunciator with individual device addresses matching those as on the main control panel. Zoning is to follow the contract drawings and as such is to match the drawing specified under section 26 05 00 - Common Work Results for Electrical.
- .2 Visual indication:
 - .1 Same as main control panel
- .3 Wired in multiple with main control panel.
- .4 Supervised, including trouble signal for open circuit.

2.11 AS-BUILT ZONE DIAGRAM

- .1 Fire alarm system zone diagram: in glazed frame minimum size 600 x 600 mm.
- .2 Fire alarm building zoning plan as identified in this specification section and on the drawings.
- .3 Provide at the main fire alarm panel and each remote annunciator.
- .4 The zoning plan to show the building plan with the device address indicated at each device on the plan and room name and number of each space indicated on the plan.

2.12 LINE VOLTAGE SURGE SUPPRESSOR

- .1 Suppressor: ULC approved with maximum 330 volt clamping level and maximum response time of 5 nanoseconds.
- .2 Suppressor: multi-stage construction which includes inductors and silicon avalanche zener diodes.
- .3 Equip suppressor with light emitting diode which extinguishes upon failure of protection components.
- .4 Fuses: externally accessible.
- .5 Wire in series with incoming power source to protected equipment using screw terminations

2.13 LOW VOLTAGE SURGE SUPPRESSOR

- .1 Provide surge suppression for circuits which leave building shell.
- .2 When circuits interconnect 2 or more buildings, provide arrestor at circuit entrance to each building.
- .3 Suppressor: UL 497B listed with maximum 30 volt clamping level and maximum response time of 5 nanoseconds.
- .4 Suppressor: multi-stage construction and both differential and common mode protection.

2.14 ANCILLARY DEVICES

- .1 Remote relay unit to initiate fan shutdown.
- .2 Provisions for remote relay units to initiate DACT for both alarm and trouble conditions.
- .3 Exterior Horn/Strobe:
 - .1 Fire alarm panel to activate solid state low voltage devices. Manufacturer to guarantee that devices will operate under all potential weather conditions at the site. Electronics for horn and strobe light, if necessary, could be remote mounted inside warm area of building as close as practical to the device. Distance from the electronics to the exterior device shall not exceed the manufacturer recommended value.
 - .2 Integral Strobe: flashing, output candela rating as indicated on drawing. Minimum 75 cd output.
 - .3 Horn: temporal output, with minimum power of 99 dB measured at 1m from device.
 - .4 Red colour. Suitable for surface or flush mounting on weatherproof box.

2.15 DIGITAL ALARM COMMUNICATOR TRANSMITTER FOR APPROVED CENTRAL STATION

- .1 Provide DACT with the following features:
 - .1 Solid state, user programmable automatic dialer.
 - .2 Each channel to be capable of being individually configurable for alarm on "contact close", "contacts open" or "no alarm".
 - .3 System to be fully compatible with a ULC-approved central monitoring station.
 - .4 Device is to be ULC listed in accordance with CAN/ULC-S561 - Installation and Services for Fire Signal Receiving Centres and Systems.
 - .5 DACT to be Bosch or approved equal as per the requirements of the fire alarm monitoring company (Arctic Alarm), complete with dual phone line module. Please note that not all autodiallers could be certified for every monitoring centre and therefore, it is the responsibility of the contractor to coordinate with the monitoring company of the Owners choosing and provide the compliant product programmed for the monitoring centre.
- .2 Provide 120Vac primary transformer for use with DACT with secondary voltage as required by manufacturer.
- .3 The DACT power supply to be complete with battery charger and back-up battery with sufficient capacity in accordance with CAN/ULC-S561.
- .4 Each of the following systems shall activate separate DACT channels with separate message:
 - .1 Fire alarm trouble, supervisory and alarm signals;
 - .2 Intrusion alarm trouble and alarm signals;
 - .3 Mechanical alarm system.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Install systems in accordance with CAN/ULC-S524 .
- .2 Install main control panel and connect to ac power supply, dc standby power.
- .3 Locate and install manual alarm stations and connect to alarm circuit wiring.
- .4 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.
- .5 Connect alarm circuits to main control panel.
- .6 Locate and install audible and visual signal devices and connect to signalling circuits.
- .7 Connect signalling circuits to main control panel.
- .8 Install end-of-line devices at end of alarm and signalling circuits.
- .9 Install remote annunciator panels and connect to annunciator circuit wiring.
- .10 Locate and install remote relay units to control fan shut down.
- .11 Each device to be permanently labeled:
 - .1 Zone Isolation Module: Indicate Zone number, "ISO".
 - .2 Addressable Input Module: Indicate Zone number, "INPUT", and device address number on loop.
 - .3 Addressable Output Module: Indicate Zone number, "OUTPUT", and device address number on loop.
- .12 Provide ground connection conductor (wire) throughout the system.
- .13 Provide necessary raceway and wiring for all listed connections and any other code required connections even if not listed herein.
- .14 Provide line isolators per NBC and CAN/ULC-S524. It is acceptable to modify the fire alarm riser diagram per actual site conditions if necessary provided that proper quantity of line isolators are provided at the locations required per NBC and CAN/ULC-S524.
- .15 Include in the bid the cost of removing an installed pull station, raceway and wiring in each stair well in each building at no extra cost. Provide blank cover.

3.3 SYSTEM VERIFICATION

- .1 An authorized representative of the fire alarm system manufacturer is to make a thorough inspection of the complete installed fire alarm system including all components such as manual stations, thermal detections, products-of combustion detectors, and controls to ensure the following:
 - .1 System is complete and functional in accordance with specifications and drawings.
 - .2 System is installed according to CAN/ULC S524 requirements.

- .3 System is installed in accordance with manufacturer's recommendations.
- .4 Regulations covering supervision of components are adhered to.
- .5 Subsequent changes necessary to conform to Items 1, 2, 3 and/or 4 to be done by Division 28 with technical assistance supplied by the manufacturer.
- .6 During the period of this inspection by the manufacturer, supply to the manufacturer one journeyman electrician.
- .7 Manufacturer to submit to Departmental Representative on completion of inspection a point-by-point check list indicating date and time of each item inspected and also issue a Certificate for his records confirming that inspection has been completed and system is installed and functioning in accordance with the specifications. Included with this Certificate to be satisfactory- proof of liability insurance valid for not less than one (1) year from date of final inspection.
- .8 Certificate to be free from defining and qualified statements, which would make it unacceptable by the Departmental Representative.
- .9 Verification shall be performed by manufacturer's certified representative with contractor's assistance. verification results shall be documented by the manufacturer's representative on the manufacturer's comprehensive fire alarm verification forms.
- .10 All aspects of the system verification are to be conducted in the presence of the Departmental Representative or his designated representative.
- .11 Notify Departmental Representative of verification date and time at least ten business days in advance.
- .12 Verification may be performed only after:
 - .1 Air balancing is complete.
 - .2 Building is at a state of completion that will ensure a reasonably dust free environment and the absence of contaminating fumes from verification date to final completion.
- .13 Manufacturer to provide sufficient backup parts on site during verification to accommodate any component failures. Backup parts not used during verification can be removed from site by the manufacturer. Recommended back-up parts list:
 - .1 10 break-glass rods (if applicable)
 - .2 2 fire detectors
 - .3 2 smoke detectors
 - .4 2 pull stations
 - .5 2 horn-strobes and electronics.
 - .6 1 outdoor horn/strobe.
 - .7 2 spare signal zone cards
 - .8 5 appropriate sized fuses
 - .9 1 CPU programming chip
 - .10 Any additional parts pertinent to the particular manufacturer that may possibly fail resulting in cancellation of the verification.
- .14 Provide two fully charged hand-held two-way voice communication radios during verification.
- .15 Provide all testing equipment and material required for testing smoke detectors and heat detectors during verification. Testing methods are to be as approved by

manufacturer. Asper CAN/ULC-S537 article 5.4.1.3, each smoke detector shall be tested to confirm that it is within its rated operating range using one of the following methods:

- .1 Using a ULC approved smoke density measurement instrument for verification of smoke detectors. Canned smoke alone is not acceptable.
- .2 Installed control units or transponders designed to test the sensitivity of individual smoke detectors.
- .3 Manufacturer's recommended test instrument, equipment or method. This method is acceptable only when complete official description of the manufacturer's recommended method, including the description of material, devices and equipment is submitted for Departmental Representative's review at least four (4) weeks prior to the verification date.
- .4 Similar for heat detectors.
- .16 Provide all testing equipment and material required for testing sound levels of the fire alarm signaling devices during verification.
- .17 Verification to be performed by the system manufacturer or it's qualified representative, certified to verify fire alarm system within the NWT.
- .18 Schedule the work at the outset of the construction so that work schedules are properly coordinated to ensure that the verification is complete prior to achieving substantial performance and occupancy.
- .19 Coordinate with other trades and the Owner for setting up their contract with the remote monitoring company, to ensure completion and attendance at the time of tests

3.4 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and CAN/ULC-S537.
- .2 Pretest the system prior to request for verification inspection and troubleshoot all deficiencies. Submit a copy of successful pretesting report along with the request for fire alarm verification field review.
- .3 Fire alarm system:
 - .1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors, sprinkler system (flow), transmit alarm to control panel and actuate first stage alarm general alarm ancillary devices.
 - .2 Check annunciator panels to ensure zones are shown correctly.
 - .3 Simulate grounds and breaks on alarm and signaling circuits to ensure proper operation of trouble signals.
 - .4 Functionally test all sprinkler valve operations, including tamper and flow switches to ensure proper annunciation on supervisory zones.
 - .5 Simulate and test all auxiliary functions.
 - .6 Simulate and test alarm and monitoring indication functions at building's control & automation panel.
 - .7 Class A Circuits:
 - .1 Test each conductor on all circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near mid-post

- point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
- .2 Test each conductor on all circuits for capability of providing alarm signal during ground-fault condition imposed near mid-post point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
- .8 Pay for all testing costs, excluding those of the Departmental Representative for single-time witnessing the verification. It is the contractor's responsibility to coordinate the verification and pretest the system prior to verification to minimize the efforts and cost.

3.5 TRAINING

- .1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

3.6 OPERATION OF DACT FOR APPROVED CENTRAL STATION

- .1 Provide all necessary wiring and auxiliary relays required to connect fire alarm panel to separate channel of the DACT for alarm, supervisory and trouble conditions.
- .2 Install DACT as close as practicable to the fire alarm panel as required by CAN/ULC-S561.
- .3 Provide two telephone lines to the DACT.
- .4 Connect DACT to automatically transfer to secondary telephone line when primary line is faulted.
- .5 Test and verify the operation of the DACT.

3.7 LABELING

- .1 The company name and phone number of the fire alarm monitoring company and a clear statement that the equipment is being monitored and that notification must be given prior to working on or testing of the fire alarm system shall be prominently displayed on the DACT and/or autodialer (as provided for under the contract) as well as the fire alarm panel, as required by CAN/ULC-S561.
- .2 When DACT transmit signals for other systems such as intrusion alarm system to the monitoring company, include all systems monitored on the same label and display the label on the control panels of other monitored systems as well.

3.8 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

Ω END OF SECTION

APPENDIX A – HERITAGE CONSERVATION ADVICE REPORT



Heritage Conservation Advice Report

Date: December 07, 2020

Prepared for:	Yakob Woldeyesus, Project Manager, PSPC
Regarding:	Hay River Fire Alarm Upgrade, R.112270.002, HC Review to determine potential impact to Heritage Value
Building/Site Name:	42043 MacKenzie Hwy Hay River, NT
Federal Heritage Designation:	Recognized buildings Fish Management Complex Unit, Carpenter Shop, Helicopter Operations and Store/ Maintenance Shop
Submission Contact:	Dean Russell, Conservation Architect, Heritage Conservation Western (HCW), 587.340.2452, dean.drrussell@pwgsc-tpsgc.gc.ca
Submitted by:	Dean Russell, Conservation Architect

All the comments within this report are intended to provide advice as requested by the Client.

CONTEXT

All advice provided in this report is in compliance with relevant federal regulations, standards and policies relating to heritage conservation including:

- *Standards and Guidelines for the Conservation of Historic Places in Canada* (S&G) (Second edition) as per the following:
- Applying the Guidelines:
 - The Guidelines should be consulted only when the element to be intervened upon has been identified as character-defining element in a Statement of Significance or equivalent document. The General Guidelines apply to all interventions, whether the primary treatment is Preservation, Rehabilitation or Restoration. There are additional guidelines Rehabilitation and Restoration projects. The Guidelines are presented in an ascending sequence of lesser to greater intervention – from documenting, to maintaining, repairing and replacing character-defining elements. Because the expressed objective of the Standard is to conserve the heritage value of an historic place, projects should focus on the first activities in the sequence of the Guidelines: that is applying the standard of minimal intervention and resorting to the last activities in the sequence only when essential functional goals cannot otherwise be met.
- Replacing Character - Defining Elements,
 - Replacement of all or parts of character-defining elements should only be considered when repair is not possible, and if there is sufficient physical evidence to match the forms, materials and detailing of a sound version of the same element. Replacement may be required because an existing feature

is deteriorated or damaged that repair is not possible from the existing fire alarm system, or because a feature is missing entirely. In all cases where replacement is required, sound elements that may be part of a larger grouping should be preserved. The fire alarm will require a repair of the character-defining elements as part of the existing system replacement. A work around of the fire alarm components is to be considered so to preserve the existing character-defining elements or repair from the existing system components.

- Replacement as Part of Rehabilitation,
 - In a Rehabilitation project, replacing a character-defining feature that is beyond reasonable repair may be appropriate if its essential form and detailing are still evident. Replacing a feature that is missing, but known from physical documentary evidence, may be appropriate. The approach for replacement work will depend on the overall design approach and design intentions and most particularly, on achieving a visual and functional balance between the new work and historic place. In some cases, the preferred design approach will be replacement in kind, in other cases, substitute forms, materials or detailing may be appropriate. The replacement should be visually and physically compatible with and distinguishable from the historic place. If the replacement is in kind, the work need only be distinguishable on close inspection. The fire alarm upgrade will utilize existing conduit runs and smaller devices, appropriate in color and scale, as reviewed with the heritage architect, so as to not interrupt the character-defining elements.
- Replacement as Part of Restoration,
 - Replacement as a rule should be done in kind. Recreating earlier forms, materials, textures, finishes, colors and detailing and patterns and relationships can help recover or represent as historic place as it appeared at a particular period of history. The fire alarm replacement will include components that are removed from the system and replaced with a more efficient system. The fire alarm replacement components that have affected the character defining elements shall incorporate restoration practices where replacement is not managed. The goal is to depict the appearance of the place or individual component as it appeared at a particular period. The replacement work is normally distinguishable only on close inspection or as part of the project documentation.

- Email Dated Dec 4, 2020, providing background information of request of Heritage Designation review.

This advice has been prepared by:

Conservation Architecture.....Dean Russell, Conservation Architect,
Heritage Conservation Western (HCW)

SCOPE OF THIS DOCUMENT

Heritage Conservation Western (HCW) was requested by PSPC Project Manager, Yakob Woldeyesus, to provide Heritage Conservation Advice of the Hay River Fire Alarm Upgrade, to determine whether the proposed scope of work will impact the Heritage Value of the Fish Management Complex Unit, Carpenter Shop, Helicopter Operations and Store/ Maintenance Shop and provide advice as required. It was determined that the buildings are over 40 years old and therefore as per Treasury Board Policy; the buildings become a candidate for FHBRO evaluation and are directly impacted by the Fire Alarm upgrades. HCW has not reviewed previous development stages in the project. The review comments and advice herein are based on review of the documents provided, and did not involve a visit to site.

PROJECT BACKGROUND

The Hay River Fire Alarm Replacement project involves installation of life safety systems and devices to replace the existing antiquated fire alarm system, and meet current Code requirements. The existing Fish Management Complex Unit, Carpenter Shop, Helicopter Operations and Store/ Maintenance Shop are over 40 years old and therefore as per Treasury Board Policy; the buildings become a candidate for FHBRO evaluation. See <https://www.pc.gc.ca/en/culture/beefp-fhbro/process/evaluation>. For this reason the replacement of the existing life safety systems within the existing buildings will be designated as a “Recognized” for the purpose of Character-Defining Elements. The Character-Defining Elements will include the existing windows, doors, flooring and wall assemblies. The replacement of the life safety systems to the existing buildings and Character-Defining Elements will follow the Standards and Guidelines for the Conservation of Historic Places in Canada as the Character-Defining Elements are impacted directly by the rehabilitation of the existing site. PSPC Heritage Conservation Architect (Design Manager) will coordinate all quality assurance reviews during pre-design and construction documentation phases for Heritage Conservation. The FHBRO Recognized designation of the Hay River DFO complex extends to the existing Fish Management Complex Unit, Carpenter Shop, Helicopter Operations and Store/ Maintenance Shop until the FHBRO evaluation is completed and designation is confirmed. The design intent to monitor the facility under the control of a single fire alarm system and to eliminate the multiple systems consisting of obsolete components, non-compliant wiring, redundant devices while ensuring fire safety for individual buildings. The scope of the work includes installation of new strobe/horn combinations; Smoke detectors; Heat detectors; End of line resistors; Relay modules; Duct detectors; Pull stations, CO2 detectors; and Annunciators, Fire alarm control panel(s) as well as removal of the existing fire alarm panel, devices, conduit, cables, boxes, and fittings back to source. The majority of the scope of work is to be completed on the exterior and interior of the existing buildings.

HERITAGE CHARACTER

The Hay River Fish Management Complex Unit, Carpenter Shop, Helicopter Operations and Store/ Maintenance Shop will be treated as ‘Recognized’ Federal Heritage Buildings, which is currently in use by Department of Fisheries and Oceans.

The interventions shall be proposed in the Pre-Design report consisting of primary treatment of rehabilitation. The interventions must follow Standards 1 to 12 of the S&G. The following Standards are of particular relevance to the interventions proposed:

Standard 3

“Conserve *heritage value* by adopting an approach calling for *minimal intervention*.”

Standard 8

“Maintain *character-defining elements* on an ongoing basis. Repair *character-defining elements* by reinforcing their materials using recognized conservation methods. Replace in-kind any extensively deteriorated or missing parts of *character-defining elements*, where there are surviving prototypes.”

Standard 11

“Conserve *heritage value* and *character-defining elements* when creating any new additions to an *historic place* or any related new construction. Make new work physically and visually compatible with, subordinate to and distinguishable from the historic place.”

COMMENTS & RECOMMENDATIONS

The majority of character-defining elements outlined in the Heritage Character Statement are relating to the exterior and interior features and detailing of the buildings; however, generally ‘*good craftsmanship and materials throughout*’ are identified as character-defining, which extends to the remaining interior character-defining historic finishes/features of the Towers. It is recommended the remaining original interior finishes and features are respected as changes are carried out in this scope of work.

Review the Design Development Report for the Fire Alarm Upgrade has resulted in the following recommendations for consideration:

- As per Standard 3, it is recommended that all interventions carried out in the scope of work adopts a minimal approach such as:
 - Where existing fire alarm devices are to be removed and replaced with new, it is recommended new devices are installed in the same location as existing devices wherever possible.
 - Existing conduit runs to be reused where possible.
 - If new locations of conduit runs are required, placement of the conduits are to be hidden and if surface mounted on heritage defining elements are required, conduit clips are to be mounted in existing mortar joints where possible.
 - Where new device mounting heights are required on the wainscot and moldings and wall finishes, revise location that the mounting heights are not damaging to the existing character defining elements.
 - Where new fire annunciator panels are required, utilize existing locations of existing panels.
 - The goal is to reduce disruption of existing character-defining finishes/features wherever possible.
 - In absence of a Heritage Inventory, exercise caution in areas of the buildings that typically include Character-Defining Elements (CDEs), such as exterior/ interior walls, floors, ceilings, doors and windows. It is recommended historic fabric related to the above areas be respected in the work proposed.
- In keeping with Standard 11, which seeks to create new additions to a historic place by making new work physically and visually compatible with, subordinate to and

distinguishable from the historic place, it is recommended that new fire alarm devices specified for installation are selected using the following criteria (code permitting):

- Select new devices that are smallest in dimension, to reduce visual disruption within the historic context;
- Select new devices that are similar in color to the surrounding finishes, wherever possible, to reduce visual disruption.

In keeping with Standard 3, it is recommended the horns and strobes specified for installation on the interior and exterior of existing buildings Fish Management Complex Unit, Carpenter Shop, Helicopter Operations and Store/ Maintenance Shop is selected to be the smallest available. New Fire Alarm Control Panels are to be reinstalled in same locations utilizing existing conduit runs. Alarm, Heat, Smoke Sensors, Sound Bases and Beam Type and Smoke Detectors to be installed in locations that are not damaging to character defining elements, Pull Station locations are not to be installed on character defining elements. Control Relay Modules to be mounted in existing locations on non-character defining elements utilizing existing conduit runs. Monitor Modules, Sampling Points to be mounted in existing locations and non-character defining elements utilizing existing conduit runs. Surface mounted fire alarm devices to be mounted on existing locations and non-character defining elements, existing conduit runs to be utilized where possible. Mounting of Fire Alarm elements to existing mortar joints in character defining elements where possible and existing locations.

Additionally, in keeping with Standards 11, it is recommended the exterior strobe specified for installation on the exterior of buildings Fish Management Complex Unit, Carpenter Shop, Helicopter Operations and Store/ Maintenance Shop, is selected in a color that is similar to the existing veneer, to reduce the visual disruption caused by the intervention. In general Fire Alarm devices to match existing interior and exterior elements small in size and closest match in context and color of character defining elements.

- To include in the specifications Demolition section - In keeping with Standard 8, include the following wording or similar:
Contractor is to patch in-kind and repair existing finishes/features using recognized heritage conservation methods, Replace in kind any extensively deteriorated or missing parts of character defining elements where there are surviving prototypes as per the Standards and Guidelines for the Conservation of Historic Places in Canada (S&G). Standard 8, pg31.

Patching in-kind involves repair and/or replacement using the same material type, design, dimension, texture, detailing and exterior appearance. The goal is to produce a patch/repair such that there is no visible difference between existing and new surfaces when viewed from 1.5 meters in ambient light. Where painting is required, the entire surface to the next change in plane is recommended.

- Typically, when projects are executed in designated federal heritage buildings, and where patching of character-defining materials is required, requirements for mock-up for each type of repair are outlined in a specification, for review by the Departmental

Representative. The goal is to ensure the patching methods are executed using recognized heritage conservation methods, with an acceptable level of quality of finish.

- Completion of a Heritage Inventory, if an inventory has not already been completed, is recommended to identify existing interior finishes/features that exhibit character-defining workmanship, quality materials, good aesthetic and functional design, which contribute to the Heritage Value of the Hay River Canadian Coast Guard Base. Inclusion of a Heritage Inventory in the Specification is also recommended, to provide the contractor with a comprehensive understanding of materials that must be protected as work is carried out, and where patch and repair in-kind using accepted conservation methods is necessary, while allowing the team to consider alternative patching methods that are less restrictive in areas not identified as having heritage value.
- The addition of a subsection in Division 1 of the Specification, “Identification of Heritage Defining Characteristics” is recommended to identify the Federal Heritage Building status, and provide information about the character-defining elements buildings Fish Management Complex Unit, Carpenter Shop, Helicopter Operations and Store/ Maintenance Shop, specifically that there are certain Physical Values that must be protected throughout the course of this project. Suggested wording may be

The existing Hay River Canadian Coast Guard Base Fish Management Complex Unit, Carpenter Shop, Helicopter Operations and Store/ Maintenance Shop are over 40 years old and therefore as per Treasury Board Policy; the buildings become a candidate for FHBRO evaluation Federal Heritage Buildings. See <https://www.pc.gc.ca/en/culture/beefp-fhbro/process/evaluation>. For this reason the existing buildings will be designated as a “Recognized” for the purpose of Character-Defining Elements under the care of the Department of Fisheries and Oceans. Protection of the heritage value of the historic place in accordance with the Standards and Guidelines of Historical Places in Canada Standards 1 to 12, is required during all stages of the scope of work in this project.

Inclusion of a similar General Note on the Contract Drawings is also recommended.

Additionally, it is suggested the following note or similar is included in the specification

The Heritage Value of the Hay River Canadian Coast Guard Base resides in its good aesthetic and functional design and good quality craftsmanship and materials.

Inclusion wording indicating that all employees of the contractor and subcontractors are required to review the Heritage Conservation Advice Report, prior to commencing work on site. The goal is to ensure the contracting team is aware of the heritage value of the buildings and character-defining elements that must be preserved during the construction phase. It is also recommended a description of the construction kick-off meeting, which indicates that a Heritage Conservation architect will review the historic site with the contractor, is added to the specification (if it is the PM’s intention to include a Heritage Representative at the kick-off meeting). The description of the construction kick-off meeting will be as follows to include into Division 01 of the specifications:

The construction kick-off meeting is an opportunity to hear from the client and the project team as well as other stakeholders about the project and get a broader understanding of the background.

- Members of contractors team, or sub-contractor has experience with working with historic structures and understanding of challenges with this project. Identification of challenges with this work, milestones and risks. Methodology, overall plan for procurement and installation of historic repair work and coordination with other trades.
- It is recommend that wording as found in the *Standards and Guidelines for the Conservation of Historic Places in Canada* in Division 3 “Standards” section is included in the specification. The addition of a “Heritage Conservation Minimal Intervention Approach” Subsection is recommended. A body of text similar to the following may be included: “Considerations of conservation are guided by a minimal intervention approach and advocate the maintenance and repair of elements instead of their removal or replacement.” It is recommended the following reference to certain standards are included in the above noted section that apply particularly to this project such as:
 - Standard 1, Do not remove, replace or substantially alter its intact or repairable character defining elements.
 - Standard 3, Conserve heritage value by adopting an approach calling for minimal intervention.
 - Standard 8, Repair character-defining elements by reinforcing their materials using recognized conservation methods. Replace in-kind any extensively deteriorated or missing parts of character-defining elements...
 - Standard 10: Repair rather than replace character-defining elements. Where character-defining elements are too severely deteriorated to repair, and where sufficient physical evidence exists, replace them with new elements that match the forms, materials and detailing of sound versions of the same elements.
 - Standard 11: Conserve the heritage value and character-defining elements when creating any new additions to an historic place or any related new construction. Make the new work physically and visually compatible with, subordinate to and distinguishable from the historic place.
 - Standard 12: Create any new additions or related new construction so that the essential form and integrity of an historic place will not be impaired if the new work is removed in the future.
- Inclusion of a General Note in the drawings similar to the following is recommended “Applicable guidelines: Standards and Guidelines for the Conservation of Historic Places in Canada, Second Edition” Division 3 Standards section.
- Generally, when construction work is carried out on designated historic buildings, criteria for documenting the existing condition at the outset of the project, as well as continued documentation of the site throughout the course of work, and at key intervals

in the construction process, are recommended. The addition of a Digital Recording Documentation section is recommended, which may include the following or similar wording:

1. Contractor is to digitally record progress of the project daily, at key stages of the work and milestones as per the project schedule.
2. Images and recordings are to be of reasonable quality and quantity to enable the viewer to understand the context and subject recorded as defined as heritage defining elements related back to the heritage character statement.
3. Include key plans to indicate views of photographic survey and/or videos
4. Historic Title Search
5. Production of sketches and field notes.
6. “As-built” photographic survey as related back to the heritage character statement.
7. Base line photographic survey to include the photographs of main character defining elements of the structure and details.
8. Measured floor plans.
9. Survey Instruments
10. Overall exterior and interior photogrammetry of the Recognized structures.
11. Provide graphic line work drawings of the floor plans.
12. Production of aerial photographs of the site.
13. Production of an – as built site plans to include existing structures, vegetation and pathways presented as architectural drawings at a scale TBD and
14. Preparation of a report for the site that summarizes the findings from the above required documentation.

It is recommended the Department Representative discuss digital recording expectations for the contractor at the kick-off meeting.

- Emphasis on the importance of caution working in close proximity to historic fabric, both on the interior and exterior of the buildings, is recommended. In any location where work is carried out in proximity to historic features, reasonable measures to protect the existing historic fabric are recommended. The addition of requirements for protective measures in the Construction Drawings is recommended, such as a General Note in the drawings similar to the following “Where work is carried out in proximity to historic features, reasonable measures to protect the existing historic fabric from accidental damage are to be taken” such as protective sheathing shrouding the character defining elements.
- Inclusion of sufficient wording in the specifications is recommended, indicating that heritage materials which are accidentally damaged may be difficult to replace and approvals from government agencies may be necessary, perhaps resulting in increased construction time and costs. In general, it is better to ensure there is adequate protection of these elements.

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