Public Works and
Government Services Canada

Travaux Publics et Services
Gouvernmentaux Canada

Specification

CORRECTIONAL SERVICES CANADA
EDMONTON INSTITUTION
Kitchen Redevelopment

Project No. R.077204.001 2/10/2019

APPROVED BY:

Regional Manager AES Date

Construction Safety Coordinator Date

TENDER:

Project Manager Date

No. of Pages

SPECIFICATIONS GROUP

GENERAL REQUIREMENTS SUBGROUP

DIVISION 01 GENERAL REQUIREMENTS

01 11 00 Summary of Work 2
01 14 10 Security Requirements 5
01 31 19 Project Meetings 2
01 32 16.07 Construction Progress Schedule – Bar (GANTT) Chart 3
01 33 00 Submittal Procedures 3
01 35 29.06 Health and Safety Requirements 2
01 41 00 Regulatory Requirements 1
01 45 00 Quality Control 3
01 51 00 Temporary Utilities 2
01 52 00 Construction Facilities 2
01 61 00 Common Product Requirements 3
01 73 00 Execution 2
01 74 11 Cleaning 1
01 74 21 Construction Waste Management and Disposal 1
01 77 00 Closeout Procedures 1
01 78 00 Closeout Submittals 2
01 79 00 Demonstration and Training 2
01 91 13 Commissioning Plan 11

FACILITY CONSTRUCTION SUBGROUP

DIVISION 02 EXISTING CONDITIONS

02 07 50 Cutting and Patching 5
02 41 19.16 Selective Interior Demolition 9

DIVISION 03 CONCRETE

Not Used

DIVISION 04 MASONRY

04 04 99 Masonry for Minor Works 3

DIVISION 05 METALS

05 50 00 Metal Fabrications 5

DIVISION 06 WOOD, PLASTICS AND COMPOSITES

Not Used

DIVISION 07 THERMAL AND MOISTURE PROTECTION

07 55 00 Membrane Roof Repair 6
07 84 00 Firestopping 4
07 92 00 Joint Sealing 4

No. of Pages

DIVISION 08 **OPENINGS**
08 11 00 Metal Doors and Frames 6
08 71 00 Door Hardware 4

DIVISION 09 **FINISHES**
09 21 16 Gypsum Board Assemblies 8
09 22 16 Non-Structural Metal Stud Framing 5
09 91 10 Painting 8

DIVISION 10 **SPECIALTIES**
10 26 00 Wall Protection 2

FACILITY SERVICES SUBGROUP
DIVISION 20 **MECHANICAL**
20 05 01 Common Work Results for Mechanical 6
20 41 23 Mechanical Demolition and Renovation 4

DIVISION 23 **HEATING, VENTILATION AND AIR CONDITIONING (HVAC)**
23 05 00 Common Work Results for HVAC 6
23 05 93 Testing, Adjusting and Balancing for HVAC 8
23 05 94 Pressure Testing of Ducted Air Systems 5
23 07 13 Duct Insulation 7
23 07 15 Thermal Insulation for Piping 11
23 33 00 Air Duct Accessories 5
23 33 14 Dampers – Balancing 4
23 33 46 Flexible Ducts 5
23 35 33 Duct Liners 5
23 37 13 Diffusers, Registers and Grilles 4
23 37 20 Louvers, Intakes and Vents 5
23 51 00 Breeching, Chimneys and Stacks 4
23 54 33 Gas Fired Heaters 4

DIVISION 26 **ELECTRICAL**
26 05 01 Common Work Results for Electrical 14

DIVISION 32 **EXTERIOR IMPROVEMENTS**
32 11 16.01 Granular Sub Base 4
32 11 23.00 Aggregate Base Courses 3
32 12 16.01 Asphalt Paving – Short Form 3

DIVISION 26 **ELECTRICAL**
26 05 00 Common Work Results Electrical .....
26 05 21 Electrical Materials and Methods .....
26 05 28 Grounding .....
26 05 64 Identification for Electrical Systems .....
26 24 16 Panelboards .....
26 28 23 Disconnect Switches .....
26 50 00 Lighting .....

DIVISION 27 **COMMUNICATIONS**
27 05 00 Common Work Results for Communication .....
27 05 53 Identification for Communications .....
27 08 00 Commissioning and Testing for Communications .....
27 15 00 Communications Horizontal Wiring .....

DIVISION 28 **ELECTRONIC SAFETY AND SECURITY**
28 31 00 Fire Detection and Alarm System.....

END TABLE OF CONTENTS

1.01 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises renovations existing Kitchen Area, located in Edmonton Maximum Security Institution, for Correctional Services Canada.

1.02 CONTRACT METHOD

.1 Construct Work under single stipulated price contract.

1.03 WORK SEQUENCE

.1 Construct Work in stages to accommodate Departmental Representative's continued use of premises during construction.

.2 Co-ordinate Progress Schedule and co-ordinate with Departmental Representative's Occupancy during construction.

.3 Maintain fire access/control.

1.04 CONTRACTOR USE OF PREMISES

.1 Unrestricted use of site until Substantial Performance.

.2 Limit use of premises to allow:
  .1 Departmental Representative's occupancy.

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

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

.5 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

.6 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.

.7 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.05 OWNER OCCUPANCY

.1 Owner will occupy premises during entire construction period for execution of normal operations.

.2 Co-operate with Departmental Representative in scheduling operations to minimize conflict and to facilitate Departmental Representative's usage.

1.06 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

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

1.07 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 notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to pedestrian vehicular traffic and tenant operations.

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

.4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.

.5 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.

.6 Provide temporary services when directed by Departmental Representative to maintain critical building and tenant systems.

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

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

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

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

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

1.08 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy each document as follows:
- .1 Contract Drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Reviewed Shop Drawings.
- .5 List of Outstanding Shop Drawings.
- .6 Change Orders.
- .7 Other Modifications to Contract.
- .8 Field Test Reports.
- .9 Copy of Approved Work Schedule.
- .10 Health and Safety Plan and Other Safety Related Documents.
- .11 Other documents as specified or required.

END OF SECTION

1 PURPOSE

.1 To ensure that both the construction project and the institutional operations may proceed without undue disruption or hindrance and that the security of the Institution is maintained at all times.

2 DEFINITIONS

.1 "Contraband" means:
- .1 an intoxicant, including alcoholic beverages, drugs and narcotics
- .2 a weapon or a component thereof, ammunition for a weapon, and anything that is designed to kill, injure or disable a person or that is altered so as to be capable of killing, injuring or disabling a person, when possessed without prior authorization,
- .3 an explosive or a bomb or a component thereof,
- .4 currency over any applicable prescribed limit, $25.00, and
- .5 any item not described in paragraphs (a) to (d) that could jeopardize the security of a Penitentiary or the safety of persons, when that item is possessed without prior authorization.

.2 “Unauthorized smoking and related Items” means all smoking items including, but not limited to, cigarettes, cigars, tobacco, chewing tobacco, cigarette making machines, matches and lighters.

.3 "Commercial Vehicle" means any motor vehicle used for the shipment of material, equipment and tools required for the construction project.

.4 "CSC" means Correctional Service Canada.

.5 "Director" means Director, Warden or Superintendent of the Institution as applicable.

.6 "Construction employees" means persons working for the general contractor, the sub-contractors, equipment operators, material suppliers, testing and inspection companies and regulatory agencies.

.7 "Departmental Representative" means the Public Works and Government Services Canada representative defined in General Conditions.

.8 "Perimeter" means the fenced or walled area of the institution that restrains the movement of the inmates.

.9 "Construction limits" means the area, as indicated in the contract documents, that the contractor will be allowed to work". This area may or may not be isolated from the security area of the institution. Limits to be confirmed at construction start-up meeting.

3 PRELIMINARY PROCEEDINGS

.1 At construction start-up meeting:
- .1 Discuss the nature and extent of all activities involved in the Project.

.2 Establish mutually acceptable security procedures in accordance with this instruction and the institution's particular requirements.

.2 The contractors' responsibilities:
.1 Ensure that all construction employees are aware of the security requirements.
.2 Ensure that a copy of the security requirements is always prominently on display at the job site.
.3 Co-operate with institutional personnel in ensuring that security requirements are observed by all construction employees.

4 CONSTRUCTION EMPLOYEES

.1 Submit to the Departmental Representative a list of the names with date of birth of all construction employees to be employed on the construction site and a security clearance form for each employee.

.2 Allow 10 working days for processing of security clearances. Employees will not be admitted to the Institution without a valid security clearance in place and a recent picture identification such as a provincial driver's license. Security clearances obtained from other CSC institutions are not valid at this institution except as approved otherwise.

.3 The Director may require that facial photographs may be taken of construction employees and these photographs may be displayed at appropriate locations in the institution or in an electronic database for identification purposes. The Director may require that these Photo ID cards be provided for all construction workers. ID cards will then be left at the designated entrance to be picked up upon arrival at the Institution and be displayed prominently on the construction employees clothing at all times while employees are in the institution.

.4 Entry to Institutional Property will be refused to any person there may be reason to believe may be a security risk.

.5 Any person employed on the construction site will be subject to immediate removal from Institutional Property if they:
.1 appear to be under the influence of alcohol, drugs or narcotics.
.2 behave in an unusual or disorderly manner.
.3 are in possession of contraband.

5 VEHICLES

.1 All unattended vehicles on CSC property must have windows closed; fuel caps locked, doors and trunks locked and keys removed. The keys must be securely in the possession of the owner or an employee of the company that owns the vehicle.

.2 The director may limit at any time the number and type of vehicles allowed within the Institution.

.3 Drivers of delivery vehicles for material required by the project will require security clearances and must remain with their vehicle the entire time that the vehicle is in the Institution. The director may require that these vehicles be escorted by Institutional staff or PWGSC Construction Escorts while in the Institution.

.4 If the Director permits trailers to be left inside the secure perimeter of the Institution, the trailer doors must be locked at all times. All windows must be securely locked bars when left unoccupied. Cover all windows with expanded metal mesh. When not in use lock all storage trailers located inside and outside the perimeter.

6 PARKING

.1 The parking area(s) to be used by construction employees will be designated by the Director. Parking in other locations will be prohibited and vehicles may be subject to removal.

7 SHIPMENTS

.1 To avoid confusion with the institution's own shipments, address all shipments of project material, equipment and tools in the Contractor’s name and have a representative on site to receive any deliveries or shipments. CSC or PWGSC staff will NOT accept receipt of deliveries or shipments of any material equipment or tools.

8 TELEPHONES

.1 The installation of telephones, facsimile machines and computers with Internet connections is not permitted within the Institution perimeter unless prior approved by the Director.

.2 The Director will ensure that approved telephones, facsimile machine and computers with Internet connections are located where they are not accessible to inmates. All computers will have an approved password protection that will stop an Internet connection to unauthorized personnel.

.3 Wireless cellular and digital telephones, including but not limited to devices for telephone messaging, pagers, Blackberries, telephone used as 2-way radios are not permitted within the Institution unless approved by the Director. If wireless cellular telephones are permitted, the user will not permit their use by any inmate.

.4 The Director may approve but limit the use of 2-way radios.

9 WORK HOURS

.1 Conform to Division 1.

.2 Work is not permitted during weekends and statutory holidays without the permission of the Director. A minimum of seven days advance notice will be required to obtain the required permission. In case of emergencies or other special circumstances, this advance notice may be waved by the Director.

10 OVERTIME WORK

.1 Conform to Division 1.

.2 Provide 48 hours advance notice to Director for all work to be performed after normal working hours of the Institution. Notify Director immediately if emergency work is required, such as to complete a concrete pour or make the construction site safe and secure.

11 TOOLS AND EQUIPMENT

.1 Maintain a complete list of all tools and equipment to be used during the construction project. Make this inventory available for inspection when required by the Institution.

.2 Throughout the construction project maintain up-to-date the list of tools and equipment specified above.

.3 Keep all tools and equipment under constant supervision, particularly power-driven and cartridge-driven tools, cartridges, files, saw blades, rod saws, wire, rope, ladders and any sort of jacking device.

.4 Store all tools and equipment in approved secure locations.

.5 Lock all tool boxes when not in use. Keys to remain in the possession of the employees of the contractor. Secure and lock scaffolding when not erected and when erected Secure in a manner agreed upon with the Institution designate.

.6 Report all missing or lost tools or equipment immediately to the Departmental Representative/Director.

.7 The Director will ensure that the security staff members carry out checks of the Contractor's tools and equipment against the list provided by the Contractor. These checks may be carried out at the following intervals:
- .1 At the beginning and conclusion of every work day or shift upon entering and exiting the Institution.
- .2 At any time when contractor is on Institution property.

.8 Certain tools/equipment such as cartridges and hacksaw blades are highly controlled items. The contractor will be given at the beginning of the day, a quantity that will permit one day's work. Used blades/cartridges will be returned to the Director's representative at the end of each day. Maintain up to date inventory of all used blades/cartridges.

.9 If propane or natural gas is used for heating the construction, the institution will require that the contractor supervise the construction site during non-working hours.

12 KEYS

.1 Security Hardware Keys.
- .1 Arrange with the security hardware supplier/installer to have the keys for the security hardware to be delivered directly to Institution, specifically the Security Maintenance Officer (SMO).
- .2 The SMO will provide a receipt to the Contractor for security hardware keys.
- .3 Provide a copy of the receipt to the Departmental Representative.

.2 Other Keys
- .1 Use standard construction cylinders for locks for his use during the construction period.
- .2 Issue instructions to employees and sub-trades, as necessary, to ensure safe custody of the construction set of keys.

.3 Upon completion of each phase of the construction, the CSC representative will, in conjunction with the lock manufacturer:
- .1 Prepare an operational keying schedule
- .2 Accept the operational keys and cylinders directly from the lock manufacturer.
- .3 Arrange for removal and return of the construction cores and install the operational core in all locks.

.4 Upon putting operational security keys into use, the PWGSC construction escort shall obtain these keys as they are required from the SMO and open doors as required by the Contractor. The Contractor shall issue instructions to his employees advising them that all security keys shall always remain with the PWGSC construction escort.

13 SECURITY HARDWARE

.1 Turn over all removed security hardware to the Director of the Institution for disposal or for safekeeping until required for re-installation.

14 PRESCRIPTION DRUGS

.1 Employees of the contractor who are required to take prescription drugs during the workday shall obtain approval of the Director to bring a one day supply only into the Institution.

15 SMOKING RESTRICTIONS

.1 Smoking is not permitted inside correctional facilities or outdoors within the perimeter of a correctional facility and persons must not possess unauthorized smoking items within the perimeter of a correctional facility.

.2 Persons in violation of this policy will be requested to immediately cease smoking or dispose of any unauthorized smoking items and, if they persist will be directed to leave the Institution.

.3 Smoking is permitted outside the perimeter of a correctional facility in an area designated by the Director.

16 CONTRABAND

.1 Weapons, ammunition, explosives, alcoholic beverages, drugs and narcotics are prohibited on institutional property.

.2 The discovery of contraband on the construction site and the identification of the person(s) responsible for the contraband shall be reported immediately to the Director.

.3 Contractors should be vigilant with both their staff and the staff of their sub-contractors and suppliers that the discovery of contraband may result in cancellation of the security clearance of the affected employee. Serious infractions may result in the removal of the company from the Institution for the duration of the construction.

.4 Presence of arms and ammunition in vehicles of contractors, sub-contractors and suppliers or employees of these will result in the immediate cancellation of security clearances for the driver of the vehicle.

17 SEARCHES

.1 All vehicles and persons entering institutional property may be subject to search.

.2 When the Director suspects, on reasonable grounds, that an employee of the Contractor is in possession of contraband, he may order that person to be searched.

.3 All employees entering the Institution may be subject to screening of personal effects for traces of contraband drug residue.

18 ACCESS TO AND REMOVAL FROM INSTITUTIONAL PROPERTY

.1 Construction personnel and commercial vehicles will not be admitted to the institution after normal working hours, unless approved by the Director.

19 MOVEMENT OF VEHICLES

.1 Escorted commercial vehicles may not be allowed to enter or leave the institution through the vehicle access gate during the regular “inmate count” occurring at breakfast, lunch and dinner hour as established by the Institution. Confirm “count” times with Director or Departmental Representative to reduce down times for deliveries to Institution and movement of contractors vehicles through Institution vehicle access gate.

.2 Construction vehicles will not be allowed to leave the Institution until an inmate count is completed.

.3 The contractor shall advise the Director twenty four (24) hours in advance to the arrival on the site of heavy equipment such as concrete trucks, cranes, etc.

.4 Vehicles being loaded with soil or other debris, or any vehicle considered impossible to search, must be under continuous supervision by CSC staff or PWGSC construction escorts working under the authority of the Director.

.5 Commercial vehicles will only be allowed access to institutional property when their contents are certified by the Contractor or his representative as being strictly necessary to the execution of the construction project.

.6 Vehicles shall be refused access to institutional property if, in the opinion of the Director, they contain any article which may jeopardize the security of the institution. Arrange with Director for parking of contractor's vehicles at minimum security Institutions.

.7 Private vehicles of construction employees will not be allowed within the security wall or fence of medium or maximum security institutions without the permission of the Director.

.8 With prior approval of the Director, a vehicle may be used in the morning and evening to transport a group of employees to the work site. This vehicle will not remain within the Institution the remainder of the day.

.9 With the approval of the Director, certain equipment may be permitted to remain on the construction site overnight or over the weekend. This equipment must be securely locked, with the battery removed. The Director may require that the equipment be secured with a chain and padlock to another solid object.

20 MOVEMENT OF CONSTRUCTION EMPLOYEES ON INSTITUTIONAL PROPERTY

.1 Subject to the requirements of good security, the Director will permit the Contractor and his employees as much freedom of action and movement as is possible.

.2 However, notwithstanding paragraph above, the Director may:
- .1 Prohibit or restrict access to any part of the institution.
- .2 Require that in certain areas of the institution, either during the entire construction project or at certain intervals, construction employees only be allowed access when accompanied by a member of the CSC security staff.

.3 During the lunch and coffee/health breaks, all employees will remain within the construction site. Employees are not permitted to eat in the officer's lounge and dining room.

21 SURVEILLANCE AND INSPECTION

.1 Construction activities and all related movement of personnel and vehicles will be subject to surveillance and inspection by CSC security staff members to ensure that established security requirements are met.

.2 CSC staff members will ensure that an understanding of the need to carry out surveillance and inspections, as specified above, is established among construction employees and maintained throughout the construction project.

22 STOPPAGE OF WORK

.1 The Director may request at any time that the contractor, his employees, sub-contractors and their employees not enter or leave the work site immediately due to a security situation occurring within the Institution. The contractor's site supervisor shall note the name of the staff member making the request and the time of the request and obey the order as quickly as possible.

.2 The contractor shall advise the Departmental Representative within 24 hours of this delay to the progress of the work.

23 CONTACT WITH INMATES

.1 Unless specifically authorized, it is forbidden to come into contact with inmates, to talk with them, to receive objects from them or to give them objects. Any employee doing any of the above will be removed from the site and his security clearance revoked.

.2 It is forbidden to take pictures of inmates, of CSC staff members or of any part of the Institution other than those required as part of this contract.

END OF SECTION

1.01 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 Departmental Representative.

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

1.02 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 Senior representatives of 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 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.
- .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
- .5 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .6 Owner provided products.

.7 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
.8 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
.9 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
.10 Monthly progress claims, administrative procedures, photographs, hold backs.
.11 Appointment of inspection and testing agencies or firms.
.12 Insurances, transcript of policies.

1.03 PROGRESS MEETINGS

.1 During course of Work and weeks prior to project completion, schedule progress meetings monthly.

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

.3 Notify parties minimum days prior to meetings.

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

2 PRODUCTS

2.01 NOT USED

.1 Not Used.

3 EXECUTION

3.01 NOT USED

.1 Not Used.

END OF SECTION

1.01 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.

1.02 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.

1.03 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.

1.04 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.

1.05 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 Slab on grade.
.6 Structural Steel.
.7 Interior Architecture (Walls, Floors and Ceiling).
.8 Plumbing.
.9 Lighting.
.10 Electrical.
.11 Piping.
.12 Controls.
.13 Heating, Ventilating, and Air Conditioning.
.14 Millwork.
.15 Fire Systems.
.16 Testing and Commissioning.

1.06 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.

1.07 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.

END OF SECTION

1.01 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.

1.02 SHOP DRAWINGS AND PRODUCT DATA

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

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

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

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

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

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

.7 Accompany submissions with transmittal letter containing:
- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

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

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

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

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

.12 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
- .2 Testing must have been within 3 years of date of contract award for project.

.13 Submit 6 electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
- .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
- .2 Certificates must be dated after award of project contract complete with project name.

.14 Submit electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.
- .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

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

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

.17 Submit 6 electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.18 Delete information not applicable to project.

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

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

1.03 SAMPLES

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

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

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

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

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

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

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

1.04 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic and hard copy of colour digital photography in jpg format, fine resolution monthly with progress statement and as directed by Departmental Representative.

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

.3 Number of viewpoints: 4 locations.
  .1 Viewpoints and their location as determined by Departmental Representative.

.4 Frequency of photographic documentation: weekly as directed by Departmental Representative.

1.05 CERTIFICATES AND TRANSCRIPTS

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

END OF SECTION

1.01 REFERENCE STANDARDS

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

.2 Province of Saskatchewan
  .1 Occupational Health and Safety Act, 1993, S.S. - Updated 2016.

1.02 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 electronic copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative and or 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 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 days after receipt of comments from Departmental Representative.

.7 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.

.8 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.

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

1.03 FILING OF NOTICE

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

1.04 SAFETY ASSESSMENT

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

1.05 MEETINGS

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

1.06 REGULATORY REQUIREMENTS

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

1.07 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.

1.08 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.

1.09 COMPLIANCE REQUIREMENTS

.1 Comply with Province of Saskatchewan Occupational Health and Safety Regulations.

1.10 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 Province 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 Health and Safety co-ordinator Safety Officer and follow procedures in accordance with Acts and Regulations of Province Territory having jurisdiction and advise Departmental Representative verbally and in writing.

1.11 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
- .1 Have working knowledge of occupational safety and health regulations.
- .2 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
- .3 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
- .4 Be on site during execution of Work and report directly to and be under direction of Registered Occupational Hygienist Certified Industrial Hygienist and or site supervisor.

1.12 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province 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 may stop Work if non-compliance of health and safety regulations is not corrected.

1.14 POWDER ACTUATED DEVICES

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

1.15 WORK STOPPAGE

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

END OF SECTION

1.01 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.

1.02 REFERENCES TO REGULATORY REQUIREMENTS

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

1.03 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.

.2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Departmental.

.3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Departmental Representative.

1.04 BUILDING SMOKING ENVIRONMENT

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

1.05 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

1.06 EASEMENTS AND NOTICES

.1 Owner 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.

END OF SECTION

1.01 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 or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

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

1.02 INDEPENDENT INSPECTION AGENCIES

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

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

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

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost. Pay costs for retesting and re-inspection.

1.03 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.

1.04 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.

1.05 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, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

1.06 REPORTS

.1 Submit 4 copies of inspection and test reports to Departmental Representative.

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

1.07 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as specified in other sections.

.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.

1.08 MILL TESTS

.1 Submit mill test certificates as requested or required within specification Sections.

END OF SECTION

1.01 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.02 DEWATERING

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

1.03 WATER SUPPLY

.1 Departmental Representative will provide continuous supply of potable water for construction use.

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

.3 Departmental Representative will pay for utility charges at prevailing rates.

1.04 TEMPORARY HEATING AND VENTILATION

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

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

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

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

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

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

.6 Permanent heating system of building, to not to be used when available. Be responsible for damage to heating system if use is permitted.

.7 On completion of Work for which permanent heating system is used, replace filters

.8 Ensure Date of Substantial Performance and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Departmental Representative.

.9 Pay costs for maintaining temporary heat, when using permanent heating system. Departmental Representative will pay utility charges when temporary heat source is existing building equipment.

.10 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
- .1 Conform with applicable codes and standards.
- .2 Enforce safe practices.
- .3 Prevent abuse of services.
- .4 Prevent damage to finishes.
- .5 Vent direct-fired combustion units to outside.

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

1.05 TEMPORARY POWER AND LIGHT

.1 Departmental Representative will payProvide and pay for temporary power during construction for temporary lighting and operating of power tools, to a maximum supply of 230 volts 30 amps.

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

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

.4 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.

1.06 TEMPORARY COMMUNICATION FACILITIES

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

1.07 FIRE PROTECTION

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

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

END OF SECTION

1.01 REFERENCE STANDARDS

.1 CSA Group (CSA)
- .1 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CSA-0121-M1978(R2003), Douglas Fir Plywood.
- .3 CAN/CSA-S269.2-M1987(R2003), Access Scaffolding for Construction Purposes.
- .4 CAN/CSA-Z321-96(R2001), Signs and Symbols for the Occupational Environment.

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

1.02 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 Indicate use of supplemental or other staging area.

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

.4 Remove from site all such work after use.

1.03 SCAFFOLDING

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

.2 Provide and maintain scaffolding, ladders and swing staging platforms

1.04 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.

1.05 CONSTRUCTION PARKING

.1 Parking will be permitted on site provided it does not disrupt Owner usage of facility.

.2 Provide and maintain adequate access to project site.

1.06 OFFICES

.1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.

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

.3 Subcontractors to provide their own offices as necessary. Direct location of these offices.
.1

1.07 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.

1.08 SANITARY FACILITIES

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

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

1.09 PROTECTION AND MAINTENANCE OF TRAFFIC

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

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

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

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

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

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

.7 Construct access and haul roads necessary.

.8 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.

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

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

.11 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative.

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

.13 Provide snow removal during period of Work.

.14 Remove, upon completion of work, haul roads designated by 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.

END OF SECTION

1.01 REFERENCE STANDARDS

.1 CSA Group (CSA)
.1 CSA-O121-[M1978(R2003)], Douglas Fir Plywood.

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

1.02 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.03 HOARDING

.1 Erect temporary enclosures using 38 x 89 mm construction grade lumber framing at 600 mm centres and 1200 x 2400 x 13 mm exterior grade fir plywood to CSA O121. Provide diamond mesh to one side of enclosure; weld sheets together to prevent tampering. Provide one 600mm x 600mm x 6mm Plexiglas viewing window as indicated.

.2 Apply plywood panels vertically with flush and butt joints.

.3 Provide one lockable pedestrian door as directed and conforming to security requirements.

.4 Paint enclosure in selected colours with one coat primer one coat exterior paint. Maintain enclosure in clean condition.

1.04 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.

.2 Provide as required by governing authorities.

1.05 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].

1.06 DUST TIGHT SCREENS

.1 Provide dust tight screens to localize dust generating activities, and for protection

of workers and finished areas of Work.

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

1.07 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 3 days prior to installation.

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

1.08 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

1.01 REFERENCE STANDARDS

.1 Within text of each specifications section, reference may be made to reference standards.

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

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

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

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

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

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

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

1.03 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.

1.04 TRANSPORTATION

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

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

1.05 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.

1.06 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.

1.07 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.

1.08 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.

1.09 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 and pedestrian and vehicular traffic.

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

END OF SECTION

1.01 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.

1.02 MATERIALS

.1 Required for original installation.

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

1.03 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.

1.04 EXECUTION

.1 Execute cutting, fitting, and patching 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 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00 - Firestopping full thickness of the construction element.

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

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

1.05 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

1.01 PROJECT CLEANLINESS

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

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

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

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

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

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

.7 Dispose of waste materials and debris off site.

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

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

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

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

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

1.02 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 including 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.

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

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

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

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

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

.14 Remove dirt and other disfiguration from exterior surfaces.

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

.16 Sweep and wash clean paved areas.

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

.18 Clean roofs, downspouts, and drainage systems.

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

.20 Remove snow and ice from access to building.

1.03 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

1.01 WASTE MANAGEMENT GOALS

.1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PWGSC's waste management goal and Contractor's proposed Waste Reduction Workplan for Construction, Renovation and /or Demolition (CRD) waste to be project generated.

.2 PWGSC's waste management goal: to divert a minimum 75 percent of total Project Waste from landfill sites. Prior to project completion provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced. The overall waste diversion goal for this project is 50%.

.3 Target percentage goals are achievable for waste diversion. Contractor to review and confirm Departmental Representative's Waste Audit acceptable values.

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

.5 Protect environment and prevent environmental pollution damage.

1.02 DEFINITIONS

.1 Approved/Authorized recycling facility: waste recycler approved by applicable provincial authority or other users of material for recycling approved by the Departmental Representative.

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

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

.4 Cost/Revenue Analysis Workplan (CRAW): based on information from Waste Reduction Workplan, and intended as financial tracking tool for determining economic status of waste management practices (Schedule E).

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

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

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

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

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

.10 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
- .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
- .2 Returning reusable items including pallets or unused products to vendors.

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

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

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

.14 Waste Audit (WA): detailed inventory of estimated quantities of waste materials that will be generated during construction, demolition, deconstruction and/or renovation. Involves quantifying by volume/weight amounts of materials and wastes that will be reused, recycled or landfilled. Refer to Schedule A.

.15 Waste Diversion Report: detailed report of final results, quantifying cumulative weights and percentages of waste materials reused, recycled and landfilled over course of project. Measures success against Waste Reduction Workplan (WRW) goals and identifies lessons learned.

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

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

1.03 DOCUMENTS

.1 Post and maintain in visible and accessible area at job site, one copy of following documents:
- .1 Waste Audit (Schedule A).
- .2 Waste Reduction Workplan (Schedule B).
- .3 Waste Source Separation Program.
- .4 Schedules A B completed for project.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prepare and submit following prior to project start-up:
- .1 1 copy and 1 electronic copy of completed Waste Audit (WA): Schedule A.
- .2 1 copy and 1 electronic copy of completed Waste Reduction Workplan (WRW): Schedule B.
- .3 1 copy and 1 electronic copy of Cost/Revenue Analysis Workplan (CRAW): Schedule E.
- .4 1 copy and 1 electronic copy of Waste Source Separation Program (WSSP).

.3 Prepare and submit on monthly basis, throughout project or at intervals agreed to by Departmental Representative the following:
- .1 Receipts, scale tickets, waybills, and/or waste disposal receipts that show quantities and types of materials reused, recycled, or disposed of.
- .2 Updated Waste Materials Tracking form (Schedule D).
- .3 Written bi-weekly monthly summary report detailing cumulative amounts of waste materials reused, recycled and landfilled, and brief status of ongoing waste management activities.

.4 Submit prior to final payment the following:
- .1 Waste Diversion Report, indicating final quantities in tones by material types salvaged for reuse, recycling or disposal in landfill and recycling centres, re-use depots, landfills and other waste processors that received waste materials
- .2 Provide receipts, scale tickets, waybills, waste disposal receipts that confirm quantities and types of materials reused, recycled or disposed of and destination.

1.05 WASTE REDUCTION WORKPLAN (WRW)

.1 Prepare and submit WRW (Schedule B) at least 10 days prior to project start-up.

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

.3 WRW should include but not limited to:
- .1 Applicable regulations.
- .2 Specific goals for waste reduction, identify existing barriers and develop strategies to overcome them.
- .3 Destination of materials identified.
- .4 Deconstruction/disassembly techniques and schedules.
- .5 Methods to collect, separate, and reduce generated wastes.
- .6 Location of waste bins on-site.
- .7 Security of on-site stock piles and waste bins.
- .8 Protection of personnel, sub-contractors.

.9 Clear labelling of storage areas.
.10 Training plan for contractor and sub-contractors.
.11 Methods to track and report results reliably (Schedule D).
.12 Details on materials handling and removal procedures.
.13 Recycler and reclaimer requirements.
.14 Quantities of materials to be salvaged for reuse or recycled and materials sent to landfill.
.15 Requirements for monitoring on-site wastes management activities.

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

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

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

1.06 WASTE SOURCE SEPARATION PROGRAM (WSSP)

.1 As part of Waste Reduction Workplan, prepare WSSP prior to project start-up.

.2 WSSP will detail methodology and planned on-site activities for separation of reusable and recyclable materials from waste intended for landfill.

.3 Provide list and drawings of locations that will be made available for sorting, collection, handling and storage of anticipated quantities of reusable and recyclable materials.

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

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

.6 Provide training for contractor sub-contractors and workers in handling and separation of materials for reuse and/or recycling.

.7 Locate separated materials in areas which minimizes material damage.

.8 Clearly and securely label containers to identify types/conditions of materials accepted and assist contractor sub-contractors and workers in separating materials accordingly.

.9 Monitor on-site waste management activities by conducting periodic site inspections to verify: state of signage, contamination levels, bin locations and condition, personnel participation, use of waste tracking forms and collection of waybills, receipts and invoices.

.10 On-site sale of salvaged materials is not permitted unless authorized in writing by Departmental Representative and provided that site safety regulations and security requirements are adhered to.

1.07 USE OF SITE AND FACILITIES

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

.2 Maintain security measures established by facility provide temporary security measures approved by Departmental Representative.

1.08 WASTE PROCESSING SITES

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

1.09 QUALITY ASSURANCE

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

.1 Date, time and location will be arranged by Departmental Representative.

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

1.10 STORAGE, HANDLING AND PROTECTION

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

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

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

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

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

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

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

.8 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.
- .1 On-site source separation is recommended.
- .2 Remove co-mingled materials to off site processing facility for separation.
- .3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.
- .4 Materials reused on-site are considered to be diverted from landfill and as such are to be included in all reporting.

1.11 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

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

.3 Keep records of construction waste including:
- .1 Number and size of bins.
- .2 Waste type of each bin.
- .3 Total tonnage generated.
- .4 Tonnage reused or recycled.
- .5 Reused or recycled waste destination.

.4 Remove materials on-site as Work progresses.

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

1.12 SCHEDULING

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

1.13 APPLICATION

.1 Do Work in compliance with WRW and WSSP.

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

1.14 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .1 Leave Work area clean at end of each day.

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .2 Source separate materials to be reused/recycled into specified sort areas.

1.15 DIVERSION OF MATERIALS

.1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
- .1 Mark containers or stockpile areas.
- .2 Provide instruction on disposal practices.

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

1.16 WASTE DIVERSION REPORT

.1 At completion of Project, prepare written Waste Diversion Report indicating quantities of materials reused, recycled or disposed of as well as the following:
- .1 Identify final diversion results and measure success against goals from Waste Reduction Workplan.
- .2 Compare final quantities/percentages diverted with initial projections in Waste Audit and Waste Reduction Workplan and explain variances.
  - .1 Supporting documentation.
  - .2 Waybills and tracking forms.
  - .3 Description of issues, resolutions and lessons learned.

END OF SECTION

1.01 ADMINISTRATIVE REQUIREMENTS

.1 Acceptance of Work Procedures:
- .1 Contractor's Inspection: 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 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 and balanced and fully operational.
  - .4 Certificates required by Boiler Inspection Branch Fire Commissioner Utility companies: submitted.
  - .5 Operation of systems: demonstrated to Owner's personnel.
  - .6 Work: complete and ready for final inspection.
- .4 Final Inspection:
  - .1 When completion tasks are done, request final inspection of Work by Departmental Representative.
  - .2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

1.02 FINAL CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.
- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1.01 ADMINISTRATIVE REQUIREMENTS

.1 Pre-warranty Meeting:

.2 Convene meeting one week prior to contract completion with contractor's representative and Departmental Representative, in accordance with Section 01 31 19 - Project Meetings to:

.1 Verify Project requirements.

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

.3 Departmental Representative to establish communication procedures for:

.1 Notifying construction warranty defects.

.2 Determine priorities for type of defects.

.3 Determine reasonable response time.

.4 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.

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

1.02 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.

1.03 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, process flow, 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.

.9 Provide 1:1 scaled CAD files in dwg format on CD.

1.04 CONTENTS - PROJECT RECORD DOCUMENTS

.1 Table of Contents for Each Volume:
.1 Provide title of project.
.2 Date of submission.
.3 Names, Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
.4 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.

1.05 AS -BUILT DOCUMENTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative one record copy of:
.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Change Orders and other modifications to Contract.
.5 Reviewed shop drawings, product data, and samples.
.6 Field test records.
.7 Inspection certificates.
.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction.
.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.

1.06 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Record information on set of blue 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, inspection certifications, field test records, required by individual specifications sections.

.7 Provide digital photos, if requested, for site records.

1.07 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 co-ordination drawings, with installed colour coded piping diagrams.

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

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

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

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

1.08 MATERIALS AND FINISHES

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

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

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

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

1.09 MAINTENANCE MATERIALS

.1 Spare Parts:
- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site location as directed; place and store.
- .4 Receive and catalogue items.
  - .1 Submit inventory listing to Departmental Representative DCC Representative Consultant.
  - .2 Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

.2 Extra Stock Materials:
- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site location as directed; place and store.
- .4 Receive and catalogue items.
  - .1 Submit inventory listing to Departmental Representative DCC Representative Consultant.
  - .2 Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

.3 Special Tools:
- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to site location as directed; place and store.
- .4 Receive and catalogue items.
  - .1 Submit inventory listing to Departmental Representative DCC Representative Consultant.
  - .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.

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 Owner'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 DCC Representative Consultant.

.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..
- .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.

END OF SECTION

1.01 ADMINISTRATIVE REQUIREMENTS

.1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date substantial completion.

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

.3 Preparation:
- .1 Verify conditions for demonstration and instructions comply with requirements.
- .2 Verify designated personnel are present.
- .3 Ensure equipment has been inspected and put into operation.
- .4 Ensure testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and equipment and systems are fully operational.

.4 Demonstration and Instructions:
- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled agreed upon times, at the equipment designated location.
- .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
- .3 Review contents of manual in detail to explain aspects of operation and maintenance.
- .4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

1.02 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.

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

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

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

1.03 QUALITY ASSURANCE

.1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
- .1 Instruct Owner's personnel.
- .2 Provide written report that demonstration and instructions have been completed.

END OF SECTION

1.01 SUMMARY

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

.2 Acronyms:
- .1 AFD - Alternate Forms of Delivery, service provider.
- .2 BMM - Building Management Manual.
- .3 Cx - Commissioning.
- .4 EMCS - Energy Monitoring and Control Systems.
- .5 O&M - Operation and Maintenance.
- .6 PI - Product Information.
- .7 PV - Performance Verification.
- .8 TAB - Testing, Adjusting and Balancing.

1.02 GENERAL

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
- .1 Verify installed equipment, systems and integrated systems operate in accordance with Contract Documents and design criteria and intent.
- .2 Ensure appropriate documentation is compiled into the BMM.
- .3 Effectively train O&M staff.

.2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
- .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
- .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

.3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.03 COMMISSIONING OVERVIEW

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

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

.3 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages 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.

.4 Departmental Representative will issue Interim Acceptance Certificate when:
- .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
- .2 Equipment, components, systems and integrated systems have been fully commissioned and functional as per design intent within the context of the Owner Requirement".
- .3 Completion of Training session for Operational and Maintenance staff"
- .4 Final O&M and Training Manual receive, review and approve by Departmental Representative for suitability".

1.04 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.

1.05 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 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.
.10 Ensure "As-Built" system schematics are available.

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

1.06 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.

1.07 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
.2 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.
.3 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
.4 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 8 weeks prior to start of Cx.
.5 Provide additional documentation relating to Cx process required by Departmental Representative.

1.08 COMMISSIONING DOCUMENTATION

.1 Departmental Representative to review and approve Cx documentation.

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

1.09 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: 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 Departmental Representative 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 accepted simulated 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 Departmental Representative to witness activities and verify results.

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 Number and location to be at discretion of Departmental Representative.

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

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

.4 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 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

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

1.32 OCCUPANCY

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

1.33 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.

1.34 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application tolerances:
- .2 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.

1.35 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.

END OF SECTION

1 General

1.01 SUMMARY

.1 This Section includes procedural requirements for cutting and patching.

1.02 DEFINITIONS

.1 **Cutting:** Removal of existing construction necessary to permit installation or performance of other Work.

.2 **Patching:** Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.03 SUBMITTALS

.1 Comply with requirements of Section 01 33 00.

.2 Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

.1 Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.

.2 Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.

.3 Products: List products to be used and firms or entities that will perform the Work.

.4 Dates: Indicate when cutting and patching will be performed.

.5 Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.

.6 Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure to the Departmental Representative prior to making cuts or modifications.

.7 Departmental Representative’s Acceptance: Obtain acceptance of cutting and patching proposal before cutting and patching. Review and acceptance of cutting and patching proposal does not waive right to later require removal and replacement of unsatisfactory work.

1.04 QUALITY ASSURANCE

.1 Structural Elements: Do not cut and patch structural elements in a manner that could change their load carrying capacity or load deflection ratio.

.2 Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety, including but not limited to the following:

.1 Primary operational systems and equipment.
.2 Air or smoke barriers.
.3 Fire protection systems.
.4 Control systems.
.5 Communication systems.
.6 Electrical wiring systems.

.3 Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety, including but not limited to the following:

.1 Water, moisture, or vapour barriers.
.2 Equipment supports.
.3 Piping, ductwork, vessels, and equipment.
.4 Noise and vibration control elements and systems.

.4 Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Departmental Representative’s opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm, including but not limited to the following:

.1 Matched veneer woodwork.
.2 Preformed metal panels.
.3 Firestopping and smokeseals.
.4 Finished flooring.
.5 Finished coatings.
.6 Wall covering.
.7 HVAC enclosures, cabinets, or covers.

.5 Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.05 WARRANTY

.1 Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

2 Products

2.01 MATERIALS

.1 General: Comply with requirements specified in other Sections of these Specifications.

.2 Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible:

.1 If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

3 Execution

3.01 EXAMINATION

.1 Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed:

.1 Provide X-ray or other approved methods to determine locations of existing services and reinforcing in existing concrete slabs and block walls before cutting and renovations. Advise Departmental Representative of findings before proceeding with the Work and revise penetration locations as required and directed by Departmental Representative. Existing concrete slab thickness is to be confirmed by Contractor

.2 Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

.3 Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.02 PREPARATION

.1 Temporary Support: Provide temporary support as required.

.2 Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

.3 Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

.4 Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas.

3.03 PERFORMANCE

.1 General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay:

.1 Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

.2 Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations:

.1 In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
.2 Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
.3 Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond core drill.
.4 Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
.5 Proceed with patching after construction operations requiring cutting are complete.

.3 Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications:

.1 Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
.2 Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

.3 Floors and Walls: Where walls or partitions that are removed extend from one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, colour, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.

.4 Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

.5 Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even plane surface of uniform appearance.

END OF SECTION

1 GENERAL

1.01 SUMMARY

.1 This Section includes the following:
- .1 Demolition and removal of selected portions of interior building components and finishes.
- .2 Repair procedures for selective demolition operations.

.2 This section does not include the following:
- .1 Removal of hazardous materials or asbestos abatement.
- .2 Demolition of exterior building components or structural elements.
- .3 Mechanical or electrical equipment, except as required to make minor modifications to allow the work to be completed.

.3 Drawings contain details that suggest directions for solving some of the major demolition and removal requirements for this project; Contractor is required to develop these details further by submitting a demolition plan prepared by a professional engineer employed by the Contractor.

1.02 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)
- .1 ANSI A10.8 2011, Safety Requirements for Scaffolding

.2 American Society for Testing and Materials (ASTM):
- .1 ASTM C 475/C 475M-15, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board

.3 National Fire Protection Association (NFPA)
- .1 NFPA 241 13, Standard for Safeguarding Construction, Alteration, and Demolition Operations

1.03 DEFINITIONS

.1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.

.2 Remove and Salvage: Detach items from existing construction and deliver them to Representative Owner ready for reuse.

.3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

.4 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled.

1.04 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate with Departmental Representative for the material ownership as follows:
- .1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Departmental Representative 's property, demolished materials shall become Contractor's property and shall be removed from Project site.
- .2 Coordinate selective demolition work so that work of this Section adheres to aesthetic criteria established by the Drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.

.2 Pre Demolition Meeting: Convene pre-installation meeting 1 week prior to beginning work of this Section and on-site installation, with Contractor and Departmental Representative Consultant in accordance with Section 01 31 19 - Project Meetings to:
- .1 Confirm extent of salvaged and demolished materials
- .2 Review Contractor's demolition plan
  - .1 Verify existing site conditions adjacent to demolition work
  - .2 Coordination with other construction sub trades

.3 Hold project meetings every week month.

.4 Ensure key personnel site supervisor project manager subcontractor representatives attend.

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

1.05 ACTION AND INFORMATION SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:
- .1 Schedule of Selective Demolition Activities: Coordinate with Section 01 32 16.06 - Construction Progress Schedule, and indicate the following:
  - .1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
  - .2 Coordinate with Departmental Representative 's ongoing site operations, and limit the number of interruptions during regular business hours.
  - .3 Interruption of utility services.
  - .4 Coordination for shutoff, capping, and continuation of utility services.
  - .5 Use of elevator and stairs.
  - .6 Locations of temporary partitions and means of egress, including for others affected by selective demolition operations.
  - .7 Coordination with Departmental Representative 's continuing occupancy of portions of existing building.
- .2 Demolition Plan: Submit a plan of demolition area indicating extent of

temporary facilities and supports, methods of removal and demolition prepared by a professional engineer in accordance with requirements of Authority Having Jurisdiction, and as follows:

.1 Proposed Dust Control and Noise Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Departmental Representative reserves the right to make modifications where proposed methods interfere with the Departmental Representative 's ongoing operation

.2 Inventory: Submit a list of items that have been removed and salvaged after selective demolition is complete.

.3 Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

.4 Pre demolition Photographs: Submit photographs indicating existing conditions of adjoining construction and site improvements prior to starting Work. Include finish surfaces that may be misconstrued as damage caused by selective demolition operations.

.2 Informational Submittals: Provide the following submittals when requested by the Departmental Representative:

.1 Qualification Data: Submit information for companies and personnel indicating their capabilities and experience to perform work of this Section including; but not limited to, lists of completed projects with project names and addresses, names and addresses of architects and owners, for work of similar complexity and extent.

1.06 QUALITY ASSURANCE

.1 Regulatory Requirements: Perform work as follows; use most restrictive requirements where differences occur between the municipal, provincial and federal jurisdictions:

.1 Provincial and Federal Requirements: Perform work in accordance with governing environmental notification requirements and regulations of the Authority Having Jurisdiction.

.2 Municipal Requirements: Perform hauling and disposal operations in accordance with regulations of Authority Having Jurisdiction.

.2 Qualifications: Provide proof of qualifications when requested by Departmental Representative:

.1 Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project:

.1 Conform to the provincial Occupational Health and Safety Act and Regulation.

.2 Conform to Workers' Compensation Board Regulations.

.3 Conform to City of local municipal bylaws and regulations governing this type of work.

1.07 SITE CONDITIONS

.1 Representative Owner will occupy portions of building immediately adjacent to selective demolition area:
- .1 Conduct selective demolition so that building operations will not be disrupted.
- .2 Provide not less than 72 hours notice to Departmental Representative of activities that will affect building operations.

.2 Maintain access to existing means of egress, walkways, corridors, exits, and other adjacent occupied or used facilities in accordance with Section 01 35 16:
- .1 Do not close or obstruct means of egress, walkways, corridors, exits, or other occupied or used facilities without written acceptance from authorities having jurisdiction.

.3 Departmental Representative assumes no responsibility for condition of areas to be selectively demolished:
- .1 Conditions existing at time of Pre Bid Site Review will be maintained by Departmental Representative as far as practical.

.4 Discovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in the Work; immediately notify Representative Consultant if materials suspected of containing hazardous substances are encountered and perform the following activities:
- .1 Refer to Section 01 41 00 - Regulatory Requirements for directives associated with specific material types.
- .2 Hazardous materials will be as defined in the Hazardous Materials Act.
- .3 Hazardous materials will be removed by Representative Owner before start of the Work.
- .4 If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Representative Owner. Hazardous materials will be removed by Representative Owner under a separate contract or as a change to the Work.

2 PRODUCTS

2.01 TEMPORARY SUPPORT STRUCTURES

.1 Design temporary support structures required for demolition work and underpinning and other foundation supports necessary for the project using a qualified professional engineer registered or licensed in province of the Work.

2.02 DESCRIPTION

.1 This section of the Work includes, but is not necessarily limited to, the following:
- .1 Demolition, removal completely from site, and disposal of all identified components, materials, equipment and debris
- .2 Selective demolition to allow new walls, bulkheads, ceilings and other materials to meet existing construction as indicated
- .3 All material from demolition shall be removed from site immediately with no salvage, selling, sorting or burning permitted on site

.4 Retain items indicated on drawings for re use in new construction

2.03 DEBRIS

.1 Make all arrangements for transport and disposal of all demolished materials from the site.

2.04 EQUIPMENT

.1 Provide all equipment required for safe and proper demolition of the building interiors indicated.

2.05 REPAIR MATERIALS

.1 Use repair materials identical to existing materials:
- .1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
- .2 Use a material whose installed performance equals or surpasses that of existing material.
- .3 Comply with material and installation requirements specified in individual Specification Sections.

.2 Floor Patching and Levelling Compounds: Cement based, trowelable, self levelling compounds compatible with specified floor finishes; gypsum based products are not acceptable for work of this Section.

.3 Concrete Unit Masonry: Lightweight concrete masonry units, and mortar, cut and trimmed to fit existing opening to be filled. Provide standard hollow core units, square end units and bond beam units as indicated on drawings.

.4 Prefinished Sheet Steel: Prefinished sheet steel, colour to match existing radiation cabinets, bent and profiled to match existing radiation cabinets.

.5 Gypsum Board Patching Compounds: Joint compound to ASTM C 475/C 475M, bedding and finishing types thinned to provide skim coat consistency to patch and prepare existing gypsum board walls ready for new finishes in accordance with Section 09 21 16 - Gypsum Board Systems.

3 EXECUTION

3.01 EXAMINATION

.1 Verify that utilities have been disconnected and capped.

.2 Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

.3 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

.4 Notify the Departmental Representative where existing mechanical, electrical, or structural elements conflict with intended function or design:
- .1 Investigate and measure the nature and extent of conflict and submit a written report to Representative Consultant.
- .2 Representative Consultant will issue additional instructions or revise drawings as required to correct conflict.

.5 Perform surveys as the work progresses to detect hazards resulting from selective demolition activities.

3.02 UTILITY SERVICES

.1 Coordinate existing services indicated to remain and protect them against damage during selective demolition operations.

.2 Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
- .1 Arrange to shut off affected utilities with utility companies.
- .2 If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
- .3 Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
- .4 Cut off pipe or conduit to a minimum of 25 mm below slab, and remove concrete mound. Patch concrete using cementitious grout.

.3 Coordinate with Mechanical and Electrical Divisions for shutting off, disconnecting, removing, and sealing or capping utilities.

.4 Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.03 PREPARATION

.1 Identify and mark all equipment and materials identified to be retained by Departmental Representative or to be re used in subsequent construction. Separate and store items to be retained in an area away from area of demolition and protect from accidental disposal.

.2 Post warning signs on electrical lines and equipment that must remain energized to serve other areas during period of demolition.

.3 Confirm that all electrical and telephone service lines entering buildings are not disconnected.

.4 Do not disrupt active or energized utilities crossing the demolition site.

.5 Provide and maintain barricades, warning signs, protection for workmen and the public during the full extent of the Work. Read drawings carefully to ascertain extent of protection required.

.6 Mark all materials required to be re used, store in a safe place until ready for re installation.

.7 Adjust all junction boxes, receptacles and switch boxes flush with new wall construction where additional layers to existing construction are indicated.

.8 Remove permanent marker lines used or found on exposed surfaces and at surfaces indicated for subsequent finish materials. Mechanically remove permanent marker lines and associated substrates where permanent marker lines occur and patch surface. Sealing or priming over permanent marker lines is not acceptable.

3.04 CONCRETE SLAB REINFORCING

.1 Locate location of reinforcing steel in concrete slabs prior to cutting or coring using non destructive, non ionizing radio frequency locators.

.2 Core concrete slabs to avoid reinforcing steel, electrical conduit or water pipes; adjust core location and coordinate with Engineer where slab features interfere with core drilling.

.3 Notify the Departmental Representative immediately for further instructions where coring or cutting will damage existing slab features.

3.05 SELECTIVE DEMOLITION

.1 Demolish and dismantle work in a neat and orderly manner and in strict accordance with all regulations.

.2 At end of each day's work, leave Work in safe condition so that no part is in danger of toppling or falling.

.3 Demolish in a manner to minimize dusting and to prevent migration of dust.

.4 Selling or burning of materials on the site is not permitted.

.5 Remove concrete bases by cutting and chipping, take precautions against slab cracking and degradation. Grind edges smooth, fill and make level with self levelling grout.

.6 Fill all openings in concrete block walls with concrete masonry units, coursing to match existing, prepare ready to receive new finishes to match existing.
- .1 Provide bond beams in new openings cut into existing concrete masonry unit walls.
- .2 Provide finished end masonry units to patch and repair for new jamb sections in existing concrete masonry unit walls.

.7 Fill all openings in gypsum board walls with gypsum board and steel framing to match existing, skim coat to make wall smooth and even.

.8 Remove all wall coverings scheduled for demolition. Patch and repair wall surfaces with skim coat of gypsum board joint compound leaving wall surfaces

smooth and even ready for new wall finishes.

.9 Patch and repair all walls, floor and ceilings damaged during demolition with material matching adjacent walls, prepare ready for new finishes.

.10 Patch and repair all radiation cabinets, mechanical equipment and electrical fixtures damaged or exposed during demolition to match adjacent finished surfaces.

3.06 PATCHING AND REPAIRING

.1 Floors and Walls:
.2 Where walls or partitions that are demolished extend from one finished area into another, patch and repair floor and wall surfaces in the new space.
.3 Provide a level and smooth surface having uniform finish colour, texture, and appearance.
.4 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.
.5 Patch with durable seams that are as invisible as possible.
.6 Provide materials and comply with installation requirements specified in other Sections of these Specifications.
.7 Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
.8 Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

.2 Ceilings: patch, repair, or re hang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.07 PROTECTION

.1 Prevent debris from blocking drainage inlets and systems and ground draining, and protect material and electrical systems and services that must remain in operation.

.2 Arrange demolition and shoring work so that interference with the use of adjoining areas by the Representative Owner and users is minimized.

.3 Maintain safe access to and egress from occupied areas adjoining.

.4 Provide and maintain fire prevention equipment and alarms accessible during demolition.

3.08 CLEANING

.1 Develop Construction Waste Management Plan related to Work of this Section and in accordance and Section 01 74 19 - Waste Management and Disposal.

.2 Waste Management: Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal, and as

follows:

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

.3 Divert excess materials from landfill to site approved Representative Consultant.

.4 Promptly as the Work progresses, and on completion, clean up and remove from the site all rubbish and surplus material. Remove rubbish resulting from demolition work daily.

.5 Maintain access to exits clean and free of obstruction during removal of debris.

.6 Keep surrounding and adjoining roads, lanes, sidewalks, municipal rights of way clean and free of dirt, soil or debris that may be a hazard to vehicles or persons.

END OF SECTION

1 General

1.01 REFERENCES

.1 CSA International

.1 CAN/CSA-A165 SERIES-04(R2009), CSA Standards on Concrete Masonry Units covers: A165.1, A165.2, A165.3.

.2 CAN/CSA-A179-04(R2009), Mortar and Grout for Unit Masonry.

.3 CAN/CSA-A370-04(R2009), Connectors for Masonry.

.4 CAN/CSA A371-04(R2009), Masonry Construction for Buildings.

.5 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.

1.02 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 masonry productsfromnicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.01 MASONRY UNITS

.1 Standard concrete block units: to CAN/CSA-A165 Series (CAN/CSA-A165.1).

.1 Classification: H/15/A/M

.2 Size: modular.

2.02 REINFORCEMENT AND CONNECTORS

.1 Bar reinforcement: to CAN/CSA-A371, Grade 400.

.2 Wire reinforcement: to CAN/CSA-A371, truss type.

2.03 MORTAR AND GROUT

.1 Mortar: to CAN/CSA-A179.

.1 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.

.2 Colour: ground coloured natural aggregates or metallic oxide pigments.

.2 Mortar Type: S,

.3 Grout: to CAN/CSA-A179, Table 3.

3 Execution

3.01 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.

.1 Visually inspect substrate in presence of Departmental Representative DCC Representative Consultant.

.2 Inform Departmental Representative DCC Representative Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative DCC Representative Consultant.

3.02 INSTALLATION

.1 Do masonry work in accordance with CAN/CSA-A371 except where specified otherwise.

.1 Bond: running stretcher bond with vertical joints in perpendicular alignment and centred on adjacent stretchers above and below.

.2 Coursing height: 200 mm for one block and one joint for three bricks and three joints.

.3 Jointing: cut joints flush tool where exposed or where paint or other finish coating is specified to provide smooth compressed concave surface.

.2 Build masonry plumb, level, and true to line, with vertical joints in alignment.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.03 CONSTRUCTION

.1 Exposed masonry:

.1 Remove chipped, cracked, and otherwise damaged units, in exposed masonry and replace with undamaged units.

.2 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects. Make cuts straight, clean, and free from uneven edges.

.2 Building-in:

.1 Install masonry connectors and reinforcement where indicated on drawings.

.2 Build in items required to be built into masonry.

.3 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

.4 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.

.5 Install loose steel lintels over openings where indicated.

.3 Concrete block lintels:

.1 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.

.2 End bearing: not less than 200 mm as indicated on drawings.

3.04 REINFORCING AND CONNECTING

.1 Install masonry connectors and reinforcement in accordance with CAN/CSA-A370, CAN/CSA-A371 and CSA S304.1 unless indicated otherwise.

.2 Prior to placing concrete mortar grout, obtain Departmental Representative's DCC Representative's Consultant's approval of placement of reinforcement and connectors.

3.05 BONDING AND TYING

.1 Bond walls of two or more wythes using metal connectors in accordance with CAN/CSA-A371, CSA S304.1 and as indicated.

.2 Tie masonry veneer to backing in accordance with NBC, CAN/CSA-A371, CSA S304.1 and as indicated.

3.06 REINFORCED LINTELS AND BOND BEAMS

.1 Reinforce masonry lintels and bond beams as indicated.

.2 Place and grout reinforcement in accordance with CAN/CSA-A179, CAN/CSA-A371 and CSA S304.1.

3.07 GROUTING

.1 Grout masonry in accordance with CAN/CSA-A179, CAN/CSA-A371 and CSA S304.1 and as indicated.

3.08 ANCHORS

.1 Supply and install metal anchors as indicated.

3.09 LATERAL SUPPORT AND ANCHORAGE

.1 Supply and install lateral support and anchorage in accordance with CSA S304.1 and as indicated.

3.10 SITE TOLERANCES

.1 Tolerances of CAN/CSA-A371 apply.

3.11 PROTECTION

.1 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

.2 Repair damage to adjacent materials caused by masonry products installation.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 ASTM International
- .1 ASTM A 53/A 53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- .2 ASTM A 269M-15a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- .3 ASTM A 307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 CSA Group
- .1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA S16-14, Design of Steel Structures.
- .4 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
- .5 CSA W59-13, Welded Steel Construction (Metal Arc Welding) Metric.

.3 The Master Painters Institute (MPI)
- .1 Architectural Painting Specification Manual - current edition.

.4 ULC Standards
- .1 UL 2768-2011, Architectural Surface Coatings.
- .2 UL 2760-2011, Surface Coatings - Recycled Water-borne.

1.02 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 sections plates pipe tubing bolts and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Shop Drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Saskatchewan, Canada.
- .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.03 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.04 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 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

2.01 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21, Grade 300W 350W.

.2 Steel pipe: to ASTM A 53/A 53M standard weight extra strong double extra strong, black galvanized finish.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A 307.

.6 Stainless steel tubing: to ASTM A 269, Type 302 commercial grade seamless welded with AISI No. 4 finish.

.7 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.02 FABRICATION

.1 Refer to Drawings for required metal fabrications.

.2 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.3 Use self-tapping shake-proof flat round oval headed screws on items requiring assembly by screws or as indicated.

.4 Where possible, fit and shop assemble work, ready for erection.

.5 Exposed welds continuous for length of each joint. File or grind exposed welds smooth and flush.

2.03 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m² to CAN/CSA-G164.

.2 Shop coat primer: MPI- INT EXT 5.1A MPI- INT EXT 5.1B in accordance with chemical component limits and restrictions requirements and VOC limits of UL 2768 UL 2760 GS-11.

.3 Zinc primer: zinc rich, ready mix to MPI-INT EXT 5.2C in accordance with chemical component limits and restrictions requirements and VOC limits of CCD-047a CCD-048 GS-11.

2.04 ISOLATION COATING

.1 Isolate aluminum from following components, by means of bituminous paint:
- .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
- .2 Concrete, mortar and masonry.
- .3 Wood.

2.05 SHOP PAINTING

.1 Primer: VOC limit 250 g/L maximum to GS-11 UL 2768 UL 2760.

.2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Paint when temperature minimum 7 degrees C.

.4 Clean surfaces to be field welded; do not paint.

3 EXECUTION

3.01 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts acceptable for metal fabrications installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions remedied and after receipt of written approval to proceed from Departmental Representative.

3.02 ERECTION - GENERAL

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Departmental Representative DCC Representative Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Supply components for work by other trades in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CSA S16 orWeld field connection.

.7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of:
.1 Primer: maximum VOC limit 250 g/L to GS-11.

.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.
.1 Primer: maximum VOC limit 250 g/L to GS-11.

3.03 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
.1 Leave Work area clean at end of each day.

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.04 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

1. General

1.01 INTENT

.1 intent of this Section is to include requirements for patching and repair of existing roofing membrane damaged due to new construction and renovations to existing building.

.2 For Bidding Purposes, assumptions have been made as to the type and condition of existing membrane and substrates. If upon further examination, it is determined that the intent of this specification cannot be met, provide Departmental Representative with written proposal outlining extent of work required and associated costs.

1.02. APPLICATOR QUALIFICATIONS

.1 A single applicator shall perform the work of this Section; and shall be a firm qualified to do such work, employing competent personnel and using adequate plant and equipment to execute the extent of work required.

.2 A crew of qualified tradesmen shall be defined as follows:

.1 A foreman holding a three year Apprenticeship Certificate.

.2 A least one other holding a three year Apprenticeship Certificate.

.3 The balance of the crew shall have completed some portion of the apprenticeship program and shall have submitted application to the Department of Advanced Education and Manpower for certification as a “Roofer”.

.4 A Journeyman Certificate is acceptable in lieu of an Apprenticeship Certificate.

1.03 REGULATORY REQUIREMENTS

.1 Comply with all codes and regulations as required by authority having jurisdiction.

1.04. REFERENCE DOCUMENTS

.1 Conform to the requirements of the Canadian Roofing Contractors' Association Ltd. (CRCA) Roofing Specification Manual.

.2 Notwithstanding the foregoing, where there are differences between this specification and CRCA requirements, this specification shall govern.

1.05. PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Deliver all materials in original, unopened, packaging and containers with manufacturer’s labels and seals intact. Ensure manufacturer’s name, brand, material mass, specification and lot numbers are indicated on labeling.

.2 Store materials in ventilated, weatherproof enclosures and protect from all types of moisture. Store roll materials on end.

.3 Avoid prolonged exposure of light or heat sensitive materials to sunlight.

.4 Do not store materials on roof in concentrations that exceed design live loads of roof structure.

1.06. ENVIRONMENTAL REQUIREMENTS

.1 Proceed with roofing work only when existing and anticipated weather conditions will allow installation of system without undue interruption.

.2 Do not proceed with work during rainy or high windy conditions or when such conditions are anticipated.

1.07. PROTECTION

.1 Protect work during all aspects of roofing application. Protect adjacent surfaces from damage by roofing work.

.2 Where hoisting is necessary, hang tarpaulins or other protective material to protect walls and other building finishes from damage.

.3 Place plywood runways over roofing work to enable movement of materials and other traffic.

.4 Locate kettles so that smoke will not discolour building finishes.

.5 Locate adequate fire extinguishers near kettles being used on or in the building and on roof when torches are being used.

1.08. QUALITY ASSURANCE

.1 Roofing system must be installed by an installer authorized by the membrane manufacturer.

.2 Roofing system must be inspected and accepted by the membrane manufacturer upon completion of installation, and by an independent inspection company retained by the Departmental Representative.

2. Products

2.01. MATERIALS

.1 Membrane Base Sheet: combination of polyester and glass fibres to ASTM D6162:

.1 Styrene-Butadiene-Styrene (SBS) elastomeric polymer prefabricated sheet.

.2 Thickness: 2.2 mm nominal.

.3 Reinforcement: minimum 95 g/m2 glass fleece.

.4 Breaking Strength: at -20° C, bend 180 degrees over a mandrel of 30 mm diameter in 5 seconds.

.5 Basis of Acceptance: Soprema Elastophene PS.

.2 Base Sheet Flashing: combination of polyester and glass fibres to ASTM D6162:.

.1 Type: Elastomeric SBS modified bituminous membrane, both sides covered with thermofusible plastic film.

.2 Thickness: minimum 2.8 mm, nominal 3.0 mm.

.3 Reinforcement: minimum 180 g/M2 non-woven polyester.

.4 Basis of Acceptance: Sopralene Flam 180.

.3 Membrane Cap Sheet and Cap Sheet Flashing: combination of polyester and glass fibres to ASTM D6162: and as follows:

.1 Type: elastomeric SBS modified bituminous membrane containing minimum 12% elastomeric polymers, granular surfaced one side and protected by a thermofusbile film on the other.

.2 Thickness: minimum 4.0 mm nominal.

.3 Reinforcement: minimum 250 g/m2 non-woven polyester.

.4 Breaking Strength: at -20° C, bend 180 degrees over a mandrel of 30 mm diameter in 5 seconds, and pass watertightness test in accordance with CGBS 37-GP-56M.

.5 Ultimate Elongation: (elongation at break) 45%.

.6 Low Temperature Flexibility: at -20° C, bend 90 degrees over a mandrel of 30 mm diameter in 30 seconds and pass watertightness test in accordance with CGSB 37-GP-56M.

.7 Basis of Acceptance: Sopralene Flam 250 Granules.

.4 Vapour Retarder Membrane: Self adhering “peel and stick” air/vapour barrier composed of Styrene-Butadiene-Styrene (SBS) modified bitumen reinforced with high density polyethylene film, anti slip surface, minimum thickness 1.0 mm

.5 Rigid Insulation:

.1 Extruded Polystyrene: to CAN/CGSB 51.20-M87, Type 4, RSI 0.65 per 25 mm thickness, shiplapped edges, total thickness as indicated. Maximum board size 1220 mm x 1220 mm.

.2 Overlay Board: 12.7 thick asphalt based recovery board with non-woven glass facers, as recommended by the membrane manufacturer.

.6 Asphalt: to CSA A123.4-M1979, Type 2 and Type 3.

.7 Nails: #10 with 25 mm heads to CSA B-111-1974, Table 12, hot dipped galvanized.

.8 Primer: asphalt based solvent primer conforming to CGSB 37-GP-9M, as recommended by membrane manufacturer.

.9 Mastic or Sealer: asphaltic based as recommended by membrane manufacturer.

.10 Tape: asphalt treated kraft paper, fibre reinforced, 100 mm wide, self adhering.

3. Execution

3.01 ROOF MEMBRANE TIE-IN PREPARATIONS

.1 Using a caulk line to identify the membrane tie-in location, mark the surface of the existing SBS membrane a minimum of 300 mm (12”) out from the base of the deleted or new roof curb locations.

.2 At the tie-in locations, prepare the existing SBS membrane by either embedding the granules using a propane torch and trowel or by applying the membrane manufacturers recommended asphalt primer. All SBS membrane tie-in locations shall be a minimum of 300 mm (12”) wide.

.3 Remove and dispose of the existing roof membrane 300 mm (12”) from around all deleted roof curbs.

.4 Upon the removal of the roof curbs, cut back and remove the existing insulation assembly a minimum of 150mm (6”) to exposed the existing vapour retarder.

.5 Prior to the installation of the new roof curbs, cut and removed the existing roof assembly within the new roof curb locations. In-fill any gaps between the existing roof assembly and new roof curb prior to the application of the new self-adhesive base sheet stripping.

3.02 NEW AUXILIARY LEVELLING SURFACE APPLICATION

.1 At all deleted roof curb openings, supply and install the following onto the new steel decking.

.1 Gypsum Sheathing Board: to ASTM C79-95, Standard paper surfacing, minimum 12.5 mm thick. Exterior Standard gypsum board CSA A82.27-M1979 shall be 12.5 mm (½") thick.

.2 Mechanically fasten gypsum sheathing to the roof deck with a minimum of twenty (20) drywall screws per 1200 mm x 2400 mm (48"x96") sheet. Tape **all new and existing** gypsum board joints.

3.03 NEW VAPOUR RETARDER APPLICATION

.1 Provide a new vapour retarder over the new gypsum board as follows:

3.04 NEW PRIMARY INSULATION APPLICATION

.1 Over the new vapour retarder, supply and install new primary insulation at the deleted roof curb locations as follows:

.1 Molded Expanded Polystyrene (MEPS) Board: Thermal Insulation, Polystyrene, Boards and Pipe Covering, Type 1, and as follows:

.1 Thermal Conductivity (kSI): 0.036 W/m°C maximum (R-3.75 / 25 mm).
.2 Board Size, Nominal: 1200 mm x 1200 mm.
.3 Dimensional Stability: 0.3% max. linear change.
.4 Certification: third party, in accordance with CGSB, ULC, or other certification programs accredited by the Standards Council of Canada

.2 Provide insulation for single layer installation. Should multiple layers be required, adhere the insulation panels with either cold asphalt or manufactures recommended adhesive. Match the thickness of the existing insulation panels.

.3 Ensure full adhesion. Fill insulation joints over 10 mm wide with insulation.

3.05 NEW SECONDARY INSULATION APPLICATION

.1 The following two (2) options can be chosen as substrate for mop application over the in-fill primary insulation:

.1 Ship-lap Edge Asphalt-Coated Wood Fibreboard: IKO Industries Ltd. 25 mm thick, to CRCA manual, Type 1, (R-2.8), offset edges (Single Layer).

.2 Squared Edge Asphalt-Coated Wood Fibreboard: Knight-Celotex or IKO Industries Ltd., ASTM C208 / C209 / C165, 11 mm thick, to CRCA manual and CSA A247-M1978, Type 1, (R-1.4), offset edges (Double Layer).

3.06 NEW MEMBRANE INSTALLATION (GENERAL)

.1 Install membrane components in accordance with requirements of membrane manufacturer.

.2 Use installation method as indicated on Primary Membrane Schedule.

.3 Torch apply sheet materials for continuous fusion of cap sheets and adhesion to non-combustible substrates.

.4 Butter all side and end lap seams with torch heat application on all field base sheet and self-adhering base sheet stripping locations. All field base sheet membrane shall overlap the existing granular cap sheet membrane tie-in a minimum of 150 mm (6”).

.5 Limit cap sheet bleed-out at seams to 12 mm. Ensure that a new field granular cap sheet membrane extend a minimum of 150 mm (6”) past the edge of the new field base sheet. A minimum of 300 mm (12”) membrane tie-in is required. Cover excessive bleed-out and replace missing mineral surfacing by embedding matching colour granules.

.6 Primary membrane deficiencies shall include, but not be limited to, ridges, tenting, buckles, wrinkles and voids.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

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

.3 Underwriter's Laboratories of Canada (ULC)
- .1 ULC-S115 Fire Tests of Fire stop Systems.

1.02 DEFINITIONS

.1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.

.2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.

.3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.

.4 Tightly Fitted; (ref: NBC Part 3.1.9.1(1) and 9.10.9.6(1)): penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction.
- .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings:
- .1 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation.
- .2 Construction details should accurately reflect actual job conditions.

.4 Samples:
- .1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.

.5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
- .1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.
  - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
- .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures
- .4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.04 QUALITY ASSURANCE

.1 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
- .1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
- .2 Twice during progress of Work at 25% and 60% complete.
- .3 Upon completion of Work, after cleaning is carried out.

1.05 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
- .2 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .3 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .4 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.

.2 Storage and Protection:
- .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Replace defective or damaged materials with new.

.3 Waste Management and Disposal:
- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

2.01 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 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.

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. 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.

3.03 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.

3.04 SPECIAL REQUIREMENTS

.1 Location of special requirements for fire stopping and smoke seal materials at openings and penetrations in fire resistant rated assemblies are as follows:
- .1 Non dust generation: at location.
- .2 Movement: % .
- .3 Designed for re-entry, removable at: location.
- .4 rating except at location.

3.05 SEQUENCES OF OPERATION

.1 Proceed with installation only when submittals have been reviewed by Departmental.

.2 Install floor fire stopping before interior partition erections.

.3 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.

.4 Mechanical pipe insulation: certified fire stop system component.
- .1 Ensure pipe insulation installation precedes fire stopping.

3.06 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.

3.07 CLEANING

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

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.08 SCHEDULE

.1 Fire stop and smoke seal at:
.1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
.2 Edge of floor slabs at curtain wall and precast concrete panels.
.3 Top of fire-resistance rated masonry and gypsum board partitions.
.4 Intersection of fire-resistance rated masonry and gypsum board partitions.
.5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
.6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
.7 Openings and sleeves installed for future use through fire separations.
.8 Around mechanical and electrical assemblies penetrating fire separations.
.9 Rigid ducts: greater than 129 cm^2 : fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 ASTM International
- .1 ASTM C 919-08, Standard Practice for Use of Sealants in Acoustical Applications.

.2 Canadian General Standards Board (CGSB)
- .1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
- .2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
- .3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
- .4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
- .5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

.3 General Services Administration (GSA) - Federal Specifications (FS)
- .1 FS-SS-S-200-E(2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

1.02 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 joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Manufacturer's product to describe:
  - .1 Caulking compound.
  - .2 Primers.
  - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.

.3 Manufacturer's Instructions:
- .1 Submit instructions to include installation instructions for each product used.

1.03 CLOSEOUT SUBMITTALS

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

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.04 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:
- .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect joint sealants from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

1.05 SITE CONDITIONS

.1 Ambient Conditions:
- .1 Proceed with installation of joint sealants only when:
  - .1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.
  - .2 Joint substrates are dry.
  - .3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Joint-Width Conditions:
- .1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:
- .1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

1.06 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Health Canada.

.2 Departmental Representative will arrange for ventilation system to be operated on maximum outdoor air and exhaust during installation of caulking and sealants.

2 PRODUCTS

2.01 SEALANT MATERIAL DESIGNATIONS

.1 Sealant: Polysulphide base, one (1) component, to CAN/CGSB-19.13-M87, Shore A hardness 15-2.

.2 Sealant: Acrylic Base, one (1) component to CGSB [CAN/CGSB-19.17-M90 emulsion base, Shore A hardness15 – 25.

.3 Sealant: Silicone base, one (1) component to CAN/CGSB-19.13-M87, Shore A hardness 15-25.

.4 Pick Resistant Sealant: 100% solids epoxy gel; Sika Everset Type II

.5 Joint Back-Up: Round closed cell foam, neoprene, Shore A hardness of 20, tensile strength 140 to 200 kPa, outsized 30-50%, compatible with sealant and primer, non-adhering to sealant.

.6 Joint Cleaner: Non corrosive solvent recommended by sealant manufacturer for applicable substrate material.

.7 Primer: Non-staining type recommended by sealant manufacturer

2.02 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.

.2 Primer: in accordance with sealant manufacturer's written recommendations.

3 EXECUTION

3.01 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for joint sealants installation in accordance with manufacturer's written instructions.
- .1 Visually 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.

3.02 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil

grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.03 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.04 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.05 MIXING

.1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.06 APPLICATION

.1 Sealant:
- .1 Apply sealant in accordance with manufacturer's written instructions.
- .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
- .3 Apply sealant in continuous beads.
- .4 Apply sealant using gun with proper size nozzle.
- .5 Use sufficient pressure to fill voids and joints solid.
- .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .8 Remove excess compound promptly as work progresses and upon completion.

.2 Curing:
- .1 Cure sealants in accordance with sealant manufacturer's instructions.
- .2 Do not cover up sealants until proper curing has taken place.

3.07 CLEANING

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

.1 Leave Work area clean at end of each day.
.2 Clean adjacent surfaces immediately.
.3 Remove excess and droppings, using recommended cleaners as work progresses.
.4 Remove masking tape after initial set of sealant.

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.08 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by joint sealants installation.

3.09 SEALANT SCHEDULE

.1 Where no specified type of sealant is shown or specified choose one of the sealants specified in this Section appropriate for its location.

.2 Make sealant selections consistent with manufacturer's recommendations.

.3 Use acrylic sealant on interior locations where little or no movement can occur.

.4 Use mould and mildew resistant silicone sealant for nonmoving joints in washrooms and kitchens. Do not use on floors.

.5 Use pick resistant sealant in cell areas and other areas accessible to prisoners and as indicated on Drawings

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 American Society for Testing and Materials International (ASTM)
- .1 ASTM A 653/A 653M-06a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM A 1008 / A 1008M-03, Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
- .3 ASTM B 29-03, Standard Specification for Refined Lead.
- .4 ASTM B 749-03, Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.

.2 CSA Group (CSA)
- .1 CSA-G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CSA W59-03, Welded Steel Construction (Metal Arc Welding).

.3 Canadian Steel Door Manufacturers' Association (CSDMA)
- .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2000.
- .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 1990.

.4 National Fire Protection Association (NFPA)
- .1 NFPA 80-99, Standard for Fire Doors and Fire Windows.
- .2 NFPA 252-03, Standard Methods of Fire Tests of Door Assemblies.

.5 Underwriters' Laboratories of Canada (ULC)
- .1 CAN/ULC-S701-01, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .2 CAN/ULC-S702-97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
- .3 CAN/ULC-S704-03, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
- .4 CAN4-S104-M80, Standard Method for Fire Tests of Door Assemblies.
- .5 CAN4-S105-M85, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

1.02 SYSTEM DESCRIPTION

.1 Design Requirements:
- .1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.
- .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.
- .3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-

S104 NFPA 252 for ratings specified or indicated.

.4 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104, ASTM E 152 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

.5 Provide Detention security metal doors and frames with specified fire rating and/or bullet resistance rating as indicated and as specified herein

1.03 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.

.3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan, Canada.

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed louvred, arrangement of hardware and fire rating and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing fire rating finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.04 DELIVERY, STORAGE AND HANDLING

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

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

2.01 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A 653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Commercial quality, level, cold-rolled steel conforming to ASTM A 1008 / A1008M CS type B.

.3 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A 653M, ZF75.

2.02 DOOR CORE MATERIALS

.1 Honeycomb construction:
  .1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m³ minimum sanded to required thickness.

.2 Stiffened: face sheets, honeycomb uninsulated core.

.3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250 degrees C at 30 60 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, ASTM E 152 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

2.03 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

.3 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.04 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior and interior top caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma steel.

.3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

.4 Metallic paste filler: to manufacturer's standard.

.5 Fire labels: metal rivited.

2.05 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Interior frames: 1.2 mm welded type construction.

.4 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.5 Protect mortised cutouts with steel guard boxes.

.6 Prepare frame for door silencers, 3 for single door, 2 at head for double door.

.7 Manufacturer's nameplates on frames and screens are not permitted.

.8 Conceal fastenings except where exposed fastenings are indicated.

.9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

2.06 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

.4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.07 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

.7 Fabricate frame products for openings in sections, x mm, splice joints for field assembly.

.8 Securely attach lead to inside of frame profile from return to jamb soffit (inclusive) on door side of frame only.

2.08 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

.2 Fabricate doors with longitudinal edges locked seam locked seamed, adhesive assisted welded. Seams: visible grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.3 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketting and hardware in accordance with ASTM E 330 to provide blast resistance of .

.4 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.5 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.6 Reinforce doors where required, for surface mounted hardware. Provide flush PVC steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.8 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN4-S104 ASTM E 152 NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.9 Manufacturer's nameplates on doors are not permitted.

2.09 DOORS: HONEYCOMB CORE CONSTRUCTION

.1 Form face sheets for exterior doors from 1.6 1.2 1.0 mm sheet steel with honeycomb polystyrene polyurethane core laminated under pressure to face sheets.

.2 Form face sheets for interior doors from 1.6 1.2 1.0 mm sheet steel with honeycomb temperature rise rated core laminated under pressure to face sheets.

2.10 THERMALLY BROKEN DOORS AND FRAMES

.1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.

.2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate thermally broken frames separating exterior parts form interior parts with continuous interlocking thermal break.

.4 Apply insulation.

2.11 DETENTION GRADE DOORS AND FRAMES

.1 Doors and frames shall be manufactured of commercial quality, level, cold-rolled steel conforming to ASTM A 1008 / A1008M CS type B.

.2 Detention security doors and frames steel shall be for Grades 3 and 4, 0.067 in. (1.7 mm), for Grades 1 and 2, 0.093 in. (2.3 mm)] minimum thickness.

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.03 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continuity of air barrier and vapour retarder.

3.04 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floorand thresholds as follows.
- .1 Hinge side: 1.0 mm.
- .2 Latchside and head: 1.5 mm.
- .3 Finished floor, top of carpet noncombustible sill and thresholds: 13 mm.

.3 Adjust operable parts for correct function.

.4 Install louvres.

3.05 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
- .1 ANSI/BHMA A156.1-2000, American National Standard for Butts and Hinges.
- .2 ANSI/BHMA A156.2-2003, Bored and Preassembled Locks and Latches.
- .3 ANSI/BHMA A156.3-2001, Exit Devices.
- .4 ANSI/BHMA A156.4-2000, Door Controls - Closers.
- .5 ANSI/BHMA A156.5-2001, Auxiliary Locks and Associated Products.
- .6 ANSI/BHMA A156.6-2005, Architectural Door Trim.
- .7 ANSI/BHMA A156.8-2005, Door Controls - Overhead Stops and Holders.
- .8 ANSI/BHMA A156.12-2005, Interconnected Locks and Latches.
- .9 ANSI/BHMA A156.13-2002, Mortise Locks and Latches Series 1000.
- .10 ANSI/BHMA A156.15-2006, Release Devices - Closer Holder, Electromagnetic and Electromechanical.
- .11 ANSI/BHMA A156.16-2002, Auxiliary Hardware.
- .12 ANSI/BHMA A156.18-2006, Materials and Finishes.
- .13 ANSI/BHMA A156.19-2002, Power Assist and Low Energy Power - Operated Doors.

.2 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)
- .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

1.02 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:
- .1 Submit for review and acceptance of each unit.
- .2 Samples will be returned for inclusion into work.
- .3 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
- .4 After approval samples will be returned for incorporation in Work.

.4 Hardware List:
- .1 Submit contract hardware list.
- .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.03 CLOSEOUT SUBMITTALS

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

.2 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.

1.04 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials:
.2 Supply maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
.3 Tools:
.1 Supply 2 sets of wrenches for door closers locksets and fire exit hardware.

1.05 QUALITY ASSURANCE

.1 Regulatory Requirements:
.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Provide, in writing, proof that hardware installer is a certified detention contractor.

1.06 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 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.4 Storage and Handling Requirements:
.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect door hardware from nicks, scratches, and blemishes.
.3 Protect prefinished surfaces with wrapping strippable coating.
.4 Replace defective or damaged materials with new.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

.1 All hardware to be provided as listed in the hardware groups

.2 No substitutions allowed

2.01 HARDWARE ITEMS

.1 Use one manufacturer's products only for similar items.

2.02 DOOR HARDWARE

.1 See hardware groups 3.06 Schedule

2.03 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

Use fasteners compatible with material through which they pass.

2.04 KEYING

.1 Supply Best Cores for commercial locks to owner

.2 All keying information will be between RPC staff and Best lock

.3 Supply ASSA mogul cylinders to all detention locks

.4 ASSA keying information to be supplied by RPC staff, try to key into existing system if possible

.5 Deliver ASSA mogul keys directly to assigned RPC security staff

.6 if required by RPC supply temporary construction cylinders to required locks

3 EXECUTION

3.01 INSTALLATION

.1 Manufacturer's Instructions: comply with manufacturer's written

recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Supply manufacturers' instructions for proper installation of each hardware component.

.4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).

.5 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.6 Use only manufacturer's supplied fasteners.
- .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.8 All detention hardware must be install by a certified detention contractor (DEC)

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3.02 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to ensure tight fit at contact points with frames.

3.03 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .1 Leave Work area clean at end of each day.
- .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
- .3 Remove protective material from hardware items where present.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.04 DEMONSTRATION

.1 Maintenance Staff Briefing:
- .1 Brief maintenance staff regarding:
  - .1 Proper care, cleaning, and general maintenance of projects complete hardware.
  - .2 Description, use, handling, and storage of keys.
  - .3 Use, application and storage of wrenches for door closers locksets and fire exit hardware.

.2 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.05 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by door hardware installation.

3.06 SCHEDULE

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Aluminum Association (AA)
- .1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.

.2 American Society for Testing and Materials (ASTM)
- .1 ASTM C 475-02(2015), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- .2 ASTM C 514-04(2014), Standard Specification for Nails for the Application of Gypsum Board.
- .3 ASTM C 557-03(2009)e1, Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
- .4 ASTM C 840-16, Standard Specification for Application and Finishing of Gypsum Board.
- .5 ASTM C 954-15, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
- .6 ASTM C 1002-14, 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.
- .7 ASTM C 1047-14a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- .8 ASTM C 1177/C 1177M-13, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .9 ASTM C 1178/C 1178M-13, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.
- .10 ASTM C 1280-13a, Standard Specification for Application of Gypsum Sheathing.
- .11 ASTM C1396/C1396M-14a, Standard Specification for Gypsum board.

.3 Association of the Wall and Ceilings Industries International (AWCI)
- .1 AWCI Levels of Gypsum Board Finish-GA-214-2015.

.4 Underwriters' Laboratories of Canada (ULC)
- .1 CAN/ULC-S102-10, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

1.02 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 board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:
- .1 Submit for review and acceptance of each component specified or

necessary for complete installation. Include technical descriptive data.

.2 Submit duplicate 300 x 300 mm size samples of vinyl faced gypsum board and 300 mm long samples of corner and casing beads vinyl mouldings shadow mould cornice cap textured finishes insulating strip.

.3 Samples will be returned for inclusion into work.

.4 Certifications:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.03 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 and applicable standard designation.

.3 Exercise care in unloading gypsum board materials shipment to prevent damage.

.4 Storage and Handling Requirements in accordance with ASTM C 840-16:

.1 Store gypsum board assemblies materials level flat off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.

.3 Protect gypsum board from direct exposure to rain, snow, sunlight, or other excessive weather conditions.

.4 Protect ready mix joint compounds from freezing, exposure to extreme heat and direct sunlight.

.5 Protect from weather, elements and damage from construction operations.

.6 Handle gypsum boards to prevent damage to edges, ends or surfaces.

.7 Protect prefinished aluminum surfaces with wrapping strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

.8 Replace defective or damaged materials with new.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

1.04 AMBIENT CONDITIONS

.1 Maintain temperature 10 °C minimum, 21 °C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimumafter completion of joint treatment.

.2 Apply board and joint treatment to dry, clean, frost free surfaces.

.3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

2 PRODUCTS

2.01 MATERIALS

.1 Gypsum Board: meeting the requirements os ASTM C1396/C1396M and as follows:

.2 Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system as indicated on drawings.

.3 Regular Gypsum Board:
- .1 Thickness: As indicated.
- .2 Long Edges: Tapered.
- .3 Location: Vertical surfaces, unless otherwise indicated.

.4 Fire Resistant Type (Type C or X):
- .1 Thickness: As indicated, 16 mm minimum.
- .2 Long Edges: Tapered.
- .3 Location: Where required for fire resistance rated assembly.

.5 Sag Resistant Gypsum Board: ceiling board manufactured to have more sag resistance than regular type gypsum board:
- .1 Thickness: As indicated.
- .2 Long Edges: Tapered.
- .3 Location: Ceiling surfaces.

.6 Mould Resistant Gypsum Board, for use on ceilings and wall in washroom, wet work stations, and janitor areas: To ASTM C1396, and mould resistance to ASTM D3273.
- .1 Thickness: As indicated, 13 mm minimum.
- .2 Long Edges: Tapered.
- .3 Location: Vertical surfaces, unless otherwise indicated.

.7 Glass Mat Water Resistant Gypsum Backer Board (Interior Applications Only): Manufactured in accordance with ASTM C1178 to produce greater resistance to water penetration and to provide improved surface bonding characteristics for ceramic tile than standard gypsum board:
- .1 Thickness: As indicated, minimum 13 mm x manufacturers maximum length and widths.
- .2 Location: Substrate for ceramic tile.

.8 Abuse Resistant Gypsum Board: Manufactured to produce greater resistance to surface indentation and impact penetration resistance than standard gypsum panels:
- .1 Gypsum panels with glass fibre reinforced core, tapered edges, minimum 16 mm thickness, Type “X” or “C” ULC fire rating, conforming to ASTM C1396 and tested to the following performance ratings:

.2 Indentation Resistance: ASTM D1037 or D5420 to provide 2.54 mm maximum indentation at 45 N.

.3 Soft Body Impact Resistance: ASTM E695 to produce failure using a 22.7 kg bag when dropped from a minimum height of 838 mm.

.1 Locations: corridors

.9 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

3 EXECUTION

3.01 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.02 ERECTION

.1 Do application and finishing of gypsum board to ASTM C 840-16 except where specified otherwise.

.2 Do application of gypsum sheathing to ASTM C 1280-13a.

.3 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C 840-16 except where specified otherwise.

.4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.5 Install work level to tolerance of 1:1200.

.6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles,

.7 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.

.8 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.9 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

.10 Install wall furring for gypsum board wall finishes to ASTM C 840-16, except where specified otherwise.

.11 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.12 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

.13 Erect drywall resilient furring transversely across studs joists between layers of gypsum board, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 38 mm common nail 25 mm drywall screw.

.14 Install 150 mm continuous strip of 12.7 mm gypsum board along base of partitions where resilient furring installed.

3.03 APPLICATION

.1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.

.2 Apply single double layer gypsum board to wood metal furring or framing using screw fastenersstud adhesive for first layer, laminating adhesive screw fasteners for second layer. Maximum spacing of screws 300 mm on centre.
- .1 Single-Layer Application:
  - .1 Apply gypsum board on ceilings prior to application of walls to ASTM C 840-16.
  - .2 Apply gypsum board on walls vertically or horizontally, providing sheet lengths that will minimize number of board edges or end joints.
- .2 Double-Layer Application:
  - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
  - .2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.
  - .3 Apply base layers at right angles to supports unless otherwise indicated.
  - .4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.

.3 Apply single double layer gypsum board to concrete concrete block surfaces, where indicated, using laminating adhesive.
- .1 Comply with gypsum board manufacturer's recommendations.
- .2 Brace or fasten gypsum board until fastening adhesive has set.
- .3 Mechanically fasten gypsum board at top and bottom of each sheet.

.4 Exterior Soffits and Ceilings: install exterior gypsum board perpendicular to supports; stagger end joints over supports. Install with 6 mm gap where boards abut other work.

.5 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions

abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, , in partitions where perimeter sealed with acoustic sealant.

.6 Arrange vinyl-faced gypsum board symmetrical about openings and wall areas, with butt joints aluminum/vinyl mouldings between joints.

.7 Apply board using stud adhesive on furring or framing laminating adhesive on base layer of gypsum board.

.8 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.9 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

.10 Install gypsum board with face side out.

.11 Do not install damaged or damp boards.

.12 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.04 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 at 150 mm on centre using contact adhesive for full length.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.5 Install shadow mould at gypsum board/ceiling juncture as indicated. Minimize joints; use corner pieces and splicers.

.6 Construct control joints of preformed units two back-to-back casing beads set in gypsum board facing and supported independently on both sides of joint.

.7 Provide continuous polyethylene dust barrier behind and across control joints.

.8 Locate control joints where indicated at changes in substrate construction at approximate 10 m spacing on long corridor runs at approximate 15 m spacing on ceilings.

.9 Install control joints straight and true.

.10 Ensure that screws or nails are properly applied in process of attaching gypsum

board to framing without damaging of gypsum board edges and ends.

.11 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.

.12 Install expansion joint straight and true.

.13 Install cornice cap where gypsum board partitions do not extend to ceiling.

.14 Splice corners and intersections together and secure to each member with 3 screws.

.15 Install access doors to electrical and mechanical fixtures specified in respective sections.
- .1 Rigidly secure frames to furring or framing systems.

.16 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.

.17 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.

.18 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board, invisible after surface finish is completed.

.19 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.20 Completed installation smooth, level or plumb, free from waves and other defects and ready for surface finish.

.21 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.

.22 Mix joint compound slightly thinner than for joint taping.

.23 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.

.24 Allow skim coat to dry completely.

.25 Remove ridges by light sanding or wiping with damp cloth.

3.05 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.06 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by gypsum board assemblies installation.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 ASTM International
- .1 ASTM C 645, Standard Specification for Nonstructural Steel Framing Members.
- .2 ASTM A 653/A 653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
- .3 ASTM C 754, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.2 Underwriter's Laboratories (UL) Environmental Standards
- .1 UL-2768-2011, Architectural Surface Coatings.

.3 The Master Painters Institute (MPI)
- .1 Architectural Painting Specification Manual - current edition.
  - .1 MPI #26, Primer, Galvanized Metal, Cementitious.

1.02 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:
- .1 Submit duplicate 300 mm long samples of non-structural metal framing.

1.03 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.04 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:
- .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect metal framing from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Waste Management and Disposal.

2 PRODUCTS

2.01 MATERIALS

.1 Non-load bearing channel stud framing: to ASTM C 645, mm stud size, roll formed from 0.53 0.91 mm thickness hot dipped zinc-coated (galvanized) steel sheet in accordance with ASTM A 653, Z180, for screw attachment of gypsum board lath.
- .1 Knock-out service holes at 460 mm centres.

.2 Floor and ceiling tracks: to ASTM C 645, in widths to suit stud sizes, and as follows:
- .1 Slotted Deflection Track for Fire Separations: Premanufactured slotted top runner with 63 mm down standing legs and having 6 mm wide x 38 mm high slots spaced at 25 mm on centre along length of runner; tested and certified for use in fire rated wall construction.
- .2 Double Runner Deflection Track: Outside runner using 50 mm 75 mm flanges; inner runner 33 mm; maintaining 25 mm minimum deflection space.
- .3 Deep Leg Deflection Track: Top runner having 50 mm 75 mm down standing legs; maintaining 13 mm minimum deflection space.
- .4 Base Runner: Bottom track with 33 mm upstanding legs.

.3 Non-load bearing truss stud framing system: to consist of:
- .1 Studs: mm size; truss-type bent rod web with double rod chords 12 x 6 mm x 1.2 mm channel chords; welded together at contact points.
  - .1 Make rod of minimum 4.5 mm diameter cold drawn steel wire having tensile strength of 620 MPa.
  - .2 Design studs for clip attachment of gypsum lath or wire tying of metal lath.
- .2 Floor track: snap-in type formed to hold studs securely in place at 50 mm intervals; fabricated from 0.5 mm thick steel sheet; size to suit studs.
- .3 Ceiling track: channel shaped track for use with stud shoes and 1.2 mm diameter double wire ties; size to suit studs.
- .4 After fabrication apply one shop coat of MPI #26 primer to steel surfaces.
  - .1 Descale and clean surfaces before painting.

.4 Furring Channels: Commercial steel sheet in accordance with ASTM A 653, Z180, hot dipped zinc-coated (galvanized), as follows:
- .1 Hat Shaped, Rigid Furring Channels: ASTM C 645, 0.75 mm thickness x 22 mm deep.
- .2 Resilient Furring Channels: 0.46 mm thickness x 13 mm deep members designed to reduce sound transmission having asymmetrical face attached to single flange by a slotted leg (web).

.5 Curving Tracks: Commercial steel sheet with ASTM A 653, Z180, hot dipped zinc-coated (galvanized), complete with flexible sliding straps to allow for curvature indicated on drawings; width to suit framing, and as follows:
- .1 Width: 65 mm 92 mm.
- .2 Minimum base metal thickness: 0.75 mm.

.6 Metal channel stiffener: x mm size, 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.

.7 Acoustical sealant: in accordance with Section 07 92 00 - Joint Sealants.

.8 Sealants: VOC limit 30 70 250 g/L maximum to SCAQMD Rule 1168 GS-36.

.9 Insulating strip: rubberized, moisture resistant 3 mm thick cork foam strip, 12 mm wide, with self sticking adhesive on one face, lengths as required.

3 EXECUTION

3.01 EXAMINATION

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

3.02 ERECTION

.1 Erect partitions in accordance with framing requirements of ASTM C 754.

.2 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.

.3 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

.4 Place studs vertically at mm on centre and not more than 50 mm from abutting walls, and at each side of openings and corners.
- .1 Position studs in tracks at floor and ceiling. Cross brace steel studs as

required to provide rigid installation to manufacturer's instructions.

.5 Erect metal studding to tolerance of 1:1000.

.6 Attach studs to bottom ceiling track using screws crimp method pop rivets.

.7 Co-ordinate simultaneous erection of studs with installation of service lines. Align web openings when erecting studs.

.8 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.9 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified.
- .1 Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.

.10 Install heavy gauge single jamb studs at openings.

.11 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs.
- .1 Secure track to studs at each end, in accordance with manufacturer's instructions.
- .2 Install intermediate studs above and below openings in same manner and spacing as wall studs.

.12 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.13 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.

.14 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.15 Extend partitions to ceiling height except where noted otherwise on drawings.

.16 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.
- .1 Use 50 mm leg ceiling tracks. Use double track slip joint as indicated.

.17 Install continuous insulating strips to isolate studs from uninsulated surfaces.

.18 Install two continuous beads of acoustical sealant insulating strip under studs and tracks around perimeter of sound control partitions.

.19 Curved Partition Tracks:
- .1 Cut top and bottom track (runners) through leg and web at 50 mm intervals for arc length. In cutting lengths of track, allow for uncut straight lengths minimum 300 mm at ends of arcs. Shape curving tracks to

profiles indicated on drawings in accordance with manufacturer's instructions.

.2 Bend track to uniform curve and locate straight lengths so they form a true tangent to arcs.

.3 Support outside (cut) leg of track by clinching steel sheet strip, 25 mm high, by thickness of track metal, to inside of cut legs using metal lock fasteners.

.4 Begin and end arc with a stud and space intermediate studs equally along arcs at stud spacing recommended in writing by gypsum board manufacturer for radii indicated. On straight lengths of minimum 2 studs at ends of arcs, place studs at 150 mm on centre.

3.03 CLEANING

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

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

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.

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

3.04 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by non-structural metal framing application.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.2 Master Painters Institute (MPI)
- .1 The Master Painters Institute (MPI)/Architectural Painting Specification Manual (ASM) - current edition.
- .2 Standard GPS-1-12, MPI Green Performance Standard.
- .3 Standard GPS-2-12, MPI Green Performance Standard.

.3 National Research Council Canada (NRC)
- .1 National Fire Code of Canada 2015 (NFC).

.4 Society for Protective Coatings (SSPC)
- .1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

1.02 ADMINISTRATIVE REQUIREMENTS

- .1 Scheduling:
- .2 Submit work schedule for various stages of painting to Departmental Representative t for review. Provide schedule minimum of 48 hours in advance of proposed operations.
- .3 Obtain written authorization from Departmental Representative for changes in work schedule.
- .4 Schedule new additions to existing building coordinate painting operations with other trades.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Provide manufacturer's instructions, printed product literature and data sheets for paint and paint products and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.
- .3 Confirm products to be used are in MPI's approved product list.

.3 Upon completion, provide records of products used. List products in relation to finish system and include the following:
- .1 Product name, type and use.
- .2 Manufacturer's product number.
- .3 Colour numbers.
- .4 MPI Environmentally Friendly classification system rating.
- .5 Manufacturer's Material Safety Data Sheets (MSDS).

.4 Samples:
- .1 Submit full range colour sample chips to indicate where colour availability is restricted.
- .2 Submit duplicate 200 x 300 mm sample panels of each paint stain clear coating special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:
  - .1 3 mm plate steel for finishes over metal surfaces.
  - .2 13 mm birch plywood for finishes over wood surfaces.
  - .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
  - .4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
  - .5 10 mm cedar hardboard siding plywood for finishes over wood surfaces.
- .3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.5 Test reports: Provide certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
- .1 Lead, cadmium and chromium: presence of and amounts.
- .2 Mercury: presence of and amounts.
- .3 Organochlorines and PCBs: presence of and amounts.

.6 Certificates: Provide certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties. MPI Gateway #.

.7 Manufacturer's Instructions:
- .1 Provide manufacturer's installation and application instructions.

1.04 CLOSEOUT SUBMITTALS

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

.2 Operation and Maintenance Data: Provide operation and maintenance data for painting materials for incorporation into manual.

.3 Include:
- .1 Product name, type and use.
- .2 Manufacturer's product number.
- .3 Colour numbers.
- .4 MPI Environmentally Friendly classification system rating.

1.05 QUALITY ASSURANCE

- .1 Qualifications:
- .2 Contractor: to have a minimum of 5 years proven satisfactory experience. When requested, provide list of last 3 comparable jobs including, job name and location, specifying authority, and project

manager.

.3 Qualified journeypersons as defined by local jurisdiction to be engaged in painting work.

.4 Apprentices: may be employed provided they work under direct supervision of qualified journeyperson in accordance with trade regulations.

.5 Conform to latest MPI requirements for exterior painting work including preparation and priming.

.6 Materials: in accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.

.7 Retain purchase orders, invoices and documents to prove conformance with noted MPI requirements when requested by Departmental Representative .

.8 Standard of Acceptance:

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Soffits: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.06 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.

.1 Labels: to indicate:

.1 Type of paint or coating.

.2 Compliance with applicable standard.

.3 Colour number in accordance with established colour schedule.

.3 Storage and Handling Requirements:

.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Observe manufacturer's recommendations for storage and handling.

.3 Store materials and supplies away from heat generating devices.

.4 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.

.5 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Departmental Representative . After completion of operations, return areas to clean condition to approval of Departmental Representative t.

.6 Remove paint materials from storage only in quantities required for same day use.

.7 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.8 Fire Safety Requirements:

.1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada (NFC).

.4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this.

1.07 SITE CONDITIONS

.1 Ambient Conditions:
.1 Heating, Ventilation and Lighting:
.1 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.
.2 Provide continuous ventilation for 7 days after completion of application of paint.
.3 Co-ordinate use of existing ventilation system with Departmental Representative DCC Representative Consultant and ensure its operation during and after application of paint as required.
.4 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
.5 Provide minimum lighting level of 323 Lux on surfaces to be painted.
.6 Temperature, Humidity and Substrate Moisture Content Levels:
.1 Unless pre-approved written approval by Specifying body Paint Inspection Agency Authority and product manufacturer, perform no painting when:
.1 Ambient air and substrate temperatures are below 10 degrees C.
.2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.
.3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.
.4 The relative humidity is under 85% or when the dew point is more than 3 degrees C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.
.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty,

raining or snowing at site.

.6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.

.2 Perform painting work when maximum moisture content of the substrate is below:

.1 12% for concrete and masonry (clay and concrete brick/block). Allow new concrete and masonry to cure minimum of 28 days.

.2 15% for hard wood.

.3 17% for soft wood.

.4 12% for plaster and gypsum board.

.3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.7 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.8 Additional interior application requirements:

.1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

.1 Environmental Performance Requirements:

.2 Provide paint products meeting MPI "Environmentally Friendly" E1 E2 E3 ratings based on VOC (EPA Method 24) content levels.

.3 Green Performance in accordance with MPI Standard GPS-1 GPS-2.

2.02 MATERIALS

.1 Only Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Provide paint materials for paint systems from single manufacturer.

.3 Only qualified products with E2 E3 "Environmentally Friendly" rating are acceptable for use on this project.

.4 Conform to latest MPI requirements for interior painting work including preparation and priming.

.5 Provide paint products meeting MPI "Environmentally Friendly" E1, E2 E3 ratings based on VOC (EPA Method 24) content levels.

.6 Use MPI listed materials having minimum E2 E3 rating where indoor air quality (odour) requirements exist.

.7 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids to be:
- .1 Be Water-based Water soluble Water clean-up.
- .2 Be non-flammable biodegradable.
- .3 Be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
- .4 Be manufactured without compounds which contribute to smog in the lower atmosphere.
- .5 Do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.

.8 Ensure manufacture and process of both water-borne surface coatings and recycled water-borne surface coatings does not release:
- .1 Matter in undiluted production plant effluent generating 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to natural watercourse or sewage treatment facility lacking secondary treatment.
- .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to natural watercourse or a sewage treatment facility lacking secondary treatment.

.9 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E2 rating.

.10 Recycled water-borne surface coatings to contain 50% post-consumer material by volume.

.11 Recycled water-borne surface coatings must not contain:
- .1 Lead in excess of 600.0 ppm weight/weight total solids.
- .2 Mercury in excess of 50.0 ppm weight/weight total product.
- .3 Cadmium in excess of 1.0 ppm weight/weight total product.
- .4 Hexavelant chromium in excess of 3.0 ppm weight/weight total product.
- .5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

2.03 COLOURS

.1 In general paint colours are to match existing.

.2 Where specific products are available in restricted range of colours, selection based on limited range.

.3 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats, if requested by Departmental Representative

.4 For deep and ultra deep colours; 4 coats may be required.

2.04 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. Obtain written approval from Departmental Representative for tinting of painting materials.

.2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.

.3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

.4 Thin paint for spraying in accordance with paint manufacturer's instructions.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity. Strain as necessary.

2.05 GLOSS/SHEEN RATINGS

.1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 2 - Velvet-Like Finish	Max.10	10 to 35
Gloss Level 3 - Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 - Satin-Like Finish	20 to 35	min. 35
Gloss Level 5 - Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 - Traditional Gloss	70 to 85	
Gloss Level 7 - High Gloss Finish	More than 85	

.2 Gloss level ratings of painted surfaces as indicated and as noted on Finish Schedule.

2.06 INTERIOR PAINTING SYSTEMS

.1 Galvanized metal: doors, frames, railings, misc. steel, pipes, overhead decking, and ducts.

.1 INT 5.3A - Latex semi-glossl (over cementitious primer) finish.

.2 Dressed lumber: including doors, door and window frames, casings, mouldings:
.1 INT 6.3A - High performance architectural latex semi-gloss (over latex primer) finish.

.3 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
.1 INT 9.2A - Latex semi-glossl finish (over latex primer/sealer).

2.07 SOURCE QUALITY CONTROL

.1 Perform following tests on each batch of consolidated post-consumer material before surface coating is reformulated and canned. Testing by laboratory or facility which has been accredited by Standards Council of Canada.
.1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.
.2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.
.3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.03 EXAMINATION

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

.2 Interior repainting work: inspected by MPI Accredited Paint Inspection Agency (inspector) acceptable to specifying authority and local Painting Contractor's

Association. Painting contractor to notify Paint Inspection Agency minimum of one week prior to commencement of work and provide copy of project repainting specification and Finish Schedule.

.3 Interior surfaces requiring repainting: inspected by both painting contractor and Paint Inspection Agency who will notify Departmental Representative in writing of defects or problems, prior to commencing repainting work, or after surface preparation if unseen substrate damage is discovered.

.4 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.5 Maximum moisture content as follows:
- .1 Stucco, plaster and gypsum board: 12%.
- .2 Concrete: 12%.
- .3 Clay and Concrete Block/Brick: 12%.
- .4 Hard Wood: 15%.
- .5 Soft Wood: 17%.

3.04 PREPARATION

.1 Protection (not applicable to new painting work):
- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Departmental Representative.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .4 Protect passing pedestrians, building occupants and general public in and about the building.

.2 Surface Preparation (not applicable to new painting work):
- .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
- .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Departmental Representative.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
- .1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
- .2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt,

oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.3 Tint filler to match stains for stained woodwork.

.6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.7 Carried out during shop priming: clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes blowing with clean dry compressed air or vacuum cleaning.

.8 Touch up of shop primers with primer as specified.

.9 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

3.05 EXISTING CONDITIONS

.1 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test" and report findings to Departmental Representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.2 Maximum moisture content as follows:

.1 Stucco: 12%.

.2 Concrete: 12%.

.3 Clay and Concrete Block/Brick: 12%.

.4 Hard Wood: 15%.

.5 Soft Wood: 17%.

3.06 APPLICATION

.1 Method of application to be as approved by Departmental Representative. Apply paint by brush roller air sprayer airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:
- .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
- .2 Work paint into cracks, crevices and corners.
- .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
- .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
- .5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:
- .1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
- .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
- .3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.
- .4 Brush out immediately all runs and sags.
- .5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.

.5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.9 Finish inside of cupboards and cabinets as specified for outside surfaces.

.10 Finish closets and alcoves as specified for adjoining rooms.

.11 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

.12 Wood, drywall, plaster, stucco, concrete, concrete masonry units and brick; if sprayed, must be back rolled.

3.07 MECHANICAL/ ELECTRICAL EQUIPMENT

.1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.

.2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Do not paint over nameplates.

.5 Keep sprinkler heads free of paint.

.6 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.7 Paint fire protection piping red.

.8 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.9 Paint natural gas piping yellow.

.10 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.11 Do not paint interior transformers and substation equipment.

3.08 SITE TOLERANCES

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.09 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and

equipment in accordance with Section 01 74 11 - Cleaning.

3.10 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Departmental Representative. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

END OF SECTION

1 General

1.01 REFERENCES

.1 Aluminum Association (AA).

.1 DAF 45-[03], Designation System for Aluminum Finishes.

1.02 SUBMITTALS

.1 Comply with requirements of Section 01 33 00.

.2 Product Data.

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

.3 Shop Drawings.

.1 Indicate, by large scale details, materials, finishes, dimensions, anchorage and assembly.

.4 Samples.

.1 Submit duplicate 300 mm long samples of profiles and colours for and wall guards.

.5 Manufacturer's Instructions.

.1 Submit manufacturer's installation instructions.

1.03 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

2 Products

2.01 MATERIALS

.2 Wall Protection:

.1 High impact non-reinforced acrylic/polyvinylchloride alloy sheet, .70 mm (028”) nominal sheet thickness, 1220 mm x 2440 mm sheet size, slight stippled texture finish to one side of sheet. Acceptable products:

.1 Kydex wallcovering manufactured by Kleerdex Company.

.2 Acrovyn wallcovering manufactured by Construction Specialties Inc.

.3 Rigiwall manufactured by GenCorp Polymer Products and distributed by Westroc

.4 Korogard supplied by Metro Wall Coverings

2.02 ACCESSORIES

.1 Adhesive: water resistant type as recommended by manufacturer for substrate.

2.03 FINISHES

.1 Refer to drawings for required colours.

3 Execution

3.01 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.02 INSTALLATION

.1 Install units on solid backing and erect with materials and components straight, tight and in alignment.

.2 Install wall protection materials in accordance with manufacturer’s instructions to areas indicated.

3.03 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

.3 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

1 General

1.01 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 and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.2 Drawings to show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.3 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.

.4 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.

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

.5 Operation and Maintenance Data: submit operation and maintenance data 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.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.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 Departmental Representative will provide [1] set of reproducible mechanical drawings. Provide sets of [white] prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information [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.

1.02 MAINTENANCE MATERIAL SUBMITTALS

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

.2 Furnish spare parts as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One head gasket set for each heat exchanger.

.4 One glass for each gauge glass.

.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.3 Provide one set of special tools required to service equipment as recommended by manufacturers.

.4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.03 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

2 Products

2.01 N/A

3 Execution

3.01 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.02 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23 - Interior Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.03 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.04 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.05 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.

3.06 CLEANING

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

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

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

3.07 PROTECTION

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

END OF SECTION

1 General

1.01 SUMMARY

.1 Provide all labour, materials, and all incidentals required to complete mechanical work described in this Section.

.2 Renovation of existing building systems as indicated in the specifications and on the drawings.

.3 Removal of redundant and obsolete mechanical components, piping, ductwork, and equipment in the renovated areas.

1.02 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.

1.03 REFERENCE STANDARDS

.1 Applicable Provincial Safety Standards including; but not limited to, the following:

.1 The Worker's Compensation Act, Safety Regulations Governing Buildings, Construction and Demolition

.2 Safety regulations governing General Accident Prevention (Alberta Regulation 179)

.2 Canadian Standards Association (CSA):

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

1.04 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate Owner’s occupancy during selective demolition with Section 02 41 16.

.2 Scheduling: Sequence of operations for demolition will proceed in stages in accordance with Construction Manager’s Construction Schedule.

1.05 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Obtain necessary permits before starting work of this Section.
.2 Provide copies of Certificate of final inspection and approval from the Authorities Having Jurisdiction to Consultant at completion of demolition work.

2 Products

2.01 REPAIR MATERIALS

.1 Use new materials required for completion or repair matching materials damaged during performance of work of this Section demolition; new will meet assembly or system characteristics and carry CSA approval labels required by the Authority Having Jurisdiction.

2.02 DEBRIS

.1 Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) [except where explicitly noted otherwise as being retained and reconditioned for re-use in new construction].

.2 Demolished Materials: Demolished materials become the property of the Contractor.

.3 Salvaged Materials: Carefully remove materials designated for salvage and store in a manner to prevent damage or devaluation of materials.

3 Execution

3.01 EXAMINATION

.1 Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before submitting Bid; Owner 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:

.1 Examine site and local conditions to determine any difficulties in carrying out work indicated and specified prior to submitting Bid.
.2 Examine site carefully and record exact condition of existing materials being removed or demolished.

3.02 PREPARATION

.1 Protection of Existing Conditions: Protection of in-place construction and pre-conditions; does not include site conditions as a result of construction.

.2 Demolition Removal: Coordinate Section specific requirements with Demolition specifications contained in Division 02; include this Section number and work reference in Division 02 Related Requirements listings:

.1 Remove Ready for Reinstallation: Description.
.2 Disconnect and cap mechanical services in accordance with requirements of local authority having jurisdiction and with approval of the Owner.

.3 Do not disrupt active or energized utilities without prior approval of the Owner.

.4 Erect and maintain dust proof and weather tight partitions to prevent the spread of dust and fumes, to occupied building areas; remove partitions when complete.

.5 Demolish parts of existing building to accommodate new construction and remedial work as indicated.

.6 At end of each day's work, leave work (site) in safe condition.

.7 Perform demolition work in a neat and workmanlike manner:

.1 Remove any 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.

3.03 PROTECTION

.1 Prevent movement, settlement or damage of adjacent services and parts of existing buildings to remain. Provide required bracing.

.2 Take precautions to support services and, if safety of buildings being demolished or of adjacent structures or services appears to be endangered, cease operations and notify the Consultant.

.3 Prevent debris from blocking drainage inlets. Protect mechanical and electrical systems that must remain in operation.

.4 Arrange demolition work so that interference with the use of the buildings by the Owner and users is minimized.

.5 Prevent debris from endangering the safe access to and egress from occupied buildings.

.6 Conform to the requirements of the referenced regulations as minimum.

3.04 RENOVATION

.1 Work associated with existing installation shall be carried out as follows”

.1 All modifications and additions to the existing mechanical system shall be carried out in such a way that the interruptions to normal operations are kept to an absolute minimum.

.2 All existing installations, in areas to be renovated, will be removed if they have been replaced by new installations and have not been specifically indicated (retained) for reuse.

.3 Render the installations at locations where existing equipment has been removed safe. Remove the existing wiring and conduits unless these conduits are indicated to be reused for (reserved for reuse in) new installations.

.4 Restore all services disrupted by the removal of existing equipment, or as a result of renovations.

.5 Include for all cutting, patching, painting and restoring of existing conditions, disturbed during installation of the specified work.

.6 Ensure prior to submission of bid that the existing wall construction and ceiling conditions are noted and allowed for in submitted price. No extra will be allowed for work or materials necessary for proper execution and completion of the contract or for the Bidder's failure, error or negligence in this regard.

END OF SECTION

1 General

1.01 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 and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.2 Indicate on drawings:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.3 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.

.4 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.

1.02 CLOSEOUT SUBMITTALS

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

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

.1 Operation 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.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.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 Departmental Representative will provide [1] set of reproducible mechanical drawings. Provide sets of [white] prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information [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.

1.03 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.

1.04 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

2 Products

2.01 N/A.

3 Execution

3.01 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Departmental Representative.

3.02 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23 - Interior Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.03 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.04 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control] and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.05 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.

3.06 CLEANING

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

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

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

3.07 PROTECTION

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

END OF SECTION

1 General

1.01 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.02 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Departmental Representative within 30 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-[2002].

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-[1998].

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-[2002].

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.03 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.04 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.05 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.06 PRE-TAB REVIEW

.1 [Review contract documents before project construction is started] confirm in writing to [Departmental Representative] [DCC Representative] [Consultant] adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to [Departmental Representative] [DCC Representative] [Consultant] in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.07 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.08 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

1.09 START OF TAB

.1 Notify Departmental Representative [7] days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, and caulking.

.5 Pressure, leakage, other tests specified elsewhere Division 23.

.6 Provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 Outlets installed, volume control dampers open.

.3 Liquid systems:

.1 Flushed, filled, vented.

.2 Correct pump rotation.

.3 Strainers in place, baskets clean.

.4 Isolating and balancing valves installed, open.

.5 Calibrated balancing valves installed, at factory settings.

.6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus [5] %, minus [5] %.

.2 Hydronic systems: plus or minus [10] %.

1.11 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus [2] % of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to Departmental Representative list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within [3] months of TAB. Provide certificate of calibration to Departmental Representative.

1.13 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

1.15 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit [6] copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

.1 Reported results subject to verification by Departmental Representative.

.2 Provide personnel and instrumentation to verify up to [30] % of reported results.

.3 Number and location of verified results as directed by Departmental Representative.

.4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, and ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

1.19 SYSTEMS

.1 Standard: TAB to most stringent of this section [TAB standards of [AABC] [NEBB] [SMACNA] [ASHRAE]].

.2 Do TAB of following systems, equipment, components, and controls:

.1 Dry Good Storage room air system AHU-9.

.2 Modified kitchen exhaust hood.

.3 Hydronic heating system.

.3 Qualifications: personnel performing TAB current member in good standing of AABC or NEBB.

.4 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.5 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.6 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

2 Products

2.01 NOT USED

.1 Not used.

3 Execution

3.01 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and methods for pressure testing ducts over 5 m in length, forming part of a supply, return or exhaust ductwork system directly or indirectly connected to air handling equipment.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)

.1 SMACNA HVAC Air Duct Leakage Test Manual, [1985].

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:

.1 Submit proposed report form and test report format to Departmental Representative for approval at least [three] months before proposed date of first series of tests. Do not start tests until approval received in writing from Departmental Representative.

.2 Prepare report of results and submit to Departmental Representative within [24] hours of completion of tests. Include:

.1 Schematic of entire system.

.2 Schematic of section under test showing test site.

.3 Required and achieved static pressures.

.4 Orifice differential pressure at test sites.

.5 Permissible and actual leakage flow rate (L/s) for test sites.

.6 Witnessed certification of results.

.3 Include test reports in final TAB report.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturer's field reports specified.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting [one] week prior to beginning work of this Section on-site installations in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.

.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.

.2 Health and Safety:

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

Part 2 Products

2.1 TEST INSTRUMENTS

.1 Test apparatus to include:

.1 Fan capable of producing required static pressure.

.2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.

.3 Flow measuring instrument compatible with the orifice plate.

.4 Calibration curves for orifice plates used.

.5 Flexible duct for connecting to ductwork under test.

.6 Smoke bombs for visual inspections.

.2 Test apparatus: accurate to within +/- [3] % of flow rate and pressure.

.3 Submit details of test instruments to be used to Departmental Representative at least one months before anticipated start date.

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 TEST PROCEDURES

.1 Maximum lengths of ducts to be tested consistent with capacity of test equipment.

.2 Section of duct to be tested to include:

.1 Fittings, branch ducts, tap-ins.

.3 Repeat tests until specified pressures are attained. Bear costs for repairs and repetition to tests.

.4 Base partial system leakage calculations on SMACNA HVAC Air Duct Leakage Test Manual.

.5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

3.3 SITE TOLERANCES

.1 System leakage tolerances specified are stated as percentage of total flow rate handled by system. Pro-rate specified system leakage tolerances. Leakage for sections of duct systems: not to exceed total allowable leakage.

.2 Leakage tests on following systems not to exceed specified leakage rates.

.1 Small duct systems up to 250 Pa: leakage [2]%.

.2 Large low pressure duct systems up to 500 Pa: leakage [2]%.

.3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.4 TESTING

.1 Test ducts before installation of insulation or other forms of concealment.

.2 Test after seals have cured.

.3 Test when ambient temperature will not affect effectiveness of seals, and gaskets.

.4 Flexible connections to VAV boxes.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services.

.1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its product[s] and submit written reports, in acceptable format, to verify compliance of Work with Contract.

.2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, at stages listed:

.1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.

.2 Upon completion of the Work, after cleaning is carried out.

.4 Obtain reports, within [3] days of review, and submit, immediately, to Departmental Representative.

.2 Performance Verification:

.1 Departmental Representative to witness tests and to verify reported results.

.2 To be certified by same TAB agency approved by Departmental Representative to undertake TAB on this project.

3.6 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.01 REFERENCES

.1 Definitions:

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - means "not concealed" as 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.

.2 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 Inc.

.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 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1168-[A2005], Adhesive and Sealant Applications.

.5 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

.6 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.

1.02 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 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.4 Samples:

.1 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.

.2 Mount sample on 12 mm plywood board.

.3 Affix typewritten label beneath sample indicating service.

.5 Manufacturers' Instructions:

.1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, cleaning procedures.

1.03 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.

1.04 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.

2 Products

2.01 FIRE AND SMOKE RATING

.1 To CAN/ULC-S102:

.1 Maximum flame spread rating: [25].

.2 Maximum smoke developed rating: [50].

2.02 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] [without] 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 [with] [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.

2.03 JACKETS

.1 Canvas:

.1 [220] gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

.3 Aluminum:

.1 To ASTM B209 with moisture barrier as scheduled in PART 3 of this section.

.2 Thickness: [0.50] mm sheet.

.3 Finish: Smooth.

.4 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.

.1 Stainless steel:

.5 Type: 304.

.6 Thickness: 0.25 mm sheet.

.7 Finish: Smooth.

.8 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.

2.04 ACCESSORIES

.1 Vapour retarder lap adhesive:

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

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: [hydraulic] setting on mineral wool, to ASTM C449.

.4 ULC Listed Canvas Jacket:

.1 [220] gm/m^2 cotton, plain weave, [treated with dilute fire retardant lagging adhesive to ASTM C921] [untreated].

.5 Outdoor Vapour Retarder Mastic:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

.6 Tape: self-adhesive, aluminum, reinforced, [50] mm wide minimum.

.7 Tie wire: [1.5] mm stainless steel.

.8 Banding: [12] mm wide, [0.5] mm thick stainless steel.

.9 Facing: [25] mm [stainless] steel hexagonal wire mesh stitched on one face of insulation with expanded metal lath on other face.

.10 Fasteners: [2] mm diameter pins with [35] mm [diameter] clips, length to suit thickness of insulation.

3 Execution

3.01 APPLICATION

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

3.02 PRE-INSTALLATION REQUIREMENTS

.1 Pressure test ductwork systems complete, witness and certify.

.2 Ensure surfaces are clean, dry, free from foreign material.

3.03 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.

3.04 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

TIAC Code	Vapour Retarder	Thickness (mm)	
Rectangular cold and dual temperature supply air ducts	[C-1]	[yes]	[50]
Round cold and dual temperatire supply air ducts	[C-2]	[yes]	[50]
Rectangular warm air ducts	[C-1]	[no]	[25]
Round warm air ducts	[C-1]	[no]	[25]
Supply, return and exhaust ducts exposed in space being served	[none]		
Outside air ducts to mixing plenum	[C-1]	[yes]	[25]
Mixing plenums	[C-1]	[yes]	[25]
Exhaust duct between dampers and louvres	[C-1]	[no]	[25]
Rectangular ducts outside	[C-1]	[special]	[50]
Round ducts outside	[C-1]	[special]	[50]
Acoustically lined ducts	[none]		

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

.1 Finishes: conform to following table:

TIAC Code		

Rectangular	Round	
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

3.05 CLEANING

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

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

END OF SECTION

1 General

1.01 SUMMARY

.1 Section Includes:

.1 Thermal insulation for piping and piping accessories in commercial type applications.

1.02 REFERENCES

.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 American Society for Testing and Materials International (ASTM)

.1 ASTM B209M-[04], Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate [Metric].

.2 ASTM C335-[04], Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411-[04], 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 C533-[2004], Calcium Silicate Block and Pipe Thermal Insulation.

.6 ASTM C547-[2003], Mineral Fiber Pipe Insulation.

.7 ASTM C795-[03], Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.8 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) Jacketting 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 (MSDS).

.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.

1.03 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.

.2 TIAC ss:

.1 CRF: Code Rectangular Finish.

.2 CPF: Code Piping Finish.

1.04 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 (MSDS) 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.

.1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.4 Samples:

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

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.

.5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 Departmental Representative will make available [1] copy of systems supplier's installation instructions.

1.05 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.

.3 Health and Safety:

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

1.06 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.

.3 Waste Management and Disposal:

.1 Place excess or unused insulation and insulation accessory materials in designated containers.

.2 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

.3 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

2 Products

2.01 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.

.1 Maximum flame spread rating: [25].

.2 Maximum smoke developed rating: [50].

2.02 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] [ASTM C547].

.2 Maximum "k" factor: to CAN/ULC-S702.

.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to [CAN/ULC-S702] [ASTM C547].

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to [CAN/ULC-S702] [ASTM C547].

.5 TIAC Code C-2: mineral fibre blanket faced [with] [without] factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to [CAN/ULC-S702] [ASTM C547].

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to [CAN/ULC-S702] [ASTM C547].

.6 TIAC Code A-6: flexible unicellular tubular elastomer.

.1 Insulation: with vapour retarder jacket.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Certified by manufacturer: free of potential stress corrosion cracking cormorants.

.7 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.

.1 Insulation: to [ASTM C533].

.2 Design to permit periodic removal and re-installation.

2.03 INSULATION SECUREMENT

.1 Tape: self-adhesive, aluminum, plain, 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.

2.04 CEMENT

.1 Thermal insulating and finishing cement:

.1 Hydraulic setting on mineral wool, to ASTM C449/C449M.

2.05 VAPOUR RETARDER LAP ADHESIVE

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

2.06 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.07 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: fibrous glass, untreated 305 g/m^2.

2.08 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.

.2 Colours: to match adjacent finish paint.

.3 Minimum service temperatures: -20 degrees C.

.4 Maximum service temperature: 65 degrees C.

.5 Moisture vapour transmission: 0.02 perm.

.6 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.2 ABS Plastic:

.1 One-piece moulded type [and sheet] with pre-formed shapes as required.

.2 Colours: to match adjacent finish paint.

.3 Minimum service temperatures: -40 degrees C.

.4 Maximum service temperature: 82 degrees C.

.5 Moisture vapour transmission: 0.012 perm.

.6 Thickness: [0.75] mm.

.7 Fastenings:

.1 Solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.8 Locations:

.1 For outdoor use ONLY.

.3 Canvas:

.1 [220] [and 120] gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

.4 Aluminum:

.1 To ASTM B209.

.2 Thickness: [0.50] mm sheet.

.3 Finish: [smooth].

.4 Joining: longitudinal and circumferential slip joints with [50] mm laps.

.5 Fittings: [0.5] mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, [19] mm wide, [0.5] mm thick at [300] mm spacing.

.5 Stainless steel:

.1 Type: [304].

.2 Thickness: [0.25] mm.

.3 Finish: [smooth].

.4 Joining: longitudinal and circumferential slip joints with [50] mm laps.

.5 Fittings: [0.5] mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, [19] mm wide, [0.5]mm thick at [300] mm spacing.

2.09 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

.1 Caulking to: Section [07 92 00 - Joint Sealants].

3 Execution

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 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.

3.03 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.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.

3.04 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: at expansion joints, valves, flanges and unions at equipment.

.2 Design: to permit movement of expansion joint, to permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:

.1 Insulation, fastenings and finishes: same as system.

.2 Jacket: high temperature fabric.

3.05 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.06 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 Thickness of insulation as listed in following table.

.1 Run-outs to individual units and equipment not exceeding 4000 mm long.

.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)				
			to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8
Hot Water Heating	60 - 94	[A-1]	25	38	38	38	38
Domestic HWS	[A-1]	25	25	25	38	38	38

Domestic CWS	[A-3]	25	25	25	25	25	25
Domestic CWS with vapour retarder	[C-2]	25	25	25	25	25	25
RWL and RWP	[C-2]	25	25	25	25	25	25

.3 Finishes:

.1 Exposed indoors: canvas.

.2 Exposed in mechanical rooms: aluminum.

.3 Concealed, indoors: canvas on valves, fittings. No further finish.

.4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.

.5 Outdoors: water-proof aluminum jacket.

.6 Finish attachments: SS, at [150] mm on centre. Seals: closed.

.7 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.07 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.01 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.02 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.

1.03 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

2 Products

2.01 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.02 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/m^2.

2.03 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] [foam rubber].

.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.

2.04 TURNING VANES

.1 Factory or shop fabricated double thickness, to recommendations of SMACNA and as indicated.

2.05 INSTRUMENT TEST

.1 [1.6] mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.06 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

3 Execution

3.01 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 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.

3.02 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 Instrument Test Ports:

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations:

.1 For traverse readings:

.1 Ducted inlets to roof and wall exhausters.

.2 Inlets and outlets of other fan systems.

.3 Main and sub-main ducts.

.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations as approved by [Departmental Representative] [DCC Representative] [Consultant].

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

.3 Turning Vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

3.03 CLEANING

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

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

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

END OF SECTION

1 General

1.01 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.02 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.

1.03 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.

1.04 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect dampers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.01 GENERAL

.1 Manufacture to SMACNA standards.

2.02 SPLITTER DAMPERS

.1 Fabricate from same material as duct but one sheet metal thickness heavier, with appropriate stiffening.

.2 Double thickness construction.

.3 Control rod with locking device and position indicator.

.4 Rod configuration to prevent end from entering duct.

.5 Pivot: piano hinge.

.6 Folded leading edge.

2.03 SINGLE BLADE DAMPERS

.1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA, except maximum height of 100 mm.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside bronze end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

2.04 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

.3 Maximum blade height: as indicated.

.4 Bearings: pin in bronze bushings.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

3 Execution

3.01 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 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.

3.02 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 Dampers: vibration free.

.6 Ensure damper operators are observable and accessible.

.7 Corrections and adjustments conducted by Departmental Representative.

3.03 CLEANING

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

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

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

END OF SECTION

1 General

1.01 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)

.2 National Fire Protection Association (NFPA)

.1 NFPA 90A-[12], Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-[12], Standard for Installation of Warm Air Heating and Air-Conditioning Systems.

.3 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, [2005].

.2 SMACNA IAQ Guideline for Occupied Buildings under Construction,[2005].

.4 Underwriters' Laboratories (UL)

.1 UL 181-[2005], Standard for Factory-Made Air Ducts and Air Connectors.

.5 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S110-[2007], Standard Methods of Tests for Air Ducts.

1.02 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 flexible ducts and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate:

.1 Thermal properties.

.2 Friction loss.

.3 Acoustical loss.

.4 Leakage.

.5 Fire rating.

.3 Test and Evaluation Reports:

.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.

1.03 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect flexible ducts from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.01 GENERAL

.1 Factory fabricated to CAN/ULC-S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.02 METALLIC - UNINSULATED

.1 Type 1: spiral wound flexible aluminum, as indicated.

.2 Performance:

.1 Factory tested to [2.5] kPa without leakage.

.2 Maximum relative pressure drop coefficient: [3].

2.03 METALLIC - INSULATED

.1 Type 2: spiral wound flexible aluminum with factory applied, [37] mm thick flexible glass fibre thermal insulation with vapour barrier and reinforced mylar/neoprene laminate jacket, as indicated.

.2 Performance:

.1 Factory tested to [2.5] kPa without leakage.

.2 Maximum relative pressure drop coefficient: [3].

2.04 NON-METALLIC - UNINSULATED

.1 Type 3: non-collapsible, coated aluminum foil mylar type, mechanically bonded to, and helically supported by, external [steel] wire, as indicated.

.2 Performance:

.1 Factory tested to [2.5] kPa without leakage.

.2 Maximum relative pressure drop coefficient: [3].

2.05 NON-METALLIC - INSULATED

.1 Type 4: non-collapsible, coated aluminum foil/mylar type mechanically bonded to, and helically supported by, external steel wire with factory applied, [37] mm thick flexible mineral fibre thermal insulation with vapour barrier and reinforced mylar/neoprene laminate jacket, as indicated.

.2 Performance:

.1 Factory tested to [2.5] kPa without leakage.

.2 Maximum relative pressure drop coefficient: [3].

2.06 METALLIC ACOUSTIC INSULATED - MEDIUM PRESSURE

.1 Type 5: spiral wound, flexible perforated aluminum with factory applied [37] mm thick flexible mineral fibre thermal insulation and sleeved by aluminum foil/mylar laminate Type M vapour barrier, as indicated.

.2 Performance:

.1 Factory tested to [2.5] kPa without leakage.

.2 Maximum relative pressure drop coefficient: [3].

.3 Acoustical performance: Minimum attenuation (dB/m) to following table:

Frequency (Hz)					
Duct Diam:	125	250	500	1000	2000
[100]	[0.6]	[3]	[12]	[27]	[0]
[150]	[1.2]	[3]	[12]	[22]	[27]
[200]	[2.0]	[5]	[12]	[19]	[20]
[300]	[2.4]	[5]	[12]	[16]	[15]

2.07 NON-METALLIC - ACOUSTIC INSULATED

.1 Type 7: non-collapsible, coated mineral base perforated fabric type helically supported by and mechanically bonded to [steel] wire with factory applied flexible mineral fibre acoustic insulation and encased in aluminum foil/mylar laminate Type M vapour barrier[, as indicated.

.2 Performance:

.1 Factory tested to [2.5] kPa without leakage.

.2 Maximum relative pressure drop coefficient: [3].

.3 Acoustical performance: Minimum attenuation (dB/m) to following table:

	Frequency (Hz)				
Duct Diam:	125	250	500	1000	2000
[100]	[0.6]	[3]	[12]	[27]	[0]
[150]	[1.2]	[3]	[12]	[22]	[27]
[200]	[2.0]	[5]	[12]	[19]	[20]
[300]	[2.4]	[5]	[12]	[16]	[15]

3 Execution

3.01 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for flexible ducts installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of [Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.02 DUCT INSTALLATION

.1 Install in accordance with: CAN/ULC-S110] [UL 181 NFPA 90A NFPA 90B and SMACNA.

3.03 CLEANING

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

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

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

END OF SECTION

1 General

1.01 REFERENCES

.1 ASTM International

.1 ASTM C423-[09a], Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.2 ASTM C916-[85(2007)], Standard Specification for Adhesives for Duct Thermal Insulation.

.3 ASTM C1071-[12], Standard specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

.4 ASTM C1338-[08], Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.

.5 ASTM G21-[09], Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

.2 National Fire Protection Association (NFPA)

.1 NFPA 90A-[12], Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 NFPA 90B-[12], Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

.3 North American Insulation Manufacturers Association (NAIMA)

.1 NAIMA AH116-[2002], Fibrous Glass Duct Construction Standards.

.4 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)

.1 SMACNA, HVAC Duct Construction Standards, Metal and Flexible-[2005].

.2 SMACNA IAQ Guideline for Occupied Buildings Under Construction-[2007].

.5 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S102-[10], Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.02 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 duct liners and include product characteristics, performance criteria, physical size, finish and limitations.

1.03 CLOSEOUT SUBMITTALS

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

.2 Operation and Maintenance Data: submit operation and maintenance data for duct liners for incorporation into manual.

1.04 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect duct liners from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.01 DUCT LINER

.1 General:

.1 Mineral Fibre duct liner: air surface coated mat facing.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with [CAN/ULC-S102] [NFPA 90A] [NFPA 90B].

.3 Fungi resistance: to [ASTM C1338] [ASTM G21].

.2 Rigid:

.1 Use on flat surfaces.

.2 [25] mm thick, to [ASTM C1071] Type [2], fibrous glass rigid board duct liner.

.3 Density: [48] kg/m^3minimum.

.4 Thermal resistance to be minimum [0.76 (m^2. degrees C)/W for 25 mm thickness] [1.15 (m^2.degrees C)/W for 38 mm thickness] [1.53 (m^2.degrees C)/W for 50 mm thickness] when tested in accordance with ASTM C177, at 24 degrees C mean temperature.

.5 Maximum velocity on faced air side: [[20.3] m/s].

.6 Minimum NRC of [0.70 at 25 mm] thickness based on Type A mounting to ASTM C423.

.7 Recycled Content: [EcoLogo certified] [containing minimum [45] [by weight] recycled content] .

.3 Flexible:

.1 Use on round or oval surfaces.

.2 [25] mm thick, to [ASTM C1071] Type [1], fibrous glass blanket duct liner.

.3 Density: [24] kg/m^3 minimum.

.4 Thermal resistance to be minimum [0.37 (m^2.degrees C)/W for 12 mm thickness] [0.74 (m^2.degrees C)/W for 25 mm thickness] [1.11 (m^2.degrees C)/W for 38 mm thickness] [1.41 (m^2.degrees C)/W to 50 mm thickness] when tested in accordance with [ASTM C177], at 24 degrees C mean temperature.

.5 Maximum velocity on coated air side: [[25.4] [30.5] m/s].

.6 Minimum NRC of [0.65 at 25 mm] thickness based on Type A mounting to ASTM C423.

2.02 ADHESIVE

.1 Adhesive: to [NFPA 90A and NFPA 90B] [ASTM C916].

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29 degrees C to plus 93 degrees C.

.3 Water-based [fire retardant] type.

2.03 FASTENERS

.1 Weld pins [2.0] mm diameter, length to suit thickness of insulation. Metal retaining clips, [32] mm square.

2.04 JOINT TAPE

.1 Poly-Vinyl treated open weave fiberglass membrane [50] mm wide.

2.05 SEALER

.1 Meet requirements of [NFPA 90A] [NFPA 90B].

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68 degrees C to plus 93 degrees C.

3 Execution

3.01 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for duct liner installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.02 GENERAL

.1 Do work in accordance with SMACNA HVAC Duct Construction Standard except as specified otherwise.

.2 Line inside of ducts where indicated.

.3 Duct dimensions, as indicated, are clear inside duct lining.

3.03 DUCT LINER

.1 Install in accordance with manufacturer's recommendations, and as follows:

.1 Fasten to interior sheet metal surface with 100% coverage of adhesive to ASTM C916.

.1 Exposed leading edges and transverse joints to be factory coated or coated with adhesive during fabrication.

.2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres impact driven mechanical fasteners to compress duct liner sufficiently to hold it firmly in place.

.1 Spacing of mechanical fasteners in accordance with SMAC HVAC Duct Construction Standard.

.2 In systems, where air velocities exceeds [20.3] m/s, install galvanized sheet metal noising to leading edges of duct liner.

3.04 JOINTS

.1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:

.1 Bed tape in sealer.

.2 Apply [2] coats of sealer over tape.

.2 Replace damaged areas of liner at discretion of Departmental Representative.

.3 Protect leading and trailing edges of duct sections with sheet metal nosing having [15] mm overlap and fastened to duct.

3.05 CLEANING

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

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

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

END OF SECTION

1 General

1.01 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.

.3 Samples:

.1 Samples are required for following:

.1 Submit duplicate 300 x 300 mm samples of each type.

1.02 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.

1.03 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect diffuser, registers and grilles from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.01 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.

2.02 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 directed by Departmental Representative.

2.03 MANUFACTURED UNITS

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

2.04 SUPPLY GRILLES AND REGISTERS

.1 General: with opposed blade dampers.

.2 Type SA: aluminum, 25 mm border, double deflection with airfoil shape, horizontal face and vertical rear bars.

2.05 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 General: with opposed blade dampers.

.2 Type RA: aluminum, 19 mm border, single 0 degrees deflection, horizontal face bars. Finish: [_____]. Model: [_____].

.3 Type RC: aluminum, 19 mm border, 25 x 25 mm egg crate type face bars.

2.06 DIFFUSERS

.1 General: volume control dampers with flow straightening devices and blank-off quadrants and gaskets.

.2 Type DB: aluminum, square type, having fixed pattern, lay-in or surface mounted. Refer to floor plan.

3 Execution

3.01 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 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.

3.02 INSTALLATION

.1 Install in accordance with manufacturers instructions.

.2 Install with flat head stainless steel screws in countersunk holes where fastenings are visible.

.3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.

.4 Provide concealed safety chain on each grille, register and diffuser in dry good storage.

3.03 CLEANING

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

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

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

END OF SECTION

1 General

1.01 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

.2 Underwriters' Laboratories of Canada (ULC)

1.02 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 chimneys and stacks and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.2 Indicate following:

.1 Methods of sealing sections.

.2 Methods of expansion.

.3 Details of thimbles.

.4 Bases/Foundations.

.5 Supports.

.6 Guy details.

.7 Rain caps.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.03 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, applicable Provincial/Territorial regulations.

.2 Certifications:

.1 Catalogued or published ratings: obtained from tests carried out by independent testing agency or manufacturer signifying adherence to codes and standards.

1.04 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

2 Products

2.01 TYPE B GAS VENT

.1 ULC labelled, [288] degrees C rating maximum, atmospheric gas vent only.

.2 Sectional, prefabricated, double wall with 13 mm air space. Aluminum inner wall. Galvanized steel outer wall. Mated fittings and couplings.

2.02 STEEL CHIMNEY REFRACTORY LINED

.1 Material:

.1 Prefabricated sections with [90] mm thick high temperature impervious insulating refractory lining, centrifugally spun into [3.5] mm thick circular casing.

.2 Construction:

.1 Prefabricated sections, welded [on site] [at factory]. Use high temperature insulating cement at joints in refractory lining.

.3 Welding:

.1 To full thickness; grind welds smooth.

.4 Supports:

.1 Welded gussets, cleats and bolts for installation on concrete base.

.2 Chimney vertically.

.5 Breeching entry:

.1 Tee section with [150] mm minimum refractory lined projection.

.6 Access door: in bottom section.

.7 Drain connection: at base of stack.

.8 Dimensions: as indicated.

2.03 ACCESSORIES

.1 Cleanouts: bolted, gasketted type, full size of breeching, as indicated.

.2 Barometric dampers: [single] [double] acting, 70% of full size of breeching area.

.3 Hangers and supports: [in accordance with recommendations SMACNA] [as indicated].

.4 Rain cap.

.5 Expansion sleeves with heat resistant caulking, held in place as indicated.

3 Execution

3.01 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for chimney and stack installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.02 INSTALLATION - GENERAL

.1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.

.2 Suspend breeching at [1.5] m centres and at each joint.

.3 Support chimneys at bottom, roof and intermediate levels as indicated.

.4 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney. Pack annular space with heat resistant caulking.

.5 Install flashings on chimneys penetrating roofs, as indicated.

.6 Install rain caps and cleanouts, as indicated.

3.03 INSTALLATION - REFRACTORY LINED STEEL CHIMNEY

.1 Grind welds smooth to form appearance of single tube.

.2 Seal insulating refractory at top of stack.

.3 Pack annular space around breeching at entry tee with heat resistant caulking.

.4 On completion, paint one coat of rust inhibitive primer and two coats of heat resisting paint of colour, make and quality approved by Departmental Representative.

3.04 CLEANING

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

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

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

END OF SECTION

1 General

1.01 SUMMARY

.1 This Section includes requirements for supply and installation of gas fired unit heaters.

1.02 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA):

.1 CSA 2.6-2002 (R2005), Gas Unit Heaters and Gas-Fired Duct Furnaces, including all Addenda.
.2 CAN/CSA B149.1-05, Natural Gas and Propane Installation Code

1.03 SUBMISSIONS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit product data sheets for unit heaters including, but not limited to, the following:

.1 Product characteristics.
.2 Performance criteria.
.3 Mounting methods.
.4 Physical size.
.5 kW (BTU/hour) rating, voltage, phase.
.6 Cabinet material thicknesses.
.7 Limitations.
.8 Colour and finish.

.3 Submit manufacturer's written installation instructions indicating special handling criteria, installation sequence, and cleaning procedures.

.4 Submit shop drawings indicating, but not limited to, the following:

.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.

1.04 CLOSEOUT SUBMISSIONS

.1 Provide operations and maintenance information in accordance with Section 01 78 00 – Closeout Submittals.

1.05 QUALITY ASSURANCE

.1 Provide materials and installation conforming to requirements of CSA, and provincial and municipal Codes; unit heaters shall be CSA listed.

2 Products

2.01 MATERIALS

.1 Self contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, gas burner and controls.

.2 Unit Heater [UH-[1]]:

.1 Performance Requirements: [as indicated in Unit Heater Schedule [on Drawing.

.2 Housing:

.1 Mounting: Ceiling; 4 point] suspension Mounted.

.2 Construction: 1.2 mm thick cold rolled steel, with threaded connections for hanger rods; and easily removed and secured access doors; glass or mineral fibre insulation and reflective liner.

.3 Finish: Gloss enamel finish; colour selected from manufacturers standard range.

.3 Heat Exchanger: Aluminized steel; welded construction.

.4 Supply Fan: Propeller fans direct drive rubber mounted; overload protected motor.

.5 Burner:

.1 Gas Supply: Natural Gas.

.2 Shut-off Valve: Manufacturers standard manual valve and union.

.3 Gas Burner: Atmospheric type with adjustable combustion air supply, equipped with combination gas valve and pressure regulator incorporating manual shut-off, pilot valve, automatic 100% shut-off and thermocouple pilot safety device.

.4 Gas Burner Safety Controls: Thermocouple sensor prevents opening of solenoid gas valve until pilot flame is proven and stops gas flow on ignition failure.

.5 Starter: Spark ignited, intermittent safety pilot with electronic flame supervision [with] [without] timed lockout]

.6 Burner Operating Controls:

.1 Low voltage, two stage adjustable room thermostat, controls burner operation to maintain room temperature setting.

.2 High limit control, with fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature and energizes burner when temperature drops to lower safe value.

.3 Control supply fan in accordance with bonnet temperatures and independent of burner controls. Include manual switch for continuous fan operation.

.7 Accessories:

.1 Vertical combustion air/vent kit including concentric adapter.

.2 Vertical louvers.

.3 Downturn air nozzle.

.4 Hanger kits.
.5 Manual shut-off valve.
.6 Thermostat guard with locking cover.

.3 Draft Control:

.1 Provide each unit heater with galvanized steel flue pipe having airtight joints in accordance with Section 23 51 00.
.2 Provide unit heater with suitable draft diverter.

3 Execution

3.01 INSTALLATION

.1 Suspend and install unit heater(s) from roof structure in accordance with manufacturer's instructions; provide supplementary suspension steel as required for complete installation.

.2 Confirm final location with Departmental Representative if different from that indicated prior to installation; request clarification from Departmental Representative where deviations beyond allowable clearances arise.

.3 Equip gas lines with shut-off valve in close proximity to unit heater(s).

.4 Install thermostats in locations indicated; confirm location with Departmental Representative where thermostat locations are in close proximity to other wall mounted devices.

.5 Set discharge patterns and fan speeds to suit requirements before acceptance.

3.02 PERFORMANCE

.1 Refer to Unit Heater Schedule on Drawing.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section includes:

.1 Labour, products, equipment and services necessary to complete the work of this Section.

1.2 CODES, PERMITS AND INSPECTIONS

.1 Applicable Codes and Standards

.1 Canadian Electrical Code, CSA C22.1 Part-I, 2018 edition
.2 CSA C22.2, Part II
.3 CSA C22.3, Part III, Overhead system
.4 CAN3-C235-[83(R2010)], Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
.5 Electrical Safety Authority (ESA)
.6 Electrical and Electronic Manufacturers Association of Canada (EEMAC)
.7 National Electrical Manufacturers Association (NEMA)
.8 Alberta Building Code 2014
.9 Canadian Standards Association (CSA)
.10 Underwriters' Laboratories of Canada (ULC)
.11 National Building Code of Canada (NBC) 2005
.12 Illuminating Engineering Society (IES)
.13 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE)
.14 CSA C282-09, Emergency Electrical Power Supply for Buildings
.15 CSA Z32-09, Electrical safety and Essential Electrical Systems in Health Care Facilities
.16 National Fire Protection Association (NFPA)
.17 American Standards Association (ASA or ANSI)
.18 Institute of Electrical and Electronic Engineers (IEEE)
.19 Electronic Industries Association (EIA)
.20 Telecommunications Industry Association (TIA)
.21 Building Industry Consulting Services, International (BICSI)
.22 Material Safety Data Sheets by product manufacturers
.23 Hydro inspection permits
.24 Codes, standards, and regulations of local governing authorities having jurisdiction
.25 Additional codes and standards listed in Trade Sections
.26 Departmental Representative's standards
.27 Local Hydro Standards

.2 Comply with Canadian Electrical Code, all local, provincial and federal laws, where applicable and with authorities having jurisdiction. Make any changes or alterations required by authorized inspector of authority having jurisdiction.

.3 Equipment and material must be acceptable to Electrical Safety Authority.

.4 Where materials are specified which require special inspection and approval, obtain such approval for the particular installation with the co-operation of the material supplier.

.5 Obtain and pay for permits and inspections required for work performed.

.6 Supply and install warning signs, nameplates and glass covered Single Line Diagrams as required by Electrical Safety Authority.

.7 Submit required Documents and shop drawings to authorities having jurisdiction in order to obtain approval for the Work. Copies of Contract Drawings and Specifications may be used for this purpose.

1.3 REFERENCE STANDARDS

.1 These Specifications supplement the referenced standards.

.2 Where standards differ between authorities, the most rigid apply.

.3 Where requirements of the specifications exceed referenced standards, the specifications apply.

.4 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.4 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE STD 100.

1.5 DRAWING AND SPECIFICATIONS COORDINATION

.1 In the case of discrepancies or conflicts between the Drawings and Specifications and local governing authority standards, contact Departmental Representative and obtain direction. If direction is not available prior to close of Bids, include for the most costly arrangement, but ensure that direction is obtained prior to start of the Work.

1.6 COORDINATION

.1 Carefully examine Work and Drawings of all related trades and thoroughly plan the Work so as to avoid interferences. Report defects which would adversely affect the Work. Do not commence installation until such defects have been corrected.

.2 Coordinate Work of this Division such that items will properly interface with Work of other Divisions.

.3 All embedded openings shall be considered by structural and architectural disciplines.

.4 Architectural Drawings, all equipment arrangement and cable or cable tray route shall be rechecked with Architectural drawing before starting installation.

.5 Mechanical Drawings, all mechanical related loads (location and required power / voltage) shall be rechecked by Mechanical final drawing.

.6 Coordinate work of this Division to ensure that damage does not occur to the fireproofing work of any other Division.

1.7 SUBSTITUTIONS

.1 When only one manufacturer's catalogued trade name is specified, provide only that catalogued trade name, material or product.

.2 When more than one manufacturer's trade name is specified for a material or product, the choice is the bidders.

.3 No substitution is allowed upon award of contract.

1.8 DIMENSIONS AND QUANTITIES

.1 Dimensions shown on Drawings are approximate. Verify dimensions by reference to shop drawings and field measurement.

.2 Quantities or lengths indicated in Contract Documents are approximate only and shall not be held to gauge or limit the Work.

.3 Make necessary changes or additions to routing of conduit, cables, cable trays, and the like to accommodate structural, mechanical and architectural conditions. Where raceways are shown diagrammatically run them parallel to building column lines.

1.9 EQUIPMENT LOCATIONS

.1 Devices, fixtures and outlets may be relocated, prior to installation, from the location shown on the Contract Drawings, to a maximum distance of 3 m, without adjustment to Contract price.

.2 Switch, control device and outlet locations are shown diagrammatically.

1.10 WORKING DRAWINGS AND DOCUMENTS

.1 Where the word "HOLD" appears on Drawings and other Contract Documents, the Work is included in the Contract. Execute such Work only after verification of dimensions and materials and obtaining Departmental representative's written permission to proceed.

1.11 INSTALLATION DRAWINGS

.1 Prepare installation drawings for equipment, based upon approved Vendor drawings, to check required Code clearances, raceway, busway and cable entries, sizing of housekeeping pads and structure openings. Submit installation drawings to Departmental Representative for review.

1.12 "AS BUILT" RECORD DRAWINGS

.1 Maintain a set of Contract Drawings on site and record all deviations from the Contract Documents. As a mandatory requirement, recording must be done on the same day deviation is made. Be responsible for full compliance with this requirement.

.2 Mark locations of feeder conduits, junction and terminal boxes and ducts or conduits run underground either below the building or outside the building.

.3 Where conduit and wiring are underground or underfloor, furnish field dimension with respect to building column lines and inverts with respect to finished floor levels or grades.

.4 Record deviations from branch circuit numbers shown on Drawings.

.5 Prepare diagrams of interconnecting wiring between items of equipment including equipment supplied by Departmental Representative and under other Specification Sections.

1.13 SINGLE LINE DIAGRAM

.1 Reproduce this diagram in drawing form under glazed frame and mount in Main Electrical Room. Provide a copy of this diagram to the Departmental Representative and include in the Maintenance Manuals.

1.14 TEST REPORTS

.1 For each check and test performed prepare and submit a Test Report, signed by the Test engineer, and where witnessed, by the Departmental representative.

.2 Include record of all tests performed, methods of calculation, date and time of test, ambient conditions, names of testing company, test engineer, witnesses, also calibration record of all test instruments used together with manufacturers name, serial number and model number.

.3 Include calibration record, percentage error and applicable correction factors.

.4 Submit a Certified Test Report from each manufacturer, signed by the certifying inspector, confirming correct installation and operation of each product and part of

Work. Include name of certifying inspector, date and times of inspection, ambient conditions.

1.15 SUBMITTALS

.1 Submittals to be in accordance with Division 01 Submittal Procedures, the articles below and/or as indicated in each electrical specification section.

.2 Submit manufacturer's printed product literature, specifications and datasheet. Include product characteristics, performance criteria, and limitations.

.3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Division 01 Submittal Procedures.

.4 Submit shop drawings in accordance with Division 01 Submittal Procedures.

.1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.2 Provide separate shop drawings for each isolated system complete with performance and product data.

.5 Submit to the Departmental Representative, the necessary number of electrical drawings and specifications for examination, special inspection and/or approval, prior to the commencement of the work, and pay for all costs and associated fees. If required prepare any additional drawings/documents required by either Authority.

.6 Obtain and pay for permits and inspections required for the work performed.

.7 Shop drawings:

.1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.3 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.8 Quality Control:

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with contract.

.5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

.9 Manufacturer's Field Reports: submit to Departmental Representative the manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

.10 Where materials are specified which require special inspection and approval, obtain such approval for the particular installation with the co-operation of the material supplier.

1.16 QUALITY ASSURANCE

.1 Quality Control and Assurance: in accordance with Division 01 Quality Control.

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.

.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.3 Health and Safety Requirements: do construction and occupational health and safety in accordance with Division 01 Health and Safety Requirements.

1.17 FACTORY WITNESS TESTS

.1 Prior to Departmental Representative attendance at factory for witness testing, perform the following:

.1 Successfully conduct test to be witnessed.

.2 Following successful testing, inform the Departmental representative, in writing, that tests to be witnessed have been successfully performed.

1.18 SYSTEM STARTUP

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

.2 Arrange and pay for services of Factory Service Engineer for major systems, to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant will aspects of its care and operation.

1.19 OPERATING AND MAINTENANCE MANUALS

.1 Refer to and comply with Division 01 and related Sections.

.2 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.3 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.4 Provide a video recording of the training sessions for all major electrical equipment and electrical systems.

.5 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.6 Post instructions where directed.

.7 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.8 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.20 AREA CLASSIFICATION

.1 No area in the Work is classified as Hazardous.

1.21 COMMISSIONING

.1 A Commissioning Agent will be appointed by the Departmental Representative to oversee the commissioning activities of the project. This contractor is to:

.1 Interface, cooperate and coordinate with the Commissioning Agent and attend commissioning meetings.

.2 Perform commissioning activities for aspects of work provided in Electrical Divisions and perform corrective work identified by the Commissioning Agent.

.3 Refer to Section 26 08 06 Field Testing and Commissioning Low Voltage for additional requirements.

.2 Refer to Division 01 for additional commissioning requirements.

.3 The Commissioning Agent may also be present for any testing/commissioning activities and are to be notified by the Contractor in advance of these activities.

.4 Submit a copy of test reports of systems and equipment to the Commissioning Agent, prior to start of commissioning activity or as directed by Commissioning Agent.

.5 Where commissioning specifications are included as part of Division 01, the requirements of the Section entitled Electrical Commissioning are to supplement commissioning requirements of Division 01. Where variances or contradictions exist, the more stringent requirement will apply unless otherwise directed by Departmental representative.

1.22 LOCAL ELECTRICAL UTILITY REQUIREMENTS

.1 Comply with the latest conditions of supply requirements of the local electrical Utility having jurisdiction. Execute infrastructure work related to the local Utility in accordance with requirements and coordinated Utility requirements with the

respective Divisions of the Work providing such work. Include for the following in relation to Utility:

.1 Two preconstruction meeting;

.2 Access for electrical Utility's Inspector to be on duty for duration of work or as required by the Utility;

.3 Underground inspection: submission of approval drawings and application for inspection prior to any inspection of work;

.4 Approval of work and materials by electrical Utility's Inspector prior to any backfilling work.

1.23 SERIES RATED COMBINATIONS

.1 Series rated combinations of over-current protective devices are not permitted. Provide full rating distribution as shown on plans.

2 Products

2.1 APPROVALS AND QUALITY

.1 Provide new materials bearing certification marks or labels acceptable under Canadian Electrical Code.

.2 Equipment must bear, on manufacturer's label, certification mark or label acceptable under Electrical Safety Authority.

.3 Provide units of same manufacture where two or more units of same class or type of equipment are required.

.4 Manufacturer's names are stated in this Specification to establish a definite basis for tender submission and to clearly describe the quality of product that is desired for the work.

2.2 STANDARD SPECIFICATIONS

.1 Ensure that the chemical and physical properties, design, performance characteristics and methods of construction of all products provided comply with latest issue of applicable Standard Specifications issued by authorities having jurisdiction, but such Standard Specifications shall not be applied to decrease the quality of workmanship, products and services required by the Contract Documents.

2.3 MATERIALS AND EQUIPMENT

.1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.

.2 Factory assemble control panels and component assemblies.

.3 Ensure no counterfeit breakers are used in the project. Do random sample checks in non-factory supplied breakers.

.4 Enclosure CSA types referred to in this specification to be in accordance to CAN/CSA 22.2 No.94-M91(R2011)-Special Enclosures and/or their EEMAC/NEMA equivalent, whichever is more stringent.

.5 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.6 Storage and Handling Requirements:

.7 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.8 Replace defective or damaged materials with new.

2.4 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls as indicated.

.2 Control Wiring and Conduit: in accordance with section 26 05 05 – Electrical Requirements for Mechanical Equipment, except for conduit wiring and connections below 50V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.5 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of departmental Representative having jurisdiction.

.2 Decal signs, minimum size 175 x 250 mm.

2.6 WIRING TERMINATIONS

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

2.7 SPRINKLER PROOF EQUIPMENT

.1 Ensure that electrical equipment installed in electrical rooms and other areas containing sprinklers is constructed such that exposure to water from the sprinkler heads does not impair the effectiveness of the enclosed equipment.

.2 Provide a separate cover or roof on all 2285 mm high equipment. Provide an overhang at the front, rear and sides to effectively prevent the entrance of water either at the top or through projecting faceplates, meters, etc.

.3 Where penetrations are made in drip shields, flash and seal using manufacturer's approved caulking to maintain drip shield integrity.

.4 Ensure that enclosure louvres are of outdoor design such that falling water or water running down the sides will not enter the enclosure.

.5 Where enclosure openings in the top or sides are required for outgoing conduits, provide waterproof conduit fittings.

.6 Provide panels and transformers with hoods.

.7 Provide sprinkler proof busways.

.8 In electrical rooms containing sprinklers provide wall mounted equipment such as pull boxes, junction boxes, splitter troughs, wireways, auxiliary gutters, cable troughs and disconnect switches located below the level of the sprinkler heads with the following accessories:

.1 Gaskets on doors and drip shields on equipment, panelboards, panels and enclosures.

.2 Louvres facing outward and downward where openings are required for heat dissipation. Expanded metal screening is not acceptable.

2.8 HOUSEKEEPING PADS

.1 Provide 100 mm high concrete pads under floor mounted electrical equipment. Extend pads 50 mm outside the equipment perimeter.

2.9 FIRE STOPPING AND SMOKE SEALS

.1 Where electrical material or devices pass through fire rated separations, make penetrations and provide fire barrier seals with a fire resistance rating equivalent to the rating of the separation.

.2 Prior to installation, submit for review, proposed fire barrier seal materials, method of installation and ULC system number.

.3 Provide fire stopping and smoke seals in accordance with Section 07 84 00.

2.10 MISCELLANEOUS METAL FABRICATIONS

.1 Provide miscellaneous structural supports, platforms, braces, brackets and preformed channel struts necessary for suspension, attachment or support of electrical equipment in accordance with Section 05 50 00.

2.11 SILICONE

.1 Products and materials containing silicone are not permitted.

2.12 EQUIPMENT COLOUR CODING

.1 Exterior finish paint colour for control panels, panelboards and devices on emergency and UPS systems:

.1 Emergency systems: red

.2 UPS systems: blue

2.13 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: lamicoid 3 mm, black face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

.2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacturing.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled, voltage and power source.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

.8 Transformers: indicate capacity, primary and secondary voltages and power source.

.9 Panelboards: indicate system, rated ampacity, voltage, phase, wire configuration and power source.

.10 Switchboard: indicate rated ampacity, voltage, phase, wire configuration.

.11 Receptacles: indicate circuit numbers using P-Touch type labels.

2.14 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1 as follows:

.1 Phase A – Red
.2 Phase B – Black
.3 Phase C – Blue
.4 Neutral – White
.5 Ground – Green

.6 Isolated Ground – Green and Yellow

2.15 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at conduit system couplings.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

System	Normal	Emergency	UPS
up to 15 kV	Yellow	-	-
347/600 V	Orange	Orange/Red	Orange/Blue
120/208 V	Black	Black / Red	Black / Blue
Fire Alarm	Red	-	-
Emergency Voice	Red / Blue	-	-
LAN	Green	-	-
Security	Red/Yellow	-	-
Low Voltage Control	White	-	-

2.16 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish to EEMAC standard.

.2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1 (ANSI 61).

2.17 PRODUCTS FURNISHED BY DEPARTMENTAL REPRESETATIVE

.1 Carefully examine the Vendor or Manufacturers' drawings and provide any incidental and miscellaneous materials, mounting hardware and supports required for complete systems.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Do complete installation in accordance with the Canadian Electrical Code except where specified otherwise.

.2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

.3 Complete installation in accordance with Alberta Building Code and Canadian Electrical Code.

.4 Elevator Systems: Provide for "Related Work" listed and identified under Section 14 20 00, Elevators, to be executed by Electrical Contractor.

.5 Mechanical Systems: Provide for 'Related Work' listed and identified for Divisions 26, 27 and 28, under Mechanical Divisions 21, 22, 23 and 25, to be executed by Electrical Contractor.

.6 Feature Water Fountain Systems: This contractor is to provide all electrical branch wiring tight-ins at panelboard 'RP-RBA' in Fountain Pump Room (B135) Room for electrical wiring brought to panelboard by Water Fountain Contractor electrical subcontractor.

3.3 MANUFACTURER'S ATTENDANCE

.1 Provide manufacturer's representatives to initially start-up each part of the Work, as specified, to check, adjust, calibrate and balance as applicable all components including controls and field wiring. Provide these services for such period and for as many visits as necessary to achieve complete working order in the subject Work.

3.4 FIELD INSPECTION

.1 Provide Field Engineer for inspection and certification of equipment during installation, testing and commissioning as required.

3.5 HOUSEKEEPING PADS

.1 Provide concrete pads to the requirements of Division 03.

3.6 FIRE BARRIERS

.1 Provide fire stopping to the requirements of Division 07

3.7 PAINTING

.1 Touch up finishes on electrical equipment found to be marred on completion of the Work using same colour and type of finish as originally used.

.2 Prime paint field fabricated metalwork.

.3 Other painting will be provided under Section 09 91 00.

3.8 CORE DRILLING

.1 Core Drilling Procedure

.1 Examine locations to be core drilled where:
  .1 Diameter is greater than 25 mm
  .2 Multiple drillings required and where the distance between centres is less than 10 times the diameter of the hole

.2 Examine by most suitable method including:
  .1 X-ray
  .2 Ferro scan
  .3 Cable detection

.3 Examine from both sides of the structure to be drilled.

.4 Examine proposed core drilling locations to determine:
  .1 Possible interference with
    .1 Services
    .2 Structural components

.5 Select locations as suitable for core drilling and label them:
  .1 Uniquely number each drilling location and core so that markings will be legible after drilling
  .2 Mark each core with a north pointing arrow where drilling a slab or upward pointing arrow where drilling a wall

.6 Without interfering with or damaging any services or structural elements, drill pilot holes sufficient to verify location of potential obstructions or for alignment purposes.

.7 Use impact drill when drilling holes of 25 mm diameter or less. For holes of greater diameter use core drill.

.8 Prepare report showing intended core drill locations including printouts, X-ray images. Submit the report for approval prior to drilling to Departmental representative.

.9 Proceed with core drilling only after approval has been received from Departmental representative.

.10 Confine drilling operation to time-of-day as stipulated by Departmental representative.

.11 Position suitable warning notices of a type acceptable to Departmental Representative and exercise caution to ensure safety and protection of personnel and property during drilling especially from effects of water, dust damage, or falling objects below the slab or behind the wall being drilled.

.12 Stop drilling immediately, and report to Departmental representative, if contact is made with foreign objects such as reinforcing steel (rebar), electrical conduit, water pipes, drainage pipes.

.13 Cover open holes with secured covers to guard against fall through of objects.

.14 Provide necessary firestopping, temporary or otherwise, sufficient to firestop holes that would be otherwise open during hours that the location is unattended. Coordinate placement of firestopping with Departmental representative.

.15 Store all cores or core fragments on site and make them available for inspection by Departmental representative. Dispose of the cores or core fragments after permission is received from Departmental representative.

3.9 SLEEVES, CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: sized for free passage of conduit, and protruding 50mm.

.2 Sleeves through concrete floors: sized for free passage of conduit, protruding 50 mm and water-tight.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.10 LOCATION OF OUTLETS

.1 Do not install outlets back-to-back in wall; install boxes in adjacent stud wall partitions to preserve STC ratings of compartments.

.2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.3 Locate light switches on latch side of doors.

.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.11 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 Light switches and Dimmer Controls: 1400 mm.

.2 Wall receptacles:

.1 Mount vertically, unless directed otherwise on drawings.

.2 General: 300 mm.

.3 Above top of continuous baseboard heater: 200 mm.

.4 Above top of counters or counter splash backs: 175 mm.

.5 Mechanical Rooms: 1400 mm

.6 Hazardous Areas: 1400 mm

.3 LAN Outlets: 300 mm.

.4 Fire alarm pull stations: 1500 mm

.5 Fire alarm bells: 2100 m.

.6 Wall mounted speakers, horns or strobes: 2300 mm or 150 mm below ceiling

.7 Card readers: 900 mm

.8 Door operators: 900 mm

.9 Television outlets: 300 mm.

.10 Panelboards: as required by Canadian Electrical Code or as indicated on plans

.11 Clocks: 2100 mm.

.12 Door bell pushbuttons: 1500 mm.

.13 Wall mounted exit signs: 150 mm above door frame

.14 Wall mounted exit signs: 150 mm below ceiling

3.12 COORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings as determined in accordance with Section 26 05 73.

.2 Ensure all distribution equipment is labelled in accordance with the Arc Flash Study.

.3 Provide a signed letter from a Professional Engineer licensed in the Province of Alberta confirming the following:

.1 Settings of the protective devices have been adjusted as per the short circuit coordination study.

.2 Arc flash classification labels to all items of electrical distribution equipment have been installed as per the Arc-flash study.

3.13 FIELD QUALITY CONTROL AND COMMISSIONING

.1 Carry out testing and commissioning for electrical systems and equipment in in presence of Departmental Representative and in accordance with relevant standards such as CSA, ULC, ANSI. Comply with the Acceptance Testing Specifications for the International Electrical Testing Association Inc (NETA).

.2 Refer to Sections 019113, 019131, 019133 and 019141 for all commissioning requirements.

.3 Conduct and pay for all testing and commissioning.

.4 Refer to each Section of Division 26, 27 and 28 for additional testing requirements for specific equipment components.

.5 Provide the instruments, meters, equipment and personnel required to conduct the tests during and at the conclusion of the project.

.6 In addition to the requirements of Division 1, all the electrical generic commissioning forms in connection with the equipment or systems have been structured in 3 parts: product identification, installation/operational check list and performance verification. All available commissioning forms are included in Division 1. Make those forms project specific and develop new ones where not

available. Structure any new forms in 3 parts as described and provide all details to capture all requirements. The contractor shall utilize and follow procedures for testing as outlined in the NETA 2001 standard for acceptance testing and in addition as described in various electrical sections.

.7 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.8 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

.1 Power generation, distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm, communications.

.6 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.9 Advise Departmental representative, when testing to be performed.

.10 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation, testing and commissioning in accordance with manufacturer's instructions.

.11 Ten months after the building has been completed and occupied, and all load balancing and adjustments have been completed, carry out or engage and pay for a specialist to carry out an Infra Red Scan using AEGMA or equivalent instrument,

on all major equipment and submit report complete with pictures and recommendations. Scanning time to be fully coordinated with the Departmental representative, at least two (2) weeks in advance, and shall meet all site operational requirements. Submit scanning plan to Departmental Representative and Engineer for review and approval.

.1 Major equipment shall include at least the following:

.1 All Low Voltage Switchboards

.2 All Distribution Panels, branch circuit Panels and disconnect switches.

.3 All motor starters (including VFDs) and all motor connections.

.4 Busway

.5 Transformers

.2 Submit to the Departmental Representative scan results within 48 hours of scanning. Adjust and modify the equipment as instructed by the Engineer. For equipment requiring adjustment or modification, rescan under load, until Engineer accepts results. Resubmit results for Engineer's review.

.3 All work to be performed on weekends and after hours.

3.14 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

End of Section

1 General

1.1 SUMMARY

.1 Section includes:

.1 Labour, products, equipment and services necessary to complete the work of this Section.

1.2 RELATED SECTIONS

.1 Section 26 05 01: Basic electrical requirements.

.2 Section 26 05 54: Electrical identification.

1.3 REFERENCES

.1 Conform to latest issues, amendments and supplements of following standards:

.1 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.40-M - Primer, Structural Steel, Oil Alkyd Type

.2 Canadian Institute of Steel Construction (CISC/CPMA)

.1 CISC/CPMA 2.75 - Canadian Institute of Steel Construction/ Canadian Paint Manufacturers Association, A Quick Drying Primer For Use on Structural Steel

.3 Canadian Standards Association (CSA):

.1 CAN3-C21.1-M - Control Cable - 600V

.2 CAN3-C21.2-M - Control Cable for Low Energy Circuits 150V and 300V

.3 CAN/CSA C22.2 No. 18 - Outlet Boxes, Conduit Boxes, and Fittings

.4 CAN/C22.2 No. 26 - Wireways, Auxiliary Gutters and Associated Fittings

.5 CSA C22.2 No. 30-M - Explosion-Proof Enclosures for Use in Class I Hazardous Locations

.6 CSA C22.2 No. 38-M - Thermoset Insulated Wires and Cables

.7 CSA C22.2 No. 40-M - Cutout, Junction and Pull Boxes

.8 CSA C22.2 No. 42-M - General Use Receptacles, Attachment Plugs and Similar Wiring Devices

.9 CSA C22.2 No. 45-M - Rigid Metal Conduit

.10 CSA C22.2 No. 49 - Flexible Cords and Cables

.11 CAN/CSA C22.2 No. 51-M - Armoured Cables

.12 CSA C22.2 No. 52-M - Service-Entrance Cables

.13 CSA C22.2 No. 56 - Flexible Metal Conduit and Liquid-Tight

Flexible Metal Conduit

.14 CSA C22.2 No. 62 - Surface Raceway Systems

.15 CSA C22.2 No. 65 - Wire Connectors

.16 CSA C22.2 No. 75-M - Thermoplastic Insulated Wires and Cables

.17 CSA C22.2 No. 76-M - Splitters

.18 CSA C22.2 No. 79 - Cellular Metal and Cellular Concrete Floor Raceways and Fittings

.19 CSA C22.2 No. 80 - Underfloor Raceways and Fittings

.20 CSA C22.2 No. 83-M - Electrical Metallic Tubing

.21 CAN/CSA-C22.2 No. 85-M - Rigid PVC Boxes and Fittings

.22 CAN/CSA C22.2 No. 94-M -Special Purpose Enclosures

.23 CSA C22.2 No. 123-M - Aluminum Sheathed Cables

.24 CSA C22.2 No. 124-M - Mineral-Insulated Cables

.25 CSA C22.2 No. 126-M - Cable Tray Systems

.26 CSA C22.2 No. 127 - Equipment Wires

.27 CAN/CSA-C22.2 No. 131-M - Type Teck 90 Cable

.28 CSA C22.2 No. 138-M - Heat Tracing Cable and Cable Sets for Use in Hazardous Locations

.29 CSA C22.2 No. 159-M - Attachment Plugs, Receptacles and Similar Wiring Devices for Use in Hazardous Locations: Class I, Groups A, B, C, and D; Class II, Group G, in Coal or Coke Dust, and in Gaseous Mines

.30 CSA C22.2 No. 174-M - Cable and Cable Glands for Use in Hazardous Locations

.31 CSA C22.2 No. 182.1 - Industrial Type, Special Use Attachment Plugs, Receptacles, and Connectors

.32 CSA C22.2 No. 182.2-M - Industrial Locking Type, Special Use Attachment Plugs, Receptacles, and Connectors

.33 CSA C22.2 No. 182.3-M - Special Use Attachment Plugs, Receptacles, and Connectors

.34 CSA C22.2 No. 208-M - Fire Alarm and Signal Cable

.35 CSA C22.2 No. 211.2-M - Rigid PVC (Unplasticized) Conduit

.36 CSA C22.2 No. 211.3 - Rigid Fiberglass Reinforced Epoxy (RE) Conduit and Associated Fittings

.37 CSA C22.2 No. 214-M - Communications Cables

.38 CSA C22.2 No. 222-M - Type FCC Under-Carpet Wiring System

.39 CSA C22.2 No. 227.1 - Electrical Nonmetallic Tubing

.40 CSA C22.2 No. 227.2 - Flexible Liquid-Tight Nonmetallic Conduit

.41 CSA C22.2 No. 227.3-M - Flexible Nonmetallic Tubing

.42 CSA C22.2 No. 230-M - Tray Cables

.43 CSA C22.2 No. 232-M - Optical Fiber Cables

.4 SSPC: Steel Structures Painting Council

.1 SSPC - Steel Structures Painting Council" Steel Structures Painting Manual, Vol. 2"

1.4 SUBMITTALS

.1 Departmental Representative reserves the right to require Contractor to submit samples of any materials to be used in this project.

.2 Dimensioned location drawings indicating required sleeves and/or openings in structural concrete or roofing or other locations affecting other trades work.

.3 Proposed equipment nameplates and warning signs.

.4 Detailed cable tray or J-Hook layouts.

.5 Equipment/product factory testing reports.

.6 Prior to application for Substantial Performance of the Work, submit the following to Departmental Representative for review:

.1 ESA inspection certificates.

.2 Fire alarm system pre-testing.

.3 Distribution system testing and coordination study performed.

.4 Structured network cabling system tested and verified.

2 Products

2.1 WIRE - LOW VOLTAGE UP TO 1000V SERVICE

.1 Conductors

.1 ASTM Class B, soft drawn, electrolytic copper

.2 Stranded for # 10 AWG and larger.

.2 Insulation

.1 CSA type RW90 XLPE (-40°C)

.1 Heat and moisture resistant

.2 Low temperature, chemically cross-linked thermosetting polyethylene material

.3 600V or 1000V rated

.4 For maximum 90°C conductor temperature

.5 For installation at minimum -40°C temperature

.6 To CSA C22.2 No. 38

.2 CSA type RWU90 XLPE (-40°C):

.1 Heat and moisture resistant

.2 Low temperature, chemically cross-linked thermosetting polyethylene material

.3 1000V rated

.4 For maximum 90°C conductor temperature

.5 For installation at minimum -40°C

.6 To CSA C22.2 No. 38

.3 CSA type T90 NYLON (-10°C):

.1 Heat resistant

.2 Flame retardant

.3 Thermoplastic PVC material with extruded nylon cover

.4 600V rated

.5 For maximum 90°C conductor temperature dry and 75°C in wet locations

.6 For installation at minimum -10°C

.7 To CSA C22.2 No. 75-M

.4 CSA type TEW:

.1 Heat resistant

.2 600V rated

.3 For maximum 105°C conductor temperature

.4 To CSA C22.2 No. 127

.5 CSA type SEW-2

.1 Heat resistant

.2 600V rated

.3 For maximum 200°C conductor temperature

.4 To CSA C22.2 No. 127

2.2 CABLE - LOW VOLTAGE UP TO 1000V SERVICE

.1 CSA Type AC90 XLPE (-40°C)

.1 Conductors

.1 ASTM Class B, soft drawn, electrolytic copper

.2 Solid for sizes #10 AWG and smaller

.3 Stranded for sizes #8 AWG and larger

.2 Insulation

.1 Heat and moisture resistant

.2 Low temperature, chemically cross-linked thermosetting polyethylene material

.3 600V rated for sizes #10 AWG and smaller

.4 1000V rated for sizes #8 AWG and larger

.5 For maximum 90°C conductor temperature

.6 For installation at minimum -40°C temperature

.7 To CSA C22.2 No. 38

.3 Construction

.1 2, 3 or 4 insulated conductors

.2 Bare ground conductor

.3 Overall interlocking aluminium armour

.4 To CSA C22.2 No. 51

.2 CSA Type TECK90 (-40°C)

.1 Conductors

.1 ASTM Class B, soft drawn, electrolytic copper

.2 Stranded

.2 Insulation

.1 Heat and moisture resistant

.2 Low temperature, chemically cross-linked thermosetting polyethylene material

.3 600V or 1000V rated

.4 For maximum 90°C conductor temperature

.5 For installation at minimum -40°C temperature

.6 CSA type RW90 XLPE

.7 To CSA C22.2 No. 38

.3 Construction

.1 1 or more insulated conductors

.2 Bare, stranded, copper ground conductor for multi-conductor cables

.3 Bare, solid, served copper ground conductors for single conductor cables

.4 Fillers with binder tape to produce a circular cross-section for multi-conductor cables

.5 Power cables

.1 1, 2, 3 or 4 conductors

.2 Conductors 1000V rated

.6 Composite cables

.1 3 power conductors

.2 3 #14 AWG control conductors

.3 Conductors 600V rated

.7 Extruded PVC inner jacket over conductor assembly

.8 Interlocking aluminium armour over inner jacket

.9 Extruded PVC overall jacket over armour

.1 FT4 flame test rated

.2 Colour black unless otherwise indicated

.10 Cable assembly for installation at minimum -40°C temperature

.11 To CSA C22.2 No. 131 and CSA C22.2 No. 174

.3 CSA Type NMD90 (Romex):

.1 Non-metallic Sheathed Cable

.2 300V rated

.4 CSA Type MI

.1 Conductors

.1 ASTM Class B, soft drawn, electrolytic copper

.2 Solid

.2 Insulation

.1 Powdered magnesium oxide

.2 600V rated for feeders on 208/120V system or control wiring

.3 1000V rated for feeders on 600/347V systems

.3 Construction

.1 Solid conductor

.2 Insulation around the conductor compressed to form a solid, homogeneous mass between the conductor and the metal sheath throughout the entire length of cable

.3 Soft annealed seamless copper sheath over insulation

.4 Extruded PVC overall jacket over sheath

.1 FT4 flame test rated

.2 Colour black unless otherwise indicated

.5 Two (2) hour fire rated where indicated on drawings.

.6 Connectors: watertight, field installed approved for MI cable.

.7 Termination kits: field installed approved for MI cable

.8 To CSA C22.1 No. 124-M

.4 Acceptable Manufacturer

.1 Pyrotenax

2.3 CONTROL CABLES

.1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: thermoplastic.

.2 Sheath: thermoplastic jacket.

.2 Type: low energy 300 V control cable: solid annealed copper conductors sized as indicated:

.1 Insulation: TW 40 degrees C.

.2 Shielding: tape coated with diamagnetic material over each conductor.

.3 Overall covering: PVC jackets.

.3 Type: 600 V stranded annealed copper conductors, sizes as indicated:

.1 Insulation: RW90 (x-link).

.2 Shielding: non-magnetic tape over each pair of conductors.

.3 Overall covering: PVC.

2.4 CABLE CONNECTORS

.1 Connectors for Type AC90 Cable

.1 Steel or malleable iron

.2 Insulated throat

.3 Acceptable manufacturers

.1 Efcor 1000B series

.2 Elliott 65200 series

.3 Thomas & Betts 3110 series

.2 Connectors for Type TECK90 Cable

.1 Copper free aluminium body

.2 Steel or copper free aluminium fittings and locknut

.3 Certified for use in hazardous locations Classes I, II, and III

.4 Class I hazardous location sealing fitting

.5 Acceptable manufacturers

.1 Thomas & Betts "STE" series

.2 Crouse-Hinds type TMC

.3 Commander/Iberville type TEK

2.5 WIRE AND CABLE CONNECTORS

.1 Copper compression type wire and cable terminations for #8 AWG and larger conductors, colour keyed, sized to suit. Long barrel NEMA 2 hole lugs for sizes #1/0 AWG and larger.

.1 Acceptable Manufacturers

.1 Thomas & Betts series 54000

.2 Ideal Powr-Connect

.3 Burndy Hylug

.2 Twist type splicing connectors, copper, sized to suit, with nylon or plastic shroud for tee connections in #10 AWG and smaller conductors.

.1 Acceptable Manufacturers

.1 Thomas & Betts spring type

.2 Ideal Twister

.3 Marr Marrette

.3 Conductor compression splice for #10 AWG or smaller.

.1 Acceptable Manufacturers

.1 Thomas & Betts STA-Kon series

.2 Ideal Splices

.3 Burndy

2.6 WIRE PULLING LUBRICANT

.1 Wire pulling lubricant to be “Ideal Industries”, Yellow 77 Plus Wire pulling Lubricant or approved equivalent.

2.7 HEAT SHRINKABLE TUBING INSULATION, HEAVY WALL

.1 Acceptable Manufacturers

.1 Thomas & Betts, Shrink-Kon series

.2 Ideal Thermo-Shrink, TS-46

.3 Raychem tubing WCSM

.4 3M cable sleeve ITCSN

2.8 MOTOR LEAD CONNECTION KITS, 600 VOLT

.1 Connection kits for low voltage motors.

.2 Acceptable Manufacturers

.1 3M, motor lead splice kit, pigtail, 5300 series

.2 Raychem, motor connection kit, MCK, type V

2.9 CONDUIT AND FITTINGS

.1 Rigid Steel Conduit

.1 To CSA C22.2 No. 45-M

.2 Rigid thick wall galvanized steel threaded conduit

.2 Coated Steel Conduit

.1 Corrosive resistant coated rigid thickwall steel threaded conduit, CSA approved.

.2 Acceptable Manufacturers

.1 Rob Roy Plastibond PVC coated

.2 Columbex Green Guard II epoxy polyester coated

.3 Rigid PVC Conduit

.1 To CSA C22.2 No. 211.2-M

.2 Rigid PVC conduit

.4 Flexible Steel Conduit

.1 To CSA 22.2 No. 56

.2 Liquid-tight flexible steel conduit with PVC cover

.5 Non-Metallic Flexible Conduit

.1 Non-metallic extra flexible PVC conduit

.2 Acceptable Manufacturers

.1 Carlon, Carflex X-Flex

.2 Hubbell, Polytuff Black

.6 Rigid Steel Conduit Fittings

.1 To CAN/CSA C22.2 No. 18

.2 Galvanized or polymer coated cast steel fittings

.3 Expansion fittings, watertight with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions

.4 Sealing condulets for hazardous areas

.5 Corrosive resistant coated cast steel fittings for corrosive resistant conduit

.7 Rigid PVC Conduit Fittings

.1 To CSA C22.2 No. 85-M

.2 Rigid PVC fittings of same manufacture as rigid PVC conduit

.8 Liquid Tight Flexible Steel Conduit Fittings

.1 Watertight connectors with nylon insulated throat

.1 Acceptable Manufacturers:

.1 T & B Series 5331 with Sealing O-ring Series 5262

.2 Commander/Iberville Series 6300-IT with nitrile O-ring

2.10 EMT AND FITTINGS

.1 EMT

.1 To CSA C22.2 No. 83-M

.2 EMT galvanized cold rolled steel tubing

.2 EMT Fittings

.1 Compression type, steel

.1 Gland compression connectors with insulated throats

.2 Compression couplings

.3 Acceptable manufacturers:

.1 T & B Series 5123 & 5120

.2 O-Z/Gedney type ZTC series

.3 Commander/Iberville Series 5600-IT and 5700

.2 Set screw type, steel, concrete-tight

.1 Connectors with insulated throats

.2 Couplings

.3 Acceptable manufacturers

.1 Commander/Iberville Series 5400 and 5500

2.11 CABLE TRAY

.1 Cable Trays and Fittings

.1 To EEMAC F5-1

.2 To CAN/CSA C22.2 No. 126-M

.2 Ladder Type

.1 Class C1

.2 Steel, hot dip galvanized after fabrication

.3 Side height, 100 mm

.4 Rung spacing, 300 mm

.5 Width as indicated on drawings.

.3 Basket Type

.1 Class C1

.2 Powder coated with average paint thickness of 30 microns to 75 microns.

.3 50 mm x 50 mm grid

.4 Side height: 100 mm minimum.

.5 Width as indicated on drawings.

.4 Acceptable manufacturers for ladder and basket types:

.1 Legrand Cablofil

.2 Cooper B-Line

.3 Canadian Electrical Raceways

2.12 WIREWAY

.1 To CSA C22.1 No. 94-M.

.2 Steel with hinged cover to give uninterrupted access.

.3 Elbows, tees, couplings and hanger fittings manufactured as accessories for wireway supplied.

.4 Acceptable Manufacturers:

.1 Amalgamated Electric

.2 Canadian Electrical Raceways

.3 Schneider Square D

.4 Pilgrim

.5 Pursley

2.13 SURFACE RACEWAY

.1 Surface Raceway to be Legrand Wiremold Model No. ‘DS4000 Designer Series’.

.2 Surface metal raceway, single or complete with snap-in divider to form 2 compartments for power and data, with removable cover. Width to suit application while keeping Code and Telecommunication standard filling ratios.

.3 Elbows, couplings, end caps, device brackets and faceplates for power, data and voice, and fittings manufactured as accessories for wireway supplied. 120V power receptacles and mounting only for voice/data.

.4 Finish: Designer Grey

.5 Acceptable manufacturer:

.1 Legrand/Wiremold or approved equivalent.

2.14 FASTENINGS, SUPPORTS AND SLEEVES

.1 Fastenings

.1 Galvanized steel straps, beam clamps and threaded rods for structural steel

.2 Concrete inserts, Crane Canada No.4-M for concrete work for single or double conduit cable tray.

.3 Unistrut multiple type inserts for runs of three or more conduits.

.4 Concrete fastener type “WEJ-IT” anchors

.5 Drywall, plaster or ceiling, 2-wing spring toggles

.6 40mm width, galvanized steel channels complete with accessories for metal framing channels.

.1 Unistrut

.2 Thomas & Betts

.7 Metal “J” hooks cable supports systems for communication systems cabling in accessible ceiling spaces were conduit or cable tray is not being provided.

.8 Velcro tie wraps for bundling and securing telecommunication cabling

.2 Sleeves

.1 Schedule 40 steel pipe, minimum I.D. 13 mm larger than O.D. of conduit or cable passing through.

.3 Strut

.1 Continuous slotted channel

.2 12 gauge pre-galvanized steel

.3 41.2 mm x 41.2 mm minimum

.4 Acceptable manufacturers:

.1 B-Line

.2 Pilgrim

.3 Pursley

.4 Unistrut

2.15 ACCESS DOORS

.1 Access doors to Section 10 00 00, manufactured Specialties.

2.16 SPLITTER BOXES

.1 Code gauge galvanized sheet steel enclosure EEMAC Type 4 or 12, welded corners and formed hinged cover suitable for locking in closed position.

.2 Cast steel enclosure EEMAC 7 or 9 with gasketted bolt on cover for and to suit the designated hazardous locations.

.3 Copper main and branch lugs to match required size and number of incoming and outgoing conductors.

.4 At least 3 spare terminals on each set of lugs in splitters less than 400 A.

2.17 JUNCTION BOXES

.1 Galvanized steel EEMAC Type 1, 4, 12, size as required by code for number and size of conduits, conductors and devices, complete with covers, corrosion resistant screws, terminal blocks and mounting rails.

.2 Screw-on sheet steel covers to match enclosure for surface mounting boxes.

.3 Covers with 25 mm minimum extension around for flush-mounted junction boxes.

.4 Galvanized steel barriers as required.

2.18 TERMINAL BLOCKS - SURGE PROTECTION

.1 Terminal blocks, rail mounted, with surge voltage protection, rated for circuit voltage.

.2 Acceptable Manufacturers

.1 Phoenix Contact Termitrab SLKK5 (Termitrab SLKK5-F) (TT-SLKK5-S).

2.19 PULL BOXES

.1 Galvanized sheet steel welded construction, EEMAC Type 4 or 12.

.2 Screw-on galvanized sheet steel covers for surface mounting boxes.

.3 Covers with 25 mm minimum extension around, for flush mounted pull boxes.

.4 Galvanized steel barriers as required.

2.20 METER CABINET

.1 Sheet steel CSA Type 2 sprinkler-proof enclosure with meter backplate, to accommodate meters, test terminal block and associated equipment, factory installed and wired.

.2 Utility metering cabinet to conform with Utilities specifications.

2.21 CONDUIT BOXES - GENERAL

.1 Boxes for EMT

.1 Galvanized pressed steel

.2 Boxes for Rigid Steel Conduit

.1 Galvanized cast iron alloy FS boxes with mounting feet for surface mounted switches and receptacles

.2 Gasketted cover plate for exterior location

.3 For corrosive resistant coated conduit: cast boxes with same finish as conduit

.3 Boxes for Rigid PVC Conduit

.1 PVC boxes

2.22 OUTLET BOXES - SHEET STEEL

.1 Pressed steel single and multi-gang flush device boxes, minimum size 100 mm x 50 mm x 38 mm. 100 mm square outlet boxes where more than 1 conduit enters 1 side, with extension rings as required.

.2 100 mm square or octagonal outlet boxes.

.3 119 mm square outlet boxes with extension and plaster rings as necessary for flush mounting devices in gypsum board, plaster or panelled walls.

2.23 MASONRY BOXES

.1 Pressed steel masonry single and multi-gang boxes for devices flush mounted in exposed masonry walls with extension and plaster rings as required.

2.24 CONCRETE BOXES

.1 Pressed steel concrete type boxes for flush mount in concrete with extension and plaster rings as required.

2.25 OUTLET BOXES - FITTINGS

.1 Bushings and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of foreign materials.

.3 Double locknuts and insulated bushings for sheet steel metal boxes.

2.26 WIRING DEVICES - SWITCHES

.1 Specification grade, general purpose AC switches, manual toggle operated, white and brown colour, 15A, 20A, 120-277V, 347V, single pole, double pole, three-way, four-way switches as required.

.2 Acceptable manufacturers:

.1 Hubbell - HBL1201 Series: HBL1221 Series: HBL18201 Series: HBL 18221 Series

.2 P & S - 15AC Series: 20AC Series: 370000 Series

.3 Arrow Hart - 1891 Series: 1991 Series: 18201 Series: 18221 Series

.3 Specification grade, general purpose AC switches, manual rocker operated, white colour, 15A, 20A, 120-277V, 347V, single pole, double pole, 3 way, 4 way switches as required.

.4 Acceptable Manufacturers

.1 Bryant, 120-277V, Fashion Series 9000

.2 Hubbell, 120-277V, Style Line 2100 Series

.3 Leviton, 120-277V and 347V, Decora Plus 5600 Series

.4 Pass & Seymour, 120-277V and 347V, Sierraplex Decorator, 2600 and 2600000 Series

2.27 WIRING DEVICES – OCCUPANCY SENSORS

.1 Occupancy Sensor, WattStopper, Model No. EW-205 or equivalent:

.1 The passive infrared sensor shall be capable of detecting presence in the control area by detecting changes in infrared energy.

.2 Sensor shall be sealed and gasketed and shall be moisture and dust proof.

.3 Sensor shall function in a temperature range of -40°F (-40°C) to +95°F (+35°C).

.4 Sensor shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens.

.5 Fresnel lens shall be a Poly IR 4 based material (for standard and Long Range lens) to offer superior performance in the infrared wavelengths and filter short wavelength infrared, such as those emitted by the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up which affects IR reception. Aisleway lenses shall be a poly IR 2 based material.

.6 Sensor shall provide 270° coverage with the Standard Lens, up to 50 linear feet with the Long Range Lens.

.7 Sensor shall have a DIP switch controlled digital time delay setting, adjustable from 15 seconds to 10 minutes approximately.

.8 Sensor shall have DIP switch sensitivity setting adjustable from minimum to maximum.

.9 Adjustments and mounting hardware shall be concealed under a removable cover to prevent tampering of adjustments and hardware.

.10 Sensors shall be capable of being wired in parallel to allow coverage of large areas.

.11 To ensure quality and reliability, sensor shall be manufactured by and ISO9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

.12 Sensor shall have a standard 5 year warranty.

.13 Sensor shall be UL and CUL listed.

.2 Light Switch Type 'B' - Dual Technology Dual Relay Wall Switch Sensor, WattStopper, Model No. DW-200 or equivalent:

.1 Sensor shall be capable of detecting presence in the control area by detecting shifts in transmitted ultrasound and passive infrared heat changes.

.2 Sensor shall utilize ultrasonic and PIR technologies to reduce likelihood of false operations

.3 Sensor shall feature a trigger mode where the end-user can choose which technology will activate the sensor from Off mode (initial), the type of detection that will reset the time delay (maintain), and the type of detection that will cause the sensor to be turned back On immediately after lights turned Off due to lack of motion (re-trigger). Selection of technologies for initial, maintain, and re-trigger shall be done with DIP switches.

.4 Sensor shall have its trigger mode factory preset to allow for quick installation in most applications. In this default setting, both technologies must occur in order to initially activate lighting systems. Detection by either technology shall maintain lighting on, and detection by either technology shall turn lights back on after lights were turned off for 5 seconds or less in automatic mode and 30 seconds or less in manual mode.

.5 Sensor shall have 4 occupancy logic options for customized control to meet application needs.

.6 Robotic test method as referred in the NEMA WD 7 guide shall be utilized for minor motion coverage verification.

.7 Automatically adjusts the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.

.8 Sensor shall utilize two relays capable of simultaneously controlling independent lighting loads or circuits. The secondary relay is isolated, allowing for two-circuit control.

.9 Sensor shall have no minimum load requirement and shall be capable of switching from 0 to 800 Watt incandescent; 0 to 800 Watt fluorescent or 1/6 hp @ 120 VAC, 60Hz; and 0 to 1200 Watt fluorescent @ 277 VAC, 60Hz.

.10 Sensor shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds, set by a DIP switch.

.11 To avoid false ON activations, the sensor shall examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.

.12 Sensor shall cover up to 1,000 sq. ft. for walking motion, with a field view of 180 degree

.13 Sensor shall have automatic-ON or manual-ON operation on both relays adjustable with DIP switch.

.14 Sensor shall have a time delay that is adjusted automatically or shall have a fixed time delay of 5 to 30 minutes, set by DIP switches.

.15 In automatic mode, sensor shall be capable to automatically return to Automatic-ON after lights are turned off manually.

.16 Each sensing technology shall have a LED indicator that remains active at all times in order to verify detection within the area to be controlled.

.17 Sensor shall have a service switch to allow end-users to operate the sensor in the unlikely event of a failure; set by a trim pot.

.18 Sensor shall be able to control electronic low voltage, and fluorescent loads.

.19 Sensor shall have a built-in light level featuring simple, one-step daylighting setup that works from 8 to 180 foot candles.

.20 Switching mechanism shall be a relay(s). Triac and other harmonic generating devices shall not be allowed. Sensor shall have ground wire and grounded strap for safety.

.21 The Dual Technology wall switch sensor shall be a completely self contained control system that replaces a standard toggle switch

.22 Sensor shall have standard 5 year warranty and shall be UL and CUL listed

.3 Light Switch Type ‘OS’ – as type ‘B’ except single relay switch.

2.28 WIRING DEVICES - RECEPTACLES FOR GENERAL SERVICE

.1 Receptacles: specification grade suitable for back and side wiring, complete with grounding terminal, white colour for straight blade devices and black colour for twistlock devices.

.2 All receptacles shall be from one manufacturer.

.3 Acceptable Manufacturers:

.1 15A, 125V, (5-15R) Single Straight Blade

.1 Arrow Hart 5261

.2 Leviton 5261

.3 Hubbell 5261

.4 Pass & Seymour 5261

.2 15A, 125V, (5-15R) Duplex Straight Blade

.1 Arrow Hart 5262

.2 Leviton 5262

.3 Hubbell 5262

.4 Pass & Seymour 5262

.3 20A, 125V, (5-20R) Single Straight Blade

.1 Arrow Hart 5361

.2 Leviton 5361

.3 Hubbell 6331

.4 Pass & Seymour 5361

.4 20A, 125V, (5-20R) Duplex Straight Blade

.1 Arrow Hart 5392

.2 Leviton 5362

.3 Hubbell 5392

.4 Pass & Seymour 5362

.5 15A, 125V, (5-15R) Duplex GFCI, Straight Blade

.1 Arrow Hart GF5242AH

.2 Leviton 6599-W

.3 Hubbell GF-5252

.4 Pass & Seymour 1591

.6 15A, 125V, (5-15R) Duplex Isolated Ground Straight Blade

.1 Arrow Hart IG5262AH

.2 Leviton 5262-IG

.3 Hubbell IG-5262

.4 Pass & Seymour IG6200

.7 20A, 125V, (L5-20R) Single locking, 2 pole, 3 wire grounding

.1 Arrow Hart 6200

.2 Leviton 2310

.3 Hubbell 2310ACN

.4 Pass & Seymour L520-RCN

.8 20A, 250V, (L6-20R) Single locking, 2 pole, 3 wire, grounding

.1 Arrow Hart 6210

.2 Leviton 2320

.3 Hubbell 2320ACN

.4 Pass & Seymour L620-RCN

.9 30A, 250V, (L6-30R) Single locking, 2 pole, 3 wire, grounding

.1 Arrow Hart 6340

.2 Leviton 70630-FR

.3 Hubbell 2620CAN

.4 Pass & Seymour L630RCN

.10 30A, 250V, (L15-30R) Single locking, 3 pole, 4 wire, phase, grounding

.1 Arrow Hart 6520

.2 Leviton 2720

.3 Hubbell 2720ACN

.4 Pass & Seymour L1530-RCN

.11 20A, 347V (L24-20R) Single locking, 2 pole, 3 wire grounding

.1 Leviton 3721

.2 Pass & Seymour L3720-RCN

.12 15A, 125V (5-15R) Quad straight blade, 2 pole, 3 wire grounding

.1 Bryant 1254

.2 Hubbell 415 series

.3 Pass & Seymour 1254

.13 15A, 347V, (24-15R) Quad straight blade, 2 pole, 3 wire grounding

.1 Bryant 3474W

.2 Hubbell 415347WC

.3 Pass & Seymour 3474W

.14 15A, 125V, (5-15R) Duplex straight blade

.1 Arrow Hart 26262

.2 Leviton Decora Plus

.3 Hubbell 2152 series

.4 Pass & Seymour 885

.15 15A, 125V (5-15R) Duplex straight blade, 2 pole, 3 wire grounding, surge suppression indicator light, blue (ivory) colour

.1 Arrow Hart 5250

.2 Hubbell 5260

.16 15A, 125V (5-15R) Duplex straight blade, 2 pole, 3 wire grounding, isolated ground surge suppression indicator light, blue (ivory) colour

.1 Arrow Hart IG5250

.2 Hubbell IG5262,

2.29 WIRING DEVICES - COVER PLATES

.1 Stainless steel Type 302 alloy, vertically brushed, 0.8 mm thick cover plates.

.2 Nylon, smooth, high impact strength.

.3 Pressed steel, galvanized.

.4 Cast covers for cast boxes with gaskets.

.5 Outdoors:

.1 Marine grade outlet box hood

.2 Weather proof die cast alloy 360 copper free aluminum

.3 Nema 3R rating for in-use protection

.4 Gaskets are closed-cell foam

.5 Latching covers hold securely

.6 Large cord openings

.7 Holes for padlocks are 6.4 mm diameter

.8 Acceptable manufacturers:

.1 Hubbell No. WP7D Series or equivalent.

.6 Cover plates of same manufacture as devices.

2.30 FUSES

.1 Form I, Class “J” HRC for continuous loads

.2 Form II, Class “C” HRC for cycling loads

.3 Acceptable manufacturers:

.1 Ferraz-Shawmut

.2 Cooper Bussmann

2.31 PUSHBUTTONS OPERATORS

.1 Rockwell Automation, 800T Series

.2 Exact type and rating to suit application

.3 Acceptable manufacturers:

.1 Rockwell Automation

.2 Eaton Cutler-Hammer

.3 SquareD

.4 GE

.5 Schneider Electric

2.32 ROOFTOP CONDUIT SUPPORT SYSTEM

.1 Cooper B-Line "Dura – Blok" series rooftop support systems

2.33 PLYWOOD BACKBOARDS

.1 Plywood backboards, good one side, 1220 mm x 222 mm unless indicated otherwise. Treat with primer and two coats of fire retardant paint.

.2 Mount plywood on vertical strapping, on 40 mm centres to provide 10 mm clearance between wall and rear of plywood. Treat strapping similar to plywood.

2.34 FINISH

.1 Equipment enclosure finish: baked grey enamel, ANSI 49 or ANSI 61.

3 **Execution**

3.1 WIRE AND CABLE

.1 Install wiring in raceways unless noted otherwise.

.2 Install separate and dedicated neutral wires for each circuit fed from:

.1 Harmonic mitigation transformers/panelboards (e.g. RP-Hxx)

.2 UPS panelboards (e.g. RP-Uxx)

.3 Lighting panelboards (e.g. LP-Lxx)

.3 Provide 600 V rated cable for up to 208 V application; 1000V rated cable for up to 600 V application.

.4 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.

.5 Minimum wire sizes:

.1 Power and lighting No. 12 AWG

.2 Control No. 14 AWG

.3 Fire alarm No.: to Section 28 31 00 Fire Detection and Alarm Systems

.6 Wire and cable application and type:

Application	Type
Lighting branch circuits	T90 nylon for conditioned spaces RW90 for unconditioned spaces/areas
Receptacle branch circuits	T90 nylon for conditioned spaces RW90 for unconditioned spaces/areas
Ceiling boxes to luminaires in suspended ACT	T90 nylon or AC90 cable (max. length as noted below)
Ceiling boxes to luminaires in non-accessible ceilings.	T90 nylon or AC90 cable (max. length as noted below)
Ceiling boxes to receptacles	T90 nylon for conditioned spaces RW90 for unconditioned spaces/areas
Wiring inside high temperature equipment (including final connection)	TEW or SEW-2
Underground and under slab raceways, duct banks, direct burial	RWU90
All distribution feeders and equipment feeders	RW90 or Mineral Insulated
Life safety feeders and equipment feeders	Mineral insulated – 2 hr rated.
Hazardous locations	RW90 or mineral insulated (as per OESC Class 1 zone 2.

.7 Type AC90 cable length limitations:

.1 Ceiling box to luminaire:

.1 2 m maximum in non-accessible ceilings;

.2 3 m in accessible ceilings

.2 Junction box to outlet:

.1 4 m maximum

.8 Load current limitations:

.1 Conductors rated for more than 90°C:

.1 75°C code ampacity rating

.2 90°C code ampacity rating if terminating device and/or equipment maximum conductor termination temperature is 90°C rated.

.2 Motor connection:

.1 75°C code ampacity rating

.9 Use wire lubricant when pulling wires into conduit. Wires shall be kept straight and not twisted.

3.2 CONNECTORS

.1 Install compression terminations and splices in accordance with manufacturer's written instructions.

.2 Make splices in junction boxes.

.3 Make connections in lighting circuits with twist type splicing connectors.

.4 Terminate and splice conductors No. 8 and larger at terminal blocks in junction boxes.

.5 Seal terminations and splices exposed to moisture, corrosive conditions or mechanical abrasions with heavy wall heat shrinkable insulation.

.6 Install fixture type connectors and tighten. Replace insulating cap.

3.3 MOTOR LEAD CONNECTION KITS, 600 VOLT

.1 Install motor lead connection kits for low voltage motors.

3.4 CONDUIT AND EMT - GENERAL

.1 Run parallel or perpendicular to building lines.

.2 Group raceways wherever possible. Support on channels.

.3 Install expansion joints as required.

.4 Run raceways in web portion of structural steel columns and beams.

.5 Do not drill structural members to pass through.

.6 Locate raceways behind infrared or unit heaters with 1500 mm clearance.

.7 Locate raceways not less than 125 mm clear where parallel to steam or hot water lines with a minimum of 75 mm at crossovers.

.8 Do not install horizontal runs in masonry walls.

.9 Use metallic raceway where temperatures exceed 75°C or where enclosed in thermal insulation.

.10 EMT and non-metallic conduits to contain insulated green ground wire.

.11 Install 6 mm diameter nylon pull cord in empty raceways.

.12 Conduits may be surface mounted (exposed) in mechanical and electrical rooms and spaces; and concealed elsewhere.

3.5 CONDUIT AND FITTINGS

.1 Minimum conduit sizes:

.1 Surface installation: 21 mm trade size conduit

.2 Embedded in concrete: 27 mm trade size conduit

.3 Directly buried: 53 mm trade size conduit

.2 Conduit application and type:

Application	Type
Corrosive areas	rigid steel corrosion resistant coated
Hazardous areas	rigid steel
Outdoor areas	rigid steel hot dip-galvanized
Embedded in concrete	rigid PVC
In or below grade slab	Rigid PVC
Exposed in unfinished areas up to 3 m above finished floor. Use EMT above 3m	rigid steel
Connection to motors and equipment subject to vibration	liquid tight flexible steel conduit
Final connection to dry type transformer	flexible steel conduit
Whip connection to modular furniture - power	Furniture whip provided by furniture system manufacturer or flexible EMT
Whip connection to modular furniture - others	non-metallic extra flexible PVC
Unheated parking garage area	Rigid steel

.3 Use field threads on rigid conduit of sufficient length to draw conduits up tight.

.4 Do not bend coated steel conduit. Use elbows for deflections.

.5 Do not install conduit under slab on grade.

.6 Do not install conduit in slab, unless indicated otherwise on drawings.

.7 Use factory "ells" where 90° bends are required for 27 trade size and larger conduits.

.8 Bend conduit offsets cold. Do not install crushed or deformed conduits and avoid trapped runs in damp or wet locations. Prevent the entrance of water and lodging of concrete, plaster, dirt, or trash in conduit, boxes, fittings, and equipment during course of construction.

.9 Where conduit joints occur in damp or wet locations, make joints watertight by applying an approved compound on the entire thread area before assembling. Draw up all conduit joints as tightly as possible.

.10 Cap exposed empty conduits which do not terminate in outlets, panels, cabinets, etc., with standard galvanized plumber's pipe caps.

.11 Plug empty conduits which terminate flush with floors or walls with flush coupling and brass plug.

.12 Install conduit sleeves for all exposed conduits and cables passing through walls, ceilings, or floors, and fill void between sleeve and conduit with caulking. If fire-rated caulking is required by code, use same class as walls, ceilings or floors.

.13 Terminate conduit stubbed up through concrete floor for connection to free standing equipment with a coupling flush with finish floor, and extend rigid conduit to equipment, except where required, use flexible conduit from a point 150 mm above floor.

.14 Install double locknuts and bushings on all rigid conduit terminations into threadless openings. Increase length of conduit threads at terminations sufficiently to permit bushing to be fully seated against end of conduit.

.15 Mechanically bend steel conduit.

.16 Install sealing condulets in conduits at hazardous area boundaries.

.17 Conduits in Poured Concrete

.1 Locate to suit reinforcing steel. Secure firmly to prevent movement during pour.

.2 Clear each conduit with mandrel and brush before concrete sets.

.3 Protect conduits from damage where they stub out of concrete.

.4 Install sleeves where conduits pass through slab or wall.

.5 Provide oversized sleeve before membrane is installed where conduits pass through waterproof membrane. Use cold mastic between sleeve and conduit.

.6 Encase conduits completely in concrete; provide 50 mm minimum concrete cover.

.7 Replace with exposed conduit, any conduit run found to be obstructed after concrete sets.

3.6 EMT AND FITTINGS

.1 Minimum EMT size: 21 mm trade size conduit.

.2 EMT Application

.1 Exposed in unfinished areas, above truss level and for drops in column web to 3 m above finished floor. Use rigid steel conduit below 3 m.

.2 In block walls and stud partitions.

3.7 CABLE TRAY

.1 Install cable tray systems.

.2 Provide barriers where required by Code.

.3 Support cable trays from structural members. Support cable tray on both sides or on cantilever brackets to provide continuous open access to one side of the tray as required. Coordinate support locations and weight per support with building structure. Provide any additional support fastenings required.

.4 Provide the following minimum clearances:

.1 300 mm vertical between top of tray and equipment or structure above.

.2 300 mm vertical between trays (between bottom of the upper tray to top of lower tray).

.3 600 mm horizontal on access side of tray.

.5 Ensure that sharp burrs or projections are removed to prevent damage to cables and injury to personnel.

.6 Install cables individually.

.7 Lay cables into cable tray. Use rollers where necessary, to pull cables.

.8 For maintained spacing, secure cables in cable tray at 3 m centers for horizontal runs with black coloured tie wraps and at 1500 mm centres for vertical runs with aluminum clamps supplied by tray manufacturer.

.9 Maintain power cables greater than one diameter minimum spacing unless shown otherwise.

.10 Firestop Fire Barriers (refer to Section 26 05 01).

.1 Penetration of fire rated walls with cable trays is not allowed. Provide instead metallic sleeves to match cable tray capacity to allow for transitioning of cabling. Pack, seal and firestop around and inside in accordance with Section 07 84 00 Fire Stopping and Smoke Seals.

3.8 WIREWAYS

.1 Install per manufacturer's recommendations.

.2 Keep number of elbows, offsets and connections to a minimum.

.3 Install barriers where required by Code.

.4 Install gutters to full length of equipment.

3.9 SURFACE RACEWAYS

.1 Install per manufacturer's recommendations.

3.10 FASTENINGS AND SUPPORTS

.1 Provide supports and fastenings for the Work of this Division. Do not use supports or equipment provided by other Trades.

.2 Equipment fastenings and supports shall conform to manufacturers recommendations.

.3 Do not attach to, or suspend any electrical product or service from the roof deck, mechanical ductwork or piping.

.4 Do not use wire lashing or perforated strap to support or secure raceways or cable.

.5 Support rods for any suspended item must not be attached to or extended through steel pan type roofs or through concrete slab roofs.

.6 For surface mounting of two or more raceways or cables use channels.

.7 Where there is no wall support for raceways and cables dropped vertically to equipment, provide channel properly secured to floor and structure.

.8 Hang supports from structural members. Where location does not permit direct support from structure provide necessary brackets, frames, channels secured to structural members.

.9 Fasten exposed conduit and cables to building construction or support systems using straps. Use beam clamps on exposed steelwork.

.10 Masonry, tile and plaster surfaces: use lead anchors.

.11 Poured concrete: use expandable inserts. Low velocity powder activated fastenings may be used only in poured concrete.

.12 Steel structures: use clips, spring loaded bolts, cable clamps, designed as accessories to basic channel members.

.13 Do not use powder activated fasteners in, tile, precast concrete or steel structure.

.14 Do not install conduits or cables on the bottom chord of joists or trusses.

.15 Use beam clamps of the 2-bolt design and of such type that the rod load is transmitted only concentrically to the beam web centreline. The use of "C" and "I" beam side clamps will not be allowed.

.16 Where the roof or floor framing consists of open web or long span steel joists and/or trusses, ensure that hangers are located at or within 150 mm of the joist or

truss top or bottom chord panel points, otherwise provide additional structural steel as required where hanger spacing does not coincide with joist or truss spacing. Design suspension assembly such that the hanger load is transmitted only concentrically to the supporting joist or truss. The use of "C" and "I" beam clamps, brackets, etc., will not be allowed.

.17 Locate secondary structural steel members between joists or trusses at or within 150 mm of top or bottom chord panel points. Where the secondary structural steel member cannot be located at or near a joist or truss panel point, provide additional diagonal structural steel web member/members designed for the applicable load to the nearest panel point in the opposite chord member. Diagonal hangers which will induce lateral stresses in the chord members of the joist will not be permitted. Submit shop drawings of the suspension assembly indicating the location of suspension or support points, the maximum load at each suspension point, location and size of hangers, brackets and intermediate framing members when required, and also details of connection to building structure.

3.11 ACCESS DOORS

.1 Provide an access door and arrange for its installation by the Division in whose work it occurs, whenever any electrical item equipment requiring accessibility, maintenance or adjustment is concealed.

3.12 SPLITTER BOXES

.1 Install splitters as indicated and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement.

3.13 JUNCTION BOXES

.1 Install junction boxes in inconspicuous but accessible locations. Secure to structure.

.2 Install terminal blocks on mounting rails, for termination of each wire and cable regardless of size.

.3 Only one voltage source is permitted in a junction box.

.4 Install barriers to separate different auxiliary systems.

.5 In areas with hard ceilings (e.g. gypsum board), install junction boxes in an accessible area. Extend conduit to junction or pull boxes.

.6 If an accessible area is not within reasonable reach, group all junction boxes for all systems in one area of the room and advise the Design Architect/Departmental Representative of the need of an access door. Do not proceed with work until approval for access panel is received from the Design Architect.

3.14 TERMINAL BLOCKS - SURGE SUPPRESSION

.1 Install surge suppression terminal blocks.

3.15 PULL BOXES

.1 Install pull boxes in inconspicuous but accessible locations. Secure to structure.

.2 Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.3 Only one voltage source is permitted in a pull box.

.4 Install barriers to separate different auxiliary systems.

.5 In areas with hard ceilings (e.g. gypsum board), install pull boxes in an accessible area. Extend conduit to junction or pull boxes.

.6 If an accessible area is not within reasonable reach, group all pull boxes for all systems in one area of the room and advise the Design Architect/Departmental Representative of the need of an access door. Do not proceed with work until approval for access panel is received from the Design Architect.

3.16 OUTLET AND CONDUIT BOXES

.1 Install conduit outlet boxes for conduit up to 32 mm and pull boxes for larger conduits.

.2 Support boxes independently of connecting conduits.

.3 Seal boxes during construction to prevent entry of debris, dust and dirt.

.4 For flush installations mount plaster rings to box, flush with wall surface to permit wall finish to come within 6 mm of opening.

.5 Provide correct size of openings in boxes for conduit, armoured cable connections. Reducing washers will not be acceptable.

.6 Install switches and other controls close to door lock or latch jambs and other openings, maintaining a minimum of 100 mm from trims of doors (except where installed in door frames of metal partitions) check door swings.

.7 Install 100 mm square or octagonal outlet boxes for lighting fixture outlets.

3.17 METER CABINET

.1 Install meter cabinet as close as feasible to service entrance switchboard.

.2 For utility meters install cabinets with all local utility requirements.

3.18 MASONRY BOXES

.1 In block walls use deep boxes to provide clear space around knockout for AC90 cable entry.

3.19 WIRING DEVICES - SWITCHES

.1 In all front of house areas and public areas, all switches are to be Decora/Decorator style.

.2 Install single throw switches with handle in UP position when switch is closed.

.3 Install switches in gang type outlet box when more than one switch is required in a location.

.4 Mount toggle switches at height indicated.

.5 Install switch colours as follows:

Area	Colour
Gypsum board, plaster or paneled	White
Office	White
Service	Brown
Patient Care Areas	White
Feature wood panels	Black

3.20 WIRING DEVICES - OCCUPANCY SENSORS

.1 Install each occupancy sensor at locations indicated.

.2 Mount occupancy sensor/switches at height indicated.

3.21 WIRING DEVICES - RECEPTACLES

.1 Generally, install receptacles vertically with ground pins up.

.2 In patient care areas, 15A/20A straight blade receptacles to be hospital grade.

.3 In all front of house areas and public areas, all receptacles are to be Decora/Decorator style.

.4 Comply with requirements of CSA Standard Z32, with regards to identifying the circuit number and supplying panelboard, permanently identified at the outlets. Identify this information in the areas on the front of each receptacle.

.5 Install receptacles vertically, use gang type outlet box where more than one receptacle is required in a location.

.6 Where split receptacle has a portion switched, mount vertically and switch upper portion.

.7 Coordinate with architectural and interior design drawings for final positioning and mounting heights of power and voice/data receptacles. Where there is disagreement between electrical and architectural drawings, take the architectural drawings as correct.

.8 Maintain clearances between receptacle outlet boxes and millwork as stipulated on the drawings.

.9 Align and evenly space outlet boxes that are mounted as a group.

.10 Install receptacle colours as follows:

Area	Colour
Gypsum board, plaster or panelled	White
Office	White
Service, exterior	gray
Patient Care Areas	White
Feature wood panels	Black

3.22 WIRING DEVICES - COVER PLATES

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates designed for flush outlet boxes on surface-mounted boxes.

.4 Provide plaster ring where necessary.

.5 Install cover plates as follows:

Area	Cover Plate Type
Gypsum board, plaster or panelled	stainless steel (nylon)
Offices	Nylon
Service	galvanized steel
Exterior	Lockable weather proof
Patient Care Areas	Stainless Steel
Feature wood panels	Black

3.23 WELDING RECEPTACLES

.1 Install welding receptacles.

.2 Ensure that phase rotation is similar for all receptacles.

3.24 CONTROL DEVICES

.1 Install as indicated.

3.25 PLYWOOD BACKBOARDS

.1 Install G1S plywood backboards where indicated on drawings.

.2 Backboards shall be installed to 8' high from floor.

.3 Backboards shall be painted with intumescent grey paint.

3.26 FIELD FABRICATED METAL WORK

.1 Clean and prime paint field fabricated metal work.

.2 After fabrication deburr, scrape, grind smooth, wire brush with power brush and degrease metal work.

.3 Prime paint steel with 1 coat of CISC/CPMA 2.75 oil alkyd primer.

.4 Prime paint aluminum as follows: wash with detergent solution and wipe down with SSPC-SP1 solvent. Apply Glidden #Y-5229 primer to 1.5 mils DFT.

.5 For brass and bronze alloy materials, prepare as for aluminum but apply 1 coat of CAN/CGSB-1.40-M zinc chromate primer.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section includes:

Labour, products, equipment and services necessary to complete the work of this Section.

.2 Refer to grounding riser diagram on drawings for additional information.

2 Products

2.1 GROUND CONDUCTORS

.1 Copper conductors, soft drawn, ASTM Class B stranded.

.2 Insulated or bare conductors. Insulation colour green.

.3 Acceptable Manufacturers:

Erico

Approved equal manufacturer

2.2 BURIED CONNECTIONS - EXOTHERMIC TYPE CONNECTION

.1 Cable to rod / cable to pipe / cable to cable.

.2 Moulds, weld metal and accessories.

.3 Acceptable Manufacturers:

Erico

Burndy

Approved equal manufacturer

2.3 CONNECTIONS TO STEEL STRCUCTURES

.1 Exothermic connection (for underground connections) or compression ground connector (for above ground connections).

.2 Bi-metalic washers shall be used in the case of steel-copper compression connection.

.3 Acceptable Manufacturers:

Erico

Burndy

Approved equal manufacturer

2.4 MISCELLANEOUS HARDWARE

.1 Galvanized steel ground studs, bolts, washers, nuts and accessories necessary for grounding system, including but not limited to:

Grounding and bonding bushings

Bolt type conductor connectors

Bonding jumpers, straps

Pressure type wire connectors

.2 Acceptable Manufacturers:

Erico

Burndy

T & B Blackburn

2.5 GROUND RODS

.1 Copper-clad steel, minimum 19 mm diameter, 3 m long, two 1.5m sections which are connected via grounding coupling.

.2 At manholes provide screw down lugs on ground rods.

.3 Acceptable Manufacturers:

Erico

Hydel

T & B Blackburn

Approved equal manufacturer

2.6 GROUND ELECTRODE INSPECTION BOX

.1 Inspection box, hot dip galvanized steel or hard PVC, with flush cover and ground lug, minimum 245mm dia., 300 mm deep, lockable door.

.2 Acceptable Manufacturers:

Erico

Burndy

Lacal

Hydel

Approved equal manufacturer

2.7 GROUND BUS

.1 Ground bus: copper, 50 mm x 6 mm thick complete with insulated supports, fastenings, connectors, length as indicated. The ground bus shall be predrilled with holes for use with standard sized lugs.

.2 Telecommunication Main Grounding Busbar (TMGB): copper, 100mm x 6 mm thick complete with insulated supports, fastenings, connector, and length as indicated.

The TMGB shall be predrilled with holes for use with standard sized lugs.

The TMGB shall be UL listed and meet the requirements of ANSI-J-STD-607-A

The TMGB shall be sized as above or lengthen to meet the requirements of the immediate application with consideration for future growth.

.3 Telecommunication Grounding Busbar (TGB): copper, 50mm x 6 mm thick complete with insulated supports, fastenings, connector, and length as indicated.

The TGB shall be predrilled with holes for use with standard sized lugs.

The TGB shall be UL listed and meet the requirements of ANSI-J-STD-607-A

The TGB shall be sized as above or lengthen to meet the requirements of the immediate application with consideration for future growth.

.4 Acceptable manufacturers:

Erico

Burndy

Harger

Approved equal manufacturer

2.8 ALUMINUM STRUCTURES AND EQUIPMENT

.1 Use tin or silver plated connectors for grounding connections to aluminum structures and equipment.

.2 Acceptable Manufacturers:

Erico

Burndy

Thomas & Betts

Approved equal manufacturer

3 Execution

3.1 GENERAL

.1 Clean all paint, rust and dirt from all surfaces to which ground lugs are bolted.

.2 Protect exposed grounding conductors from mechanical damage.

.3 Ensure that moulds, for exothermic type connections, are not used for more than 50 connections.

.4 All panels, junction and terminal boxes, shall be bonded to grounding conductors.

.5 Primary grounding:

Install continuous grounding system including, electrodes, conductors, connectors and accessories as indicated and to requirements of ESA (Electrical Safety Authority) and Horizon Utilities.

Install connectors and cadweld in accordance with manufacturer's instructions.

Protect exposed grounding conductors during and after construction.

Make buried connections, and connections to electrodes, structural steel work, using copper welding by thermite process.

Use mechanical connectors for grounding connections to equipment provided with lugs.

Use tinned copper conductors for aluminium structures, in all connection of two different metals, bimetallic washers shall be used.

Do not use bare copper conductors near unjacketed lead sheath cables.

.6 Secondary grounding:

Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.

Where EMT or rigid steel is used, run separate and dedicated ground wire for each circuit within.

Install connectors in accordance with manufacturer's instructions.

Protect exposed grounding conductors from mechanical injury.

Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermite process.

Use mechanical connectors for grounding connections to equipment provided with lugs.

Soldered joints are not permitted.

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.

Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

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

Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at both ends.

Make ground connections to continuously conductive underground water pipe on street side of water meter.

Install water meter shunt.

3.2 EQUIPMENT GROUNDING

.1 Install grounding connections as indicated to typical station equipment including: metallic water main, line sky wire, neutral, gradient control mats. Non current

carrying parts of: transformers, generators, motors, circuit breakers, reclosers, current transformers, frames of gang-operated switches and fuse cutout bases shall be bonded to ground. Cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers shall be grounded. Meter and relay cases, any exposed building metal, within or forming part of station enclosure shall be bonded to ground. Sub-station fences, pothead bodies and outdoor lighting poles shall be bonded to ground.

.2 Ground hinged doors to main frame of electrical equipment enclosure with flexible jumper.

.3 Connect metallic piping (water, oil, air, etc.) inside station to main ground bus at several locations, including each service location within station.[Make connections to metallic water pipes outside station to assist in reduction of station ground resistance value].

3.3 BURIED GROUNDING LOOP

.1 For buried grounding connected only exothermic connection types are permitted.

.2 Install ground rods 300 mm below finished grade.

.3 Install ground loop around transformer foundation 300 mm below finished grade. Refer and comply with Horizon Utilities ground requirements for pad mounted transformers.

3.4 DUCT BANKS

.1 Bond metal raceway within duct banks to system ground each 10 m distance (at least from two points).

.2 Connect grounding conductor in duct banks to ground bus or ground rods in electrical rooms, substations, manholes, etc.

3.5 MANHOLES

.1 Provide ground rod(s) in each manhole and connect to metalwork such as, ladder, cable racks, manhole metal frame.

.2 Install ground rod with top projecting through floor slab and install a screw down lug for connection of portable appliances etc.

.3 Where more than one compartment is provided, install ground rod in each compartment.

3.6 STRUCTURAL STEEL AND BUILDING GROUNDING

.1 Ground building structural steel columns to buried perimeter grounding conductor. Ensure perimeter cable is slack to avoid stressing the connections.

.2 Install grounding jumpers across building expansion joints.

.3 Install ground rods close to column foundations and drive top of rod 300 mm below grade or finished floor level of slab on grade.

.4 Install inspection boxes.

3.7 ELECTRICAL ROOMS

.1 Install ground buses as indicated on plans.

.2 Connect electrical panels and equipment ground buses and lugs to electrical room perimeter or ground bus bar. Make connections to bus with cable lugs, bolted through the copper bus with shakeproof lockwashers and nuts. Use minimum No. 2/0 AWG or as shown on drawings, bared copper conductor to bond ground bus to grounding system.

3.8 LIGHTING POLES

.1 Lighting poles shall be connected to the grounding system via the grounding conductor inside the lighting cable (fifth core in 5-core cables or third-core in 3-core cables)

3.9 PAD MOUNTEDTRANSFORMERS

.1 Main transformer (utility transformer) body shall be connected to the ground grid around it from at least two points.

.2 Main transformer neutral point shall be connected directly to the ground grid with minimum 4/0 AWG size grounding conductor.

.3 Also, transformer neutral points shall be interconnected via interconnection cables (Neutral core of the connecting cable).

3.10 POLE MOUNTED TRANSFORMER GROUNDING

.1 Drive ground rods at base of each pole on which transformers are mounted and interconnect transformer, system neutral, lightning arresters and ground rods.

3.11 NEUTRAL GROUNDING

.1 Connect transformer neutral and distribution neutral together using 1000 V insulated conductor to one side of ground test link, the other side of the test link being connected directly to main station ground. Ensure distribution neutral and neutrals of potential transformers and service banks are bonded directly to transformer neutral and not to main station ground.

.2 Interconnect electrodes and neutrals at each grounding installation.

.3 Connect neutral of station service transformer to main neutral bus with tap of same size as secondary neutral.

.4 Ground transformer tank with continuous conductor from tank ground lug through connector on ground bus to primary neutral. Connect neutral bushing at transformer to primary neutral in same manner.

3.12 LOW VOLTAGE PANELS

.1 All electrical panels' body shall be connected to the panel ground bus from two points. Panel ground busbar shall be connected to the grounding busbar in electrical room from two different points.

3.13 CONDUCTORS

.1 Conductors: bare, stranded, soft annealed copper wire, size No. 4/0 AWG and 2/0 AWG for ground bus, electrode interconnections, metal structures, gradient control mats, transformers, switchgear, motors, ground connections.

.2 Conductors: bare or PVC insulated coloured green, stranded [un] [tinned] soft annealed copper wire, size No. 4 AWG for grounding cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers.

.3 Conductors: pvc insulated coloured green, stranded soft annealed copper wire No. 10 AWG for grounding meter and relay cases.

.4 Conductors: No. 3/0 AWG extra flexible (425 strands) copper conductor for connection of switch mechanism operating rod to gradient control mat, fence gates, vault doors.

3.14 RACEWAYS

.1 On raceways, lock-up tight all couplers and connections to boxes and enclosures. Install bonding jumpers at expansion joints, and where necessary. Maintain ground continuity throughout run of raceway.

.2 Install bonding jumpers on both ends of flexible conduit. Use grounding bushing, solderless lug, clamp or cup washer and screw connection. Install grounding conductor inside flexible conduit.

.3 EMT and non-metallic raceways: install insulated grounding conductor in raceway.

.4 Branch and feeder circuits in rigid conduit: use raceway as bonding conductor.

.5 Cable trays: provide a bare No. 2/0 AWG ground conductor along inside of tray run bonded to tray at 15 m intervals. Where multiple cable trays are supported on a common structure bond all trays to one common grounding conductor at 15 m intervals. Keep grounding continuity when cable trays transition to conduit. Provide conduit bonding lugs as required.

3.15 TELECOMMUNICATIONS ROOMS

.1 Bond metallic raceways to building ground

.2 Provide telecommunications ground bus TMGB or TGB as designated on drawings, on one wall of telecommunications room (as indicated). Mounted TMGB and TGB on stand-off brackets to clear adjacent obstructions.

.3 Provide No. 6 AWG insulated grounding conductor from TGB to ground bus to telecommunications room power distribution panel.

.4 Maintain isolation between building ground and all components within the telecommunications room connected to the TMGB or TGB.

.5 Provide isolated ground receptacles in telecommunications rooms. Provide a separate ground conductor from each receptacle to the ground bus in the power distribution panel.

.6 Connection to the TMGB and TGB shall be made by exothermic welding or by listed two-hole compression lugs.

.7 Provide No. 6 AWG insulated grounding conductor to bond TMGB to ground bus in main electrical room

.8 All metal conduits or raceways for telecommunications cabling located within the same room or space as the TMGB or TGB shall be bonded to TMGB or TGB.

Metal conduits 27mm diameter and larger shall be bonded using electro thin plated pipe clamps.

Metal conduits 21mm diameter and smaller shall be bonded using electro thin plated conduit bonding clamps.

Metal cable trays shall be bonded using electro-tinplated cable tray bonding clamps.

Bonding surface areas shall be cleaned to bare metal removing all paint, etc. The contact area shall be protected from corrosion using antioxidant joint compound.

.9 Where an electrical panelboard for telecommunication equipment is located in the same room or space as the TGB or TMGB, the panelboard ground bus or panelboard enclosure shall be bonded to the TMGB or TGB.

.10 The TMGB or TGB shall be located in an area that is accessible to telecommunications personnel.

.11 Provide individual No. 6 AWG insulated grounding conductors from each telecommunications cabinet or frame to the TGB

.12 Provide #12AWG insulated green conductor from static dissipative tile (SDT) to TGB.

3.16 TESTING

.1 Test the primary grounding loop resistance to ground, before bonding to others loops or devices (e.g. lightning protection loops) the connection is made to link them together.

.2 For resistance to ground measurements use a ground resistance test set with an accuracy of 10 milliohms.

.3 For measuring resistance to ground use the fall of potential method as outlined in IEEE Standard No. 81. After selecting the distance for the current probe take resistance measurements at a minimum of six voltage probe locations. Ensure that three of the voltage probe locations have resistance values such that the difference between any two is 0.5 ohm or less. If this is not the case repeat and retest with a larger distance for the current probe until this condition is satisfied.

.4 Perform testing under average weather conditions; allow three days after the last rain before conducting test. Do not test resistance to ground under frozen soil conditions unless specifically approved by Consultant.

.5 Test the integrity of the connections between the various components of the total grounding system. Test separately the continuity of the building perimeter loop (if used) and the connections between the primary grounding grid and the building grounding system.

.6 For continuity measurements use a bridge or similar type test meter designed for the purpose with an accuracy of 1 milliohm.

.7 Where readings are not acceptable to Electrical Inspection and Consultant provide additional ground conductors, ground rods, connections, as necessary to satisfy the requirements of both.

.8 Prepare and submit a Test Report, signed by the Test Engineer, and where witnessed, by Consultant. Include record of tests performed, methods of calculation, date and time of test, ambient conditions, and names of testing company, test engineer, witnesses, also calibration record of all test instruments used together with manufacturers name, serial number and model number. Calibration record shall include percentage error, correction factors, if any. Submit 3 copies.

END OF SECTION

1 General

1.1 **SUMMARY**

.1 Section includes:

.1 Labour, products, equipment and services necessary to complete the work of this Section.

1.2 **APPROVALS**

.1 Identification subject to prior approval of Departmental Representative.

2 Products

2.1 **WIRE AND CABLE MARKERS**

.1 Wire and Cable Diameter Less Than 13 mm

.1 Acceptable manufacturer

.1 Wieland Z type

.2 Cable Diameter 13 mm and Larger

.1 Acceptable manufacturer

.1 Wieland K type

.3 Non-Circular Wire

.1 Acceptable manufacturer

.1 Raychem Shrinkmark sleeves

2.2 **CONDUIT AND ELECTRICAL METALLIC TUBING MARKERS**

.1 Stick-On Marker

.1

Raceway Size	Minimum Character Height
.1 19 mm – 32 mm	15 mm
.2 38 mm – 51 mm	19 mm
.3 Over 51 mm	32 mm

.2 Acceptable Manufacturers

.1 Brady, vinyl cloth, black on orange, type B-500

.2 Panduit, vinyl cloth, black on yellow, type PCL

.3 Wieland, mylar, black on yellow, type NL

2.3 **CABLE TRAY MARKERS**

.1 Stick-On Marker each 15m

.1 Acceptable Manufacturers

.1 Brady, vinyl cloth, black on orange, 48 mm character height, type B-500

.2 Safety Supply Canada, conduit and voltage markers, style A, 48 mm character height

.3 Panduit, vinyl indoor/outdoor, black on yellow, 50 mm character height, type PVL

.4 Wieland, black on yellow, 50 mm character height, Electrocode NL

2.4 **BUSWAY MARKERS**

.1 Stick-On Marker

.1 Acceptable Manufacturers

.1 Brady, vinyl cloth, black on orange, 48 mm character height, type B-500

.2 Safety Supply Canada, conduit and voltage markers, style A, 48 mm character height

.3 Panduit, vinyl indoor/outdoor, black on yellow, 50 mm character height, type PVL

.4 Wieland, black on yellow, 50 mm character height, Electrocode NL

.2 Laminated plastic, black letters on white background, 75 mm character height.

.3 Suspended sign, rigid vinyl, black on yellow, 75 mm character height.

.1 Acceptable Manufacturers

.1 Panduit

.2 Safety Supply Canada

.4 Typical Identification: “347/600 V, 800A, 3-ph, 4W” “FED from MSB".

2.5 **PANELBOARD IDENTIFICATION**

.1 Engraved laminated plastic, black lettering on white background, 6 mm character height.

.2 Typical 2-line identification for lighting panel:

"LP-L2A, 120/208V, 3ph, 4W” “FED from TX2C”

.3 Directories: Typewritten identification of breaker number, ampere rating and connected equipment.

2.6 **SWITCHBOARD IDENTIFICATION**

.1 Engraved laminated plastic, black lettering on white background, 15 mm minimum character height.

.2 Typical Identification: "Switchboard AAA, 347/600V, 3 ph, 4 w".

2.7 **MOTOR STARTER, CONTACTOR AND DISCONNECT SWITCH IDENTIFICATION**

.1 Engraved laminated plastic, black lettering on white background, 6 mm character height.

.2 Typical Identification: "Pump S4, 600V, 3 ph". “FED from DP-MBA”

2.8 **MAGLOCK/FIRE ALARM PULL STATIONS IDENTIFICATION**

.1 Engraved laminated plastic, red lettering on white background, 25 mm character height.

.2 Identification: "EMERGENCY EXIT UNLOCKED BY FIRE ALARM OR BY SECURITY SYSTEM".

2.9 **WARNING SIGNS**

.1 Outdoor - metal, porcelain enamel finish. Indoor - rigid vinyl.

.2 Typical Identification: "Danger - High Voltage".

.3 Acceptable Manufacturers

.1 Outdoor: Safety Supply Canada

.2 Indoor: Safety Supply Canada, Panduit

2.10 **MARKER TAPE, SERVICE AND PHASE IDENTIFICATION**

.1 Acceptable Manufacturer

.1 3M, Scotch Code Tape, type STD with SDR colour refills or 3M Scotch 35 colour tape.

3 Execution

3.1 **SYSTEMS IDENTIFICATION**

.1 Identify outlet boxes for various systems with distinctive paint colour. Apply a small area of paint to inside of outlet, junction and pull boxes and panels. In suspended ceiling areas, apply paint to inside and outside of junction boxes. System colours:

System	Normal	Emergency	UPS
120/208 volt	black	black/red	black/blue
347/600 volt	orange	orange/red	orange/blue
Fire alarm	red		
Intercom	brown		
Low voltage control	black		
Security	light green		

3.2 **POWER COMPANY SERVICE IDENTIFICATION**

.1 Identify service conductors with coloured marker tape as follows:

.1	Phase A	red
.2	Phase B	black
.3	Phase C	blue
.4	Neutral	white
.5	Ground	green

3.3 **WIRE AND CABLE IDENTIFICATION**

.1 Identify power, control, lighting and receptacle wires with continuous coloring as follows:

.1	Phase A	red
.2	Phase B	black
.3	Phase C	blue
.4	Neutral	white
.5	Ground	green
.6	Isolating ground	green and yellow
.7	Control	red
.8	Interlock	yellow
.9	D.C.	blue

.2 For larger wire sizes available only in black, install colored wire marker tape in accordance with above coding.

.3 Cables Bearing Identification Numbers on the Drawings

.1 Install identification markers at each end of cable run.

.4 Control/Indication Conductors

.1 Install conductor identification markers at switchgear, motor control centres and motor starter terminal blocks and at remote devices.

.2 Identification in accordance with the Drawings and reviewed shop drawings.

.5 Lighting and Receptacle Branch Circuits

.1 Install conductor identification markers at panel, outlet box connections to lighting fixtures and device outlet boxes.

.2 Typical identification if fixture or device is connected to panel RP-H2B, circuit 5: H2B-5.

.6 Low Voltage Lighting Control

.1 Install conductor identification marker at relay phase conductors. Typical identification if connected to panel LP-L2A, circuit 5: L2A-5.

.2 Install conductor identification marker on conductors between control locations and relay panels. Identify in accordance with reviewed shop drawings.

.7 Data, Voice and Fibre Optic Cables

.1 Label horizontally distributed cabling at the following locations:

.1 Both ends of cable run

.2 Entrance and exit of cable pathway (i.e. cable trays, zone conduits, etc.)

.2 Label riser/backbone distribution cables at the following locations:

.1 Both ends of cable run

.2 Entrance and exit of cable pathway (ie. cable trays, zone conduits, etc.)

.3 1.5 m above finished floor in communication closets and equipment rooms

.4 At entrance and exit of a sleeve or slot in communication closets and equipment rooms

.3 Use the following color codes for labels:

Function	Color
Auxiliary and miscellaneous circuits	Yellow
Common equipment	Purple
Customer side of network interface	Green
First level backbone	White
Horizontal cabling to workstations	Blue
Inter-building backbone	Brown
Key telephone systems	Red
Network side of network interface	Orange
Second level backbone	Gray

Note: Common equipment refers to PBX equipment, host computer, LANs and multiplexer. Miscellaneous refers to maintenance alarms, security, paging systems, and other system and circuits not an integral part of common equipment. Color codes to ANSI/TIA/EIA-606.

.8 Fire Alarm and Miscellaneous Systems

.1 Install identification on conductors at panels, remote devices and system connections. Identify in accordance with reviewed shop drawings.

.2 Install maglock/fire alarm pull station identification adjacent to each door equipped with a maglock.

3.4 CONDUIT AND ELECTRICAL METALLIC TUBING (EMT) IDENTIFICATION

.1 Where Drawings indicate conduit and EMT identification numbers/letters, install identification markers at each end of run and at pull box locations.

3.5 **CABLE TRAY IDENTIFICATION**

.1 Install markers indicating system, voltage, or voltages for trays with barriers, and identification number at intervals of 20 m maximum, at branches and termination locations.

3.6 **BUSWAY IDENTIFICATION**

.1 Install stick-on markers indicating busway identification number and rating at cable tap boxes and thereafter at intervals of 30 m maximum.

.2 Install suspended identification signs at start of run and at intervals of 30 m maximum.

3.7 **PANELBOARD IDENTIFICATION**

.1 Install identification plates, using adhesive, on outside of panel.

.2 Install directory.

.3 Identify main bus as follows:

.1	Phase A	red
.2	Phase B	black
.3	Phase C	blue
.4	Neutral	white
.5	Ground	green

3.8 **SWITCHBOARD IDENTIFICATION**

.1 Install identification plates for panel and branch feeders.

3.9 **MOTOR STARTER, CONTACTOR AND DISCONNECT SWITCH IDENTIFICATION**

.1 Install identification plates using self-tapping screws.

3.10 **IDENTIFICATION AFTER FINISH PAINTING**

.1 Behind access doors at shaft plenums: identify busways, feeder cables and feeder conduits.

3.11 **EQUIPMENT WARNING SIGNS**

.1 Install "Danger - High Voltage" signs.

.2 When equipment is supplied from more than one source install red warning signs to this effect.

3.12 **PATCH PANEL AND FACEPLATE IDENTIFICATION**

.1 Identify each jack at each wall or furniture outlet with a label supplied by the faceplate manufacturer. Each jack identification designation to match the respective cable identification designation.

.2 Identify each jack at each patch panel jack with labels, front and back, supplied by the patch panel manufacturer. Each jack identification designation to match the respective cable identification designation.

.3 In addition to an alphanumeric label use manufacturer's matching colour coded icons, which conform to ANSI/TIA/EIA-606, to identify individual jacks on faceplate and patch panels.

End of Section

1 General

1.1 SUMMARY

.1 Section includes:

.1 Labour, products, equipment and services necessary to complete the work of this Section.

1.2 RELATED SECTIONS

.1 Section 26 05 01: Basic electrical requirements.

.2 Section 26 05 54: Electrical identification.

1.3 REFERENCES

.1 Conform to latest issues, amendments and supplements of following standards:

.1 CSA C22.2 No.29-11, Panelboards and enclosed Panelboards.

.2 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SYSTEM DESCRIPTION

.1 Panelboards – Power Switching Circuit Breaker Type

2 Products

2.1 PANELBOARDS - CIRCUIT BREAKER TYPE

.1 All of Panelboards to be product of one manufacturer.

.2 Enclosures: Steel, NEMA 2, sprinklerproof.

.3 Bus: Copper, ground bar, isolated ground bar and full capacity neutral bar, braced for interrupting capacity as indicated on drawings or schedules.

.4 A minimum of 10% spares.

.5 Breakers

.1 Moulded-case circuit breakers, circuit breakers and ground-fault circuit-interrupters to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Circuit breakers to have minimum symmetrical rms interrupting capacity rating as required in the single line diagrams.

.5 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.6 Ground Fault Interrupter Breakers – Class A:

.1 Single or two pole ground fault circuit interrupter c/w test and reset facilities.

.2 5mA trip sensitivity.

.7 Ground Fault Equipment Protector Breakers – Class B:

.1 Single or two pole ground fault circuit interrupter c/w test and reset facilities.

.2 30 mA trip sensitivity.

.8 Main breaker:

.1 Separately mounted in vertical position on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.9 Provide RED colour breakers with lock-on devices for breakers serving fire alarm devices.

.10 Lock-on devices for all security, life safety and asset integrity circuits as identified.

.11 Breaker Arrangement: Locate breakers at specific circuit number locations shown on panelboard schedule sheet.

.12 Lock-on Devices: For circuits supplying continuously operating equipment. Minimum quantity 10% of 15A, 20A and 30A rated breakers.

.6 Door: Hinged lockable door.

.7 Keys: 2 keys per panelboard; key panelboards alike.

.8 In addition to CSA requirements, manufacturer's nameplate to indicate panel withstand fault current.

.9 Spaces: Fully bussed for future breakers with removable filler plates.

.10 Acceptable Manufacturers

.1 Cutler-Hammer

.2 Schneider Electric / Square D

.3 GE Canada

.4 Siemens Canada

2.2 PANELBOARDS – POWER SWITCHING CIRCUIT BREAKER TYPE

.1 The Power Switching Panelboard is an Eaton Cutler Hammer, “Pow-R-Command 750” or approved equivalent.

.2 Acceptable Manufacturers:

.1 Eaton Cutler Hammer

.2 Schneider Electric / Square D

.3 Siemens Canada

.3 Enclosures:

.1 Steel, NEMA 2, sprinklerproof.

.2 Interiors shall be capable of housing a control module and sized to allow easy access and replacement of the control modules.

.3 Interiors shall provide a Class 2 separation for the control module with an internal Class 2, 120/277 VAC power supply with secondary thermal magnetic ON/OFF protection to provide power to the panelboard control module. Power supply shall be fed from panelboard bus.

.4 Provide dead front cover for access to control module

.5 Control module shall be provided with local ON/OFF switch and programming/diagnostic port.

.4 Bus: Copper, ground bar and full capacity neutral bar, braced for interrupting capacity as indicated on drawings or schedules.

.5 A minimum of 10% spares.

.6 Integral programmable plug and play lighting control module that provides ON/OFF control for low voltage switchable circuit breakers.

.7 Pre-wired and factory assembled.

.8 Switching ‘Smart’ Breakers

.1 Low voltage controlled thermal magnetic circuit breaker in a standard panelboard enclosure.

.2 Branch circuit breakers shall have bolt-on type bus connectors. Plug-in type circuit breakers are not acceptable.

.3 Circuit breakers shall have an overcenter toggle mechanism, which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- pole circuit breakers shall have common tripping of all poles.

.4 Circuit breaker trip target shall be provided. In addition, the circuit breaker handle shall move to center of travel on breaker trip.

.5 Circuit breakers marked “Remotely Controlled” on drawings shall respond to a remote low voltage Class 2 signal for Open or Closed contact positioning. Circuit breaker power contacts shall remain Open when the breaker handle is in the OFF or tripped position, regardless of the remote close command. Remote control shall only be possible when the breaker handle is in the ON position. Circuit breakers may be manually controlled by operating the breaker handle in the event of a control module failure. Control power for circuit breakers shall be derived from the control module.

.9 Standard Breakers

.1 Moulded-case circuit breakers, circuit breakers and ground-fault circuit-interrupters to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Circuit breakers to have symmetrical rms interrupting capacity rating as specified in the single line diagram.

.5 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.6 Ground Fault Interrupter Breakers – Class A:

.1 Single or two pole ground fault circuit interrupter c/w test and reset facilities.

.2 5mA trip sensitivity.

.7 Ground Fault Equipment Protector Breakers – Class B:

.1 Single or two pole ground fault circuit interrupter c/w test and reset facilities.

.2 30 mA trip sensitivity.

.8 Main breaker:

.1 Separately mounted in vertical position on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.9 Provide RED colour breakers with lock-on devices for breakers serving fire alarm devices.

.10 Lock-on devices for all security, life safety and asset integrity circuits as identified.

.11 Breaker Arrangement: Locate breakers at specific circuit number locations shown on panelboard schedule sheet.

.12 Lock-on Devices: For circuits supplying continuously operating equipment. Minimum quantity 10% of 15A, 20A and 30A rated breakers.

.10 Door: Hinged lockable door.

.11 Keys: 2 keys per panelboard; key panelboards alike.

.12 In addition to CSA requirements, manufacturer's nameplate to indicate panel withstand fault current.

.13 Spaces: Fully bussed for future breakers with removable filler plates.

3 Execution

3.1 GENERAL

.1 Protect equipment from dust, debris, moisture, and physical damage, with sealed envelope of plastic or other impervious material until building is enclosed and cleaned and equipment is energized.

.2 Protect from condensation by maintaining at suitable temperature above 0°C.

.3 Finish equipment enclosures to ANSI 49 or ANSI 61, baked grey enamel.

3.2 PANELBOARDS

.1 Locate panelboards, secure, plumb true and square to structure.

.2 Mounting Methods

.1 Exterior walls and interior combustible walls: mount on continuous slotted channel strut with 75 mm clear between back of panel and wall. Where practical, group panelboards on common frame.

.2 Interior non-combustible walls: mount against wall.

.3 Provide plywood backboards behind all wall mounted panelboards. Plywood to G1S and painted with Intumescent grey paint.

.3 Where panelboards are flush mounted, provide 3 – 25 mm spare empty conduits from each panelboard into ceiling space above.

.4 Identify load circuits on panel directory complete with name and location.

.5 Where panelboards are equipped with fused switches, install fuses immediately prior to energize. Record fuse rating on breaker or switch cover.

.6 Training

.1 Provide a training session for the Departmental Representatives for normal workdays at a jobsite location determined by the Departmental representative.

.2 The training session shall be conducted by a manufacturer's qualified representative. Training program shall include review of all system components and their function and operation instructions.

.3 Factory Testing

.1 The factory service shall provide adequate testing of the supplied equipment to ensure that the system performs as intended by the specification. Building engineering personnel shall be trained on all aspects of operating and maintaining the system. Care shall be taken to ensure that the system load connections are to the electrical drawing and that the control scenarios are operating properly.

.4 Field Quality Control

.1 Provide the services of a qualified factory-trained manufacturer's representative to assist the Contractor in starting-up the system for a period of working days. The

manufacturer's representative shall be factory-trained and shall have a thorough knowledge of the system and functions:

.1 Check installation of all smart panelboards, expansion cabinets and the central operator's station

.2 Test operation of all remote-controlled loads

.3 Repair or replace any defective component

.4 Test operation of complete lighting control system

.5 Conduct system point-by-point walk through

.5 The Contractor shall provide three (3) copies of the manufacturer's field startup.

3.3 DELIVERY, STORAGE AND HANDLING

.1 Do not ship equipment to site prior to completion of factory testing and acceptance of test results by Departmental representative.

3.4 WARRANTY

.1 Warranty requirements shall be as indicated in Division 01 except for this equipment the duration of warranty period shall be 12 months from the date the equipment is placed in service or 18 months from the date the equipment is accepted at site, whichever shall occur first.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section includes:

.1 Labour, products, equipment and services necessary to complete the work of this Section including, but not limited to, the following:

.1 Lighting equipment as per the luminaire schedule and as specified herein.

.2 Refer to Electrical lighting plan for exact location of luminaires.

.3 Check latest ceiling finish schedule in areas where recessed luminaires are specified to ensure that luminaires have suitable ceiling trim for particular ceiling finish.

.4 Refer to Luminaire Schedule located on drawings for specific light fixture information.

1.2 SUBMITTALS

.1 Submit shop drawings in accordance with Division 01.

.2 Submit certified copies of photometric test data, for each luminaire type, prepared by independent testing laboratory. Photometric data to include total input watts, candlepower summary, candlepower distribution, zonal lumen summary, luminaire efficiency, coefficient of utilization table, lamp type, ballast type and manufacturer, and lumen rating in accordance with IESNA testing procedures.

.3 Submit samples as directed by Departmental Representative for the following luminaire types:

1.3 REFERENCES

.1 CSA C22.2 No. 9-M1988 Luminaires

.2 CSA C22.2 No. 34-M1987 Electrode Receptacles, Fittings, and Connectors for Gas Tubes

.3 CSA C22.2 No. 43-M1984 Lampholders

.4 CSA C22.2 No. 66-1988 Specialty Transformers

.5 CSA C22.2 No. 74-92 Equipment for Use with Electric Discharge Lamps

.6 CSA C22.2 No. 141-M1985 Unit Equipment for Emergency Lighting

.7 ANSI/IEEE C62.41 Guide for Surge Voltages in Low Voltage AC Power Circuits

1.4 CODES AND STANDARDS

.1 All wiring to be in accordance with the Alberta Electrical Safety Code.

.2 Provide only equipment bearing a label acceptable to the Electrical Safety Authority (ESA) to indicate that the equipment has been tested to applicable CSA standards.

2 Products

2.1 LUMINAIRES

.1 General

.1 Furnish luminaires in accordance with CSA C22.2 No. 9.

.2 Luminaire finishes shall resist chipping, crazing, and discolouration.

.3 Luminaires to contain no asbestos.

.4 Furnish luminaires with flanges and gaskets to eliminate light leaks.

.2 Fluorescent Luminaires

.1 Fabricate steel luminaires from minimum 22 gauge mild sheet steel with joints securely fastened.

.2 Do not use pre-painted steel.

.3 Remove sharp edges.

.4 Phosphate dip, prime and paint luminaire body, hardware and accessories with 2 coats of baked enamel, or other finish where indicated, after fabrication.

.5 Interior baked enamel finish to have a minimum 88% reflectance and a minimum thickness of 1.2 mils.

.6 Where 2 level switching is indicated, furnish 2 ballasts, separately switched, with one ballast connected to the outer lamps and the other ballast connected to the inner lamp(s).

.7 Acrylic lens, 100% virgin acrylic, 0.125" nominal thickness, extruded aluminum hinged frame.

.3 Exit Light Luminaires

.1 Green running man exit sign.

.2 Universal ceiling, end-to-wall, surface back-to-wall mounting or recessed mounting if indicated.

.3 Connection for emergency 12V source where indicated.

.4 Refer to luminaire schedule.

2.2 BALLASTS – NON-DIMMABLE

.1 Fluorescent

.1 To CSA C22.2 No. 74.

.2 Electronic, to operate 1 or 2 lamps, integrally mounted in luminaire unless otherwise indicated.

.3 Rapid start type for normal output lamps unless otherwise indicated.

.4 Instant start type for high output lamps.

.5 Programmed start type for applications with occupancy/vacancy sensors.

.6 Type as indicated in luminaire type appendix.

.7 Totally enclosed containing no polychlorinated biphenyls.

.8 Rated 60 Hz, voltage as indicated.

.9 Rated for operation over an ambient temperature range of 10°C to 40°C.

.10 Maximum case temperature not greater than 25°C above ambient temperature.

.11 Operate at in a frequency range of 25 kHz to 40 kHz.

.12 Produce no visible flicker.

.13 Minimum sound rating of Class A.

.14 Minimum ballast factor of 0.9.

.15 Minimum power factor of 0.95.

.16 Maximum crest factor of 1.5.

.17 Maximum input current total harmonic distortion of 10% measured at rated output.

.18 To withstand line transients as defined by ANSI/IEEE C62.41, Category A.

.19 Acceptable manufacturers:

.1 Lutron

.2 Philips Advance

.3 Osram Sylvania

.4 GE Motorola

.2 LED Drivers

.1 Dims continuously from 100% to 1% lighting level (if applicable)

.2 Rated for a 50,000 hour lifetime

.3 Constant current reduction (CCR) or pulse width modulation (PWM) dimming for constant current drivers selection

.4 Works with Forward Phase controls (neutral wire required), 3-wire fluorescent controls and network lighting management controls

.5 Constant Current model: 200 mA to 2.1 A (in 10 mA steps), 5 W to 40 W

.6 Constant Voltage model: 10 Volts to 40 Volts (in 0.5 V steps), 5 W to 40 W

.7 Universal input voltage

.8 Full range of UL Class 2 products operating at low DC voltage

.9 Operational down to -30° C for use in outdoor and cold areas

.10 Integrated short circuit protection

.11 Acceptable manufacturers:

.1 Lutron

.2 Philips Advance

.3 Osram Sylvania

.4 GE Motorola

.3 Compact Fluorescent

.1 Ballasts shall be CSA and/or UL listed, Class P thermally protected and meet ANSI C62.41 (IEEE 587, Category A) for surge protection.

.2 Light level output shall be continuous, smooth and flicker free over the entire dimming range.

.3 Ballast shall have:

.1 Power factor greater than .95 and it should be self-compensated

.2 Total harmonic distortion less than 10%

.4 Ballast shall have an ambient noise level of 27dB or less throughout the dimming range.

.5 Ballasts must comply with FCC part 18 regulations and shall not interfere with other electrical or electronic equipment

.6 Ballasts shall have a minimum starting temperature of 10 deg C.

.7 Ballasts shall have protected control wire input which is not damaged by miswire.

.8 Ballasts current inrush shall not exceed three amps at 120 volts to avoid nuisance circuit breaker trips and control contact malfunctions.

.9 Lead length from ballast to lamp socket shall not exceed 1M (3ft.)

.10 Acceptable manufacturers:

.1 Lutron

.2 Philips Advance

.3 Osram Sylvania

.4 GE Motorola

.4 Metal halide ballast:

.1 Rating: [voltage as indicated] 120 V, 60 Hz, for use with 1-400W metal halide lamp. Provide circuitry for quartz re-strike standby light where indicated.

.2 Totally encased and designed for 40 degrees Celsius ambient temperature.

.3 Power factor: minimum 95 % with 95% of rated lamp lumens.

.4 Input voltage range: plus or minus 10% of nominal.

.5 Minimum starting temperature: minus 30 degrees Celsius at 90% line voltage.

.6 Mounting: as per drawings.

.7 Current crest factor: 1.7 maximum current.

.5 High pressure sodium ballast: to ANSI C82.4 design.

.1 Rating: 120 V, 60Hz, for use with 1-400W high pressure sodium lamp.

.2 Totally encased and designed for 40 degrees Celsius ambient temperature.

.3 Power factor: minimum 95 % with 95% of rated lamp lumens.

.4 Type: as recommended by manufacturer.

.5 Input voltage range: plus 10% to minus 10% of nominal.

.6 Minimum starting temperature: minus 40 degrees Celsius at 90% line voltage.

.7 Mounting: As per drawings..

.8 Current crest factor: 1.7 maximum current.

.6 Low pressure sodium ballast:

.1 Rating: 120 V, 60 Hz, for use with 1-35W low pressure sodium lamp.

.2 Totally encased and designed for 40 degrees Celsius ambient temperature.

.3 Power factor: minimum 95% with 95% of rated lamp lumens.

.4 Input voltage range: plus or minus 20% of nominal.

.5 Minimum starting temperature: minus 34 degrees Celsius at 90% line voltage.

.6 Mounting: as per drawings.

2.3 BALLASTS – DIMMABLE

.1 Fluorescent

.1 Ten-year operational life while operating with a case temperature range of 10 degrees C (50 degrees F) to 75 degrees C (167 degrees F) and 90 percent non-condensing relative humidity.

.2 Designed and tested to withstand electrostatic discharges up to 15,000 V without impairment IEC 801-2.

.3 Electrolytic capacitors to operate at least 20 degrees C below the capacitor's maximum temperature rating when the ballast is under fully-loaded conditions and case temperature is 75 degrees C (167 degrees F).

.4 Programmed Rapid Start Type.

.5 Current crest factor (CCF) less than 1.7.

.6 Meet ANSI C82.11 High frequency ballast standard.

.7 Will not interfere with infrared devices operating at frequencies between 38 kHz and 42 kHz.

.8 Withstand up to a 4,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.

.9 Manufactured in a facility that employ ESD reduction practices in compliance with ANSI/ESD S20.20.

.10 Inaudible in a 27 dBA ambient.

.11 No visible change in light output with a variation of +/- 10 percent line voltage input.

.12 Total Harmonic Distortion less than 10 percent and meet ANSI C82.11 maximum allowable THD requirements

.13 Actively prevent overheating in T5-HO linear fluorescent lamp applications.

.14 Ballasts to track evenly across:

.1 Multiple lamp lengths.

.2 All light levels.

.15 Dimming range of ballast shall be from 1% to 100% illuminance level.

.16 Acceptable manufacturers:

.1 Lutron

.2 Philips Advance

.3 Osram Sylvania

.4 GE Motorola

.2 Compact Fluorescent

.1 Continuous dimming from 100 percent to 5 percent relative light output for T4 compact and T5 twin tube lamps.

.2 Generate digital communication commands to distribute ballast data on the digital bus.

.3 Monitor and report lamp and ballast status.

.4 Lights automatically return to the setting prior to power interruption.

.5 Each ballast responds independently to:

.1 Up to 32 occupant sensors.

.2 Up to 64 personal control inputs.

.3 Up to 2 daylight sensors.

.6 Unique internal reference number visibly displayed on ballast cover.

.7 Averages 2 independent daylight harvesting inputs internally.

.8 Responds to digital load shed command.

.1 Sets high end trim.

.2 Automatically scales light output proportional to load shed command.

.1 Example: If light output is at 30 percent and a load shed command of 10 percent is received, the ballast automatically sets the maximum light output at 90 percent and lowers current light output by 3 percent to 27 percent.

.9 Maximum inrush current of 7 amperes for 120V ballasts and 3 amperes for 277V ballasts.

.10 Acceptable manufacturers:

.1 Lutron

.2 Philips Advance

.3 Osram Sylvania

.4 GE Motorola

.3 Light Emitting Diodes (LEDs)

.1 Continuous dimming from 100 percent to 1 percent relative light output.

.2 Ability to operate with installed or specified building control system.

.3 Lights automatically return to the setting prior to power interruption.

.4 Each driver responds independently to:

.1 Up to 32 occupant sensors.

.2 Up to 16 daylight sensors.

.5 Responds to digital load shed command.

.6 Sets high end trim.

.7 Automatically scales light output proportional to load shed command.

.1 Example: If light output is at 30 percent and a load shed command of 10 percent is received, the driver automatically sets the maximum light output at 90 percent (of the 30 percent light level) and lowers current light output by 3 percent to 27 percent.

.8 Acceptable manufacturers:

.1 Lutron

.2 Philips Advance

.3 Osram Sylvania

.4 GE Motorola

2.4 LAMPS

.1 Fluorescent Lamps are as per project luminaire schedule and lighting plan drawings.

.2 Incandescent lamps to be - clear, A19, 100 Watt with 1000 hour lamp life, rough-service rated; or as indicated..

.3 Tungsten halogen lamps to be - clear, T-3, 300 Watt, RSC base, 2000 hour lamp life, 5000 lumens; or as indicated.

.4 Fluorescent lamps to be - T8, 32 Watt, medium bi-pin, rapid-start, 4100 K, 30,000 hour lamp life, 2950 initial lumens, CRI [80]; or as indicated.

.5 Metal halide lamps to be - clear, BT37, 400 Watt, mogul base, horizontal burn, 4100 K, 15,000 hour lamp life, 36,000 initial lumens, CRI[65], open or enclosed type to suit the luminaire; or as indicated.

.6 Low pressure sodium lamps to be - clear, T21, 135 Watt, BY22d base, horizontal burn,16,000 hour lamp life, 22,000 initial lumens; or as indicated.

.7 High pressure sodium lamps to be - clear, ED18, 400 Watt, mogul base, 30,000 hour lamp life, 54,000 initial lumens; or as indicated.

.8 Compact fluorescent lamps to be - 18 Watt, G24q-2 base, 12,000 hour lamp life, 12,000 initial lumens, 4100 K, CRI [80]; or as indicated.

.9 Light emitting diodes (LEDs):

.1 Provide the most technically proven, advanced and successfully tested LED technology at time of installation.

.2 Colour temperature range to be from 2800 K to 4000 K as shown on luminaire schedule

.3 Minimum CRI of: 80

.4 Rated life: at least 50,000 hours based on 70% lumen depreciation level

.5 Heat sinks to adequately remove heat from bottom of semiconductor

2.5 LIGHTING POLES

.1 Design poles and arms to withstand wind loading of 160 km/h and gusts of 1.3, without deformation, with designated luminaires installed.

.2 Furnish poles round, aluminum, finish and colour as shown, designed for mounting on concrete base, height as indicated, complete with base bolt covers, grounding lug, handhole and flush weatherproof cover at base housing fuses and terminal strip.

.3 Fuseholder, in-line, waterproof, breakaway type with 10A fuse.

.1 Acceptable manufacturers:

.1 Bussman, Tron fuseholder, HEB series with insulation boot

.2 Buchanan/Elastimold, Style 65

.3 Gould Shawmut, GEB series with insulating boots

2.6 EMERGENCY BATTERY UNITS

.1 Supply voltage 120 V AC, 1PH, 60Hz.

.2 Output voltage 12 V DC.

.3 Batteries: sealed lead acid calcium alloy grid type sized to operate the lamp load to 91% of initial voltage for 30 minutes.

.4 Battery charger: solid state, multi-rate, voltage/current regulated, sized to restore battery to full charge in 12 hours.

.5 Low voltage disconnect: solid state, modular, operates at 80% battery voltage.

.6 EEMAC 2 code gauge steel housing.

.7 Auxiliary equipment:

.1 "AC Power ON"

.2 "Fast charge" pilot light

.3 Voltmeter

.4 Test switch

.5 5 minute time delay relay

.6 Cord and plug

.8 Lamp heads: mounted as indicated, 360° horizontal and 180° vertical adjustment, (12W) (20W) (55W) (micro quartz) (quartz halogen composite) lamps.

.9 Acceptable Manufacturers:

.1 –Refer to Luminaire Schedule.

3 Execution

3.1 INSTALLATION - GENERAL

.1 Provide supports for luminaires. For continuous row fluorescent type, provide support for each end plus at least one for each channel section, or additional as required. Swivel mount stems. Provide concrete inserts at points of luminaire support in unfinished areas where a concrete slab serves as ceiling. Provide support from concrete floor and roof steel above ceiling as applicable.

.2 Align luminaires in rows, maintain required heights, and install luminaires clear of other work.

.3 Keep luminaires covered and protected from construction dust and debris until building is broom clean and free of suspended dust clouds.

.4 Do not lamp luminaires until ready for testing and use. Obtain Departmental Representative's approval before lamping. Install lamps in lampholders.

.5 When installation is complete, demonstrate operation to satisfaction of Departmental Representative.

.6 Standard octagonal boxes may be supplied where conduits feeding luminaires in finished areas are exposed on ceiling if hanger canopies entirely cover outlet

boxes and are neatly notched for conduit. Otherwise, provide cast condulet outlet boxes with a diameter larger than canopies.

.7 Attach boxes or hickeys directly to poured concrete with 6 mm minimum diameter bolts and lead expansion anchors where luminaires are suspended directly from concrete slabs. Use 8 mm minimum bolts through precast slabs, welded to 100 mm x 100 mm minimum, 3.5 mm plate above slabs.

.8 Do not mount luminaires above pipes, ducts or equipment. In event of unavoidable tight locations, provide hangers to clear obstructions. Check layouts of other trades on job and plan cooperatively. Luminaires in any room shall hang at one height. Obtain approval before any changes are made to layouts shown.

.9 Provide continuous 12 mm x 38 mm channel above ceiling, where luminaires are suspended or mounted on furred ceilings. Fasten luminaires to channel with two 6 mm minimum diameter studs with minimum 1220 mm on centre.

.10 Where two 4'-0" surface or suspended fluorescent luminaires occur in tandem, an 8'-0" body may be used. Where two single lamp luminaires occur in tandem, a common lamp ballast may be used.

.11 Verify catalogue number of luminaires with description prior to ordering, and check for final ceiling finish in areas where recessed luminaires are called for in order to provide ceiling trim, flanges and mounting brackets to suit particular construction used where luminaires are installed.

.12 Support luminaires in an approved manner to comply with the Ontario Electrical Safety Code and the Ontario Building Code.

.13 Provide steel luminaire studs, brackets and hangers. Where luminaires are hung on chain hangers, provide chain of closed link type capable of supporting ten times luminaire weight. Use U-bolts for chain ends; S-hooks are not acceptable.

3.2 INSTALLATION - EMERGENCY AND EXIT LIGHTS

.1 Exit sign installation shall meet all requirements of the authorities having jurisdiction.

.2 Install emergency battery units where shown. Support on brackets supplied by manufacturer.

.3 Aim heads to properly illuminate exit path.

3.3 INSTALLATION - CEILINGS

.1 Suspend luminaires mounted from or in a suspended T-bar ceiling directly from building structure, independent of the T-bar system, to ULC, Local Fire Marshal's Office, Alberta Building Code, Electrical Safety Authority (ESA) and Departmental Representative's approval.

.2 In non-accessible ceilings wire with not more than 1200 mm of AC90 or RW90 XLPE wire in flexible conduit to adjacent outlet boxes placed above finished ceiling within reach of the luminaire openings.

.3 In accessible ceilings wire with not more than 1800 mm of AC90 or RW90 XLPE wire in flexible conduit to adjacent outlet boxes, locations as shown on the Drawings.

.4 Provide suitable trim for all luminaires installed in drywall ceilings or within lay-in or snap-in tiles.

3.4 INSTALLATION - POLES

.1 Wire down inside of lighting poles with No. 10 AWG RW90 plus No. 10 AWG insulated ground wire and secure to clips. Provide strain relief at the top of the pole so that the weight of the wiring down to the bottom of the pole does not place a strain on the wiring terminations. Install fuse holders and fuses.

.2 Assemble arms and luminaires securely to pole. Provide lamps in lampholders.

.3 Erect pole plumb and true on base. Along roadways, orient pole handhole on the side opposite the roadway unless otherwise indicated.

.4 Connect underground ground wire and pole ground wire at ground lug in pole.

.5 Leave slack in wires to allow connector and ground wire to be pulled out of handhole 150 mm clear of pole without disconnecting.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section includes:

.1 Labour, products, equipment and services necessary to complete the work of this Section.

1.2 DIMENSIONS AND QUANTITIES

.1 Dimensions shown on Drawings are approximate. Verify dimensions by reference to shop drawings and field measurement.

.2 Quantities or lengths indicated in any of the Contract Documents are approximate only and are not to gauge or limit the Work.

.3 Make necessary changes to routing of cables and the like to accommodate structural, mechanical, electrical and architectural conditions. Coordinate with other trades and make allowance for conditions that will arise from work in progress under separate contract.

1.3 WORKING DRAWINGS AND DOCUMENTS

.1 Where the word "HOLD" appears on Drawings and other Contract Documents, the Work is included in the Contract. Execute such Work only after verification of dimensions and materials and obtaining Departmental Representative's written permission to proceed.

1.4 OPERATING AND MAINTENANCE MANUALS

.1 Submit Operating and Maintenance Manuals.

1.5 "AS BUILT" RECORD DRAWINGS

.1 Where wiring is underground or underfloor, furnish field dimension with respect to building column lines and inverts with respect to finished floor levels or grades.

.2 Record deviations from cable numbers shown on the Contract Drawings.

.3 Prepare records of interconnecting and cross-connecting wiring between items of equipment including equipment supplied by Departmental Representative and under other Specification Sections. Provide the records loaded into a data base. Select the data base by mutual agreement with the Departmental Representative.

.4 Approved data base products:

.1 Microsoft Access

.2 Microsoft Excel

.5 Prepare drawings clearly identifying routes taken by cable where the cable is not supported along its length by either conduit or raceway.

.6 Include all test reports as part of the "As-built" submittals.

.7 Provide all test data and numeric as-built information in a format approved by the Departmental Representative selected from the following alternatives:

.1 CD-ROM (write once, read many)

.2 DVD-ROM (write once, read many)

1.6 MANUFACTURER'S ATTENDANCE

.1 Provide manufacturer's representatives to verify installation practices for each part of the Work as may be relevant to all components including wiring and terminations.

1.7 FIELD INSPECTION

.1 Provide field engineer for inspection and certification of equipment during installation, testing and commissioning as required.

1.8 QUALITY ASSURANCE

.1 These Specifications supplement the Electrical and Electronic Manufacturers Association of Canada, Canadian Standards Association Standards, Electronic Industries Association, Telecommunications Industries Association standards and recommendations. Conditions of the EEMAC, CSA, EIA, TIA and ISO/IEC standards and recommendations apply unless superseded or modified by this Specification.

.2 Where requirements of the specifications exceed referenced standards, the specifications apply. Where standards differ between authorities, the most rigid applies.

.3 Requirements of the specifications that are substandard to referenced standards should be brought to the attention of Departmental Representative during bidding period in sufficient time to allow suitable action to be taken and addenda issued as necessary.

.4 Equipment must be acceptable to electrical inspection authorities.

.5 Where any part of the Work fails tests, repair the fault in a manner to prevent recurrence and re-test.

.6 Where any part of the Work fails tests and that Work is to be built without physical discontinuity, remove the offending material and install new without increase in cost to the Contract.

1.9 AREA CLASSIFICATION

.1 No area in the Work is classified as Hazardous.

2 Products

2.1 MANUFACTURERS

.1 Cable Support Hardware

.1 Cable supports of open hook construction with curved cable bearing surface. Do not exceed minimum bending radius restriction.

.2 Flexible corrugated non-metallic conduit to be available in colours:

.1 Orange

.3 Flexible corrugated non-metallic conduit to be available in the following nominal sizes:

.1 25 mm inside diameter

.2 32 mm inside diameter

.4 Flexible corrugated non-metallic conduit to be available in the following fire ratings:

.1 FT4

.2 FT6 - plenum rated

2.2 WLAN INFRASTRUCTURE

.1 The entire building is to have 100% wireless LAN (WLAN) coverage. Category 5E horizontal network cabling drops are shown on drawings as provisions to enable the deployment the WLAN access points (AP) throughout the facility.

.2 This contractor is to:

.1 Site Signal Survey:

.1 Perform a coverage site signal survey/audit and confirm if additional Cat. 5E cabling drops are required or locations of the ones on drawings need to be adjusted.

.2 Site survey is to be performed immediately after all interior partitions are in place.

.3 Submit a copy of survey/audit to the Engineer for review.

.2 Coordinate and install active AP equipment supplied by the Departmental Representative.

.1 Make recommendation to the Departmental Representative of type of AP to be provided (e.g. Directional, omnidirectional) for each particular location.

.3 Location criteria:

.1 Minimum threshold coverage: -65 dBm

.2 User density:

.1 Second floor: high density user area (teaching rooms, multipurpose room)

.2 Remaining floors: standard density user areas.

.3 Above accessible ceilings or on underside of slab in no-ceiling areas

.4 In service areas/rooms adjacent to public areas

.5 In accessible light coves hiding antennas from view

.6 Near an access panel if in hard ceilings.

3 Execution

3.1 GENERAL

.1 All cables and cable pathways to run parallel or perpendicular to building lines.

.2 Proposed installation drawings to be submitted to the Engineer or Departmental Representative prior to installation.

3.2 DUCT DISTRIBUTION

.1 Clean out each section of duct by pulling a steel wire brush and mandrel of the correct size through the duct before pulling cables.

.2 When cleaning ducts, if obstructions are encountered which cannot be removed, advice the Departmental Representative of the problems encountered.

.3 Cable entry and exit from ducts to be protected by flexible corrugated non-metallic conduit or plastic bushings attached to the end of the conduit.

.4 Pull cables in underground duct-bank in continuous length. Splicing of any kind will not be permitted.

.5 Pull cable in bottom ducts first, leaving top ducts for future.

.6 Apply manufacturer recommended lubricant to cables to reduce friction between the cable and the duct.

.7 Cable grip to be attached to the sheath and its strength members so that no direct force is applied to the conductors/fibres. The cable grip shall have a ball bearing swivel to prevent the cable from twisting during pulling.

.8 Station personnel at each access point (i.e. manhole/handhole) to observe and lubricate the cables during pull.

.9 Cable passing through manholes to have sufficient slack for expansion and contraction and to be mounted with clips to prevent sagging.

.10 Submit tension pulling calculation for installation of cables to Engineer.

.11 The fibre optic cables maximum tensile rating shall not be exceeded during installation. Tension of cable to be monitored during installation.

.12 Minimum bend radius to be as per manufacturer's recommendations or 10 times the cable outside diameter which ever is the greater.

.13 Where cable must be pulled through a distance of greater than 30 m or through a pathway containing more than one 90° bend, use a dynamometer to record

installation tension and a tension limiting device to be used to prevent exceeding the maximum pulling tension specification during installation. The tension limit shall be set at or below the manufacturer's maximum limit. The cable to be taken up at intermediate pulling points with an intermediate cable take-up device as approved by the Departmental Representative, to prevent over tension on the cable.

.14 Make cable pulls continuous and steady between pull points and not to interrupt the pull unless necessitated by excessive tension on the cable.

.15 Following the installation of the cables, all duct entrance into buildings to be sealed with duct sealing compound to prevent the ingress of moisture, foreign materials and rodents.

.16 Exposed cable ends shall be protected from moisture ingress.

.17 For underground non-metallic conduit run-empty/spare or with fiber optic cables, provide a metal tracing cable through their entire length within the conduit conveying such cable. The tracing cable will be a minimum size # 12 AWG wire to be terminated at each end so that tracer can be attached. All underground buried conduits will also be marked with plastic caution tape, within a layer of backfill just above the conduit as a warning for future excavation.

3.3 GROUNDING

.1 All grounding bonding to comply with CSA C22.1 standard or after applicable codes.

.2 Install grounding cables between all equipment frames and enclosures and connect to grounding bus.

.3 Support grounding cables in the non-metallic conduits or cable trays provided.

3.4 WARRANTY

.1 Test complete structural cabling system to meet manufacturer's best warranty.

.2 Submit all necessary test results, drawings, and any other documents required to receive manufacturer's warranty certificate to manufacturer's representative.

END OF SECTION

1 General

1.1 **SUMMARY**

.1 Section includes:

.1 Labour, products, equipment and services necessary to complete the work of this Section.

1.2 **SHOP (VENDOR) DRAWINGS AND PARTS LISTS**

.1 Submit for review, manufacturer's or vendor's drawings and specifications for all products being furnished. Include rating, performance, specification sheets, descriptive literature, schematic and wiring diagrams, dimensional layouts and weights of components as well as complete assemblies.

1.3 **AREA CLASSIFICATION**

.1 No area in the Work is classified as Hazardous.

2 Products

2.1 **MANUFACTURERS**

.1 Copper Cable Labels

.1 All cables to be labelled using self-adhesive, self-laminating material.

.1 Label to be installed 100 mm from each end of cable termination.

.2 All grounding conductors to be labelled with materials in compliance with CSA-T528 or ANSI/TIA/EIA-606 specification.

.2 Identification Labels

.1 All faceplate and icons labels to suit selected faceplate.

.2 All patch panels and termination strips to be labelled with materials to suit selected patch panel or termination strip.

.3 All pullboxes, cabinet, racks to have 75 mm high (minimum) lamacoid labels at the top of unit.

.4 Colour code labels in accordance with EIA/TIA-606A or as Instructed by the Engineer.

.3 Fibre Labels

.1 Provide fibre labels along the length of the fibre cable or fibre conduit in interval of 3 meters.

.2 Provide labels at junction and pull boxes.

.3 Provide labels at each end of the fibre cables within 150 mm of the termination.

.4 Provide labels at fibre optic patch panels.

.4 Provide 15% additional labels in each room for future use.

3 Execution

3.1 **INSTALLATION GENERAL**

.1 Submit shop drawings and sample of all proposed labels and obtain approval before printing of any labels.

.2 Clearly identify all cables according to the administration system shown on the Contract Drawings.

.3 Use only approved cable marking materials.

.4 Clearly identify all outlets, patch-panels, patch-cords, cables, racks, enclosures, spaces, closets, conduit, and raceways according to the administration system shown on the contract drawings.

.5 Use only machine printed labelling for outlets.

.6 Use only engraved plastic plates for the labelling of enclosures and racks.

.7 For each termination panel port affix and secure two (2) corresponding unique Identification labels on the termination panel front and back surfaces.

3.2 **LABELLING**

.1 Provide horizontal cabling labelling in accordance with McMaster Standards. Labelling shall have the following format at both ends of the cable:

.1 Label each drop with the room number and jack number. The jack number is determined by the patch panel. Using a 48 port patch panel:

.1 Patch Panel #1

.1 room#-1 Room#-24

.2 room#-25 Room#-48

.2 Patch Panel #2

.1 room#-49 Room#-72

.2 room#-73 Room#-96

.3 Example: Room 110, the label will read: “110-53”

End of Section

1 General

1.1 **SUMMARY**

.1 Section includes:

.1 Labour, products, equipment and services necessary to complete the work of this Section.

.2 Include all test reports as part of the "As-built" submittals.

.3 Provide all test data and numeric as-built information in a format approved by the Departmental Representative selected from the following alternatives:

.1 CD-ROM (write once, read many)

.2 DVD-ROM (write once, read many)

1.2 **TEST REPORTS**

.1 For each check and test performed prepare and submit a Test Report, signed by the Test engineer, and where witnessed, by the Departmental Representative.

.2 Test Reports to include a record of all tests performed, methods of calculation, date and time of test, ambient conditions, names of testing company, test engineer, witnesses, also calibration record of all test instruments used together with manufacturers name, serial number and model number.

.3 Calibration record to include percentage error and applicable correction factors.

.4 Tests performed with instruments that have not been calibrated or certified as Fit for Purpose within 12 months preceding the date of use will not be accepted.

.5 Submit a Certified Test Report from each manufacturer, signed by the certifying inspector, confirming correct installation and operation of each product and part of Work. Include name of certifying inspector, date and times of inspection, ambient conditions.

.6 Submit evidence from each third party warranting performance guarantees of any part of the cabling system of their agreement that testing and site inspection procedures are fit for the purpose of upholding the warranty.

.7 Undertake either full or sample testing daily and have reports available for inspection by the Departmental Representative as an assurance that standards of working practices are being maintained.

.8 Complete test records and certification of such records prior to project cutover.

1.3 **MANUFACTURER'S ATTENDANCE**

.1 Provide manufacturer's representatives to verify installation practices for each part of the Work as may be relevant to all components including wiring and terminations.

1.4 **FIELD INSPECTION**

.1 Provide field engineer for inspection and certification of equipment during installation, testing and commissioning as required.

1.5 **QUALITY ASSURANCE**

.1 These Specifications supplement the Electrical and Electronic Manufacturers Association of Canada, Canadian Standards Association Standards, Electronic Industries Association, Telecommunications Industries Association standards and recommendations. Conditions of the EEMAC, CSA, EIA, TIA and ISO/IEC standards and recommendations apply unless superseded or modified by this Specification.

.2 Where requirements of the specifications exceed referenced standards, the specifications apply. Where standards differ between authorities, the most rigid applies.

.3 Requirements of the specifications that are substandard to referenced standards should be brought to the attention of Departmental Representative during bidding period in sufficient time to allow suitable action to be taken and addenda issued as necessary.

.4 Equipment must be acceptable to electrical inspection authorities.

.5 Where any part of the Work fails tests, repair the fault in a manner to prevent recurrence and re-test.

.6 Where any part of the Work fails tests and that Work is to be built without physical discontinuity, remove the offending material and install new without increase in cost to the Contract.

2 Products

3 Execution

3.1 **TESTING AND ACCEPTANCE**

.1 Horizontal cabling testing to be completed according to the following test criteria.

.1 All terminated cabling runs shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements found in the TIA/EIA-568-C series of standards. All pairs in each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation, including (but not limited to) cables, connectors, patch panels, and cordage shall be repaired or replaced in order to ensure 100% usability of all installed runs.

.2 All balanced twisted-pair cable links shall be tested for basic for:

.1 Wire map, including shield connection if present

.2 Insertion loss

.3 Cable length;

.4 Attenuation;

.5 NEXT loss, pair-to-pair, measured from local end

.6 NEXT loss, pair-to-pair, measured from far-end

.7 NEXT loss, power sum, measured from local end

.8 NEXT loss, power sum, measured from far-end

.9 ELFEXT, pair-to-pair

.10 ELFEXT, power sum

.11 Return loss, measured from local end

.12 Return loss, measured from far-end

.13 Propagation delay

.14 Delay skew

.15 ACR;

.16 Power sum ACR;

.17 End to end continuity;

.18 Opens or shorts;

.19 Pair polarity.

.3 Provide full bandwith graphical results for all cables.

.4 Category 6 performance testing shall be done according to the published standards.

.2 Fibre optic cabling testing to be completed according to the following test criteria.

.1 The backbone optical fibre cabling link segment shall be tested in at least one direction at both operating wavelengths to account for attenuation deltas associated with wavelength.

.1 Singlemode backbone links should be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper.

.2 Multimode backbone links shall be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper.

.3 Because backbone length and the potential number of splices vary depending upon site conditions, the link attenuation equation should be used to determine acceptance values based upon this Standard's component requirement at each of the applicable wavelengths.

.2 Test every fibre of each cable with an Optical Time Domain Reflectometer for length and attenuation. Include a hard copy chart recording with the test documentation.

.3 Tabulate and include test results with the test documentation.

.3 Correct all cable faults. Splicing of any cable will not be permitted, for any reason, unless prior authorization is received in writing by the Departmental Representative.

.4 All installed cables and terminations must meet and exceed the minimum performance specifications as outline by the cable manufacturer. Marginal passes are NOT acceptable and must be corrected prior to test results submission.

.5 All defects and deficiencies which become evident during the warranty period are to be repaired or replaced within a time frame that is acceptable to the Departmental Representative and at no extra cost.

.6 Submit complete test results in hard and soft format.

.7 Submit letter of system certification within 3 weeks of substantial completion. Include:

.1 Notification of systems installed (Category 6)

.2 Verification of performance of the system

.3 Manufacturer certificate number

.4 Copy warranties

End of Section

1 General

1.1 **SUMMARY**

.1 Section includes:

.1 Labour, products, equipment and services necessary to complete the work of this Section.

1.2 **SHOP (VENDOR) DRAWINGS AND PARTS LISTS**

.1 Submit for review, manufacturer's or vendor's drawings and specifications for all products being furnished. Include rating, performance, specification sheets, descriptive literature, schematic and wiring diagrams, dimensional layouts and weights of components as well as complete assemblies.

2 Products

2.1 **MANUFACTURERS**

.1 Horizontal (Distribution) UTP Cables

.1 The copper backbone cables shall be Belden “IBDN DataTwist 2400 UTP, Category 5E”.

.2 Horizontal UTP cables to be of characteristic impedance 100Ω and comply with ANSI/EIA/TIA 568A specification for Category 5E UTP cables except where indicated otherwise on the Contract Drawings.

.3 Bandwidth: 250 MHz

.4 Horizontal UTP cable to be 4 pair 23 AWG solid conductor.

.5 Exposed cable in air space between underside of ceiling and underside of overhead slab to be FT6 Plenum rating (CMP).

.6 Cable routed through the air space between underside of ceiling and underside of overhead slab and fully contained in metallic conduit or electrical metallic tubing to be FT4 rated (CMG).

3 Execution

3.1 **GENERAL**

.1 All cables and cable pathways to run parallel or perpendicular to building lines.

.2 The following minimum clearances from electrical and heat sources are to be maintained when routing cables.

.1	Unit substations	10 m
.2	Power transformers (greater than 30KVA)	10 m
.3	Transformers	1.2 m
.4	Motors	1.2 m

.5	Switch gear (greater than 600V)	10 m
.6	Feeder cables (600V and above)	1 m
.7	Distribution cables (less than 600V)	750 mm
.8	Conduit (Enclosing 30A branch circuits)	300 mm
.9	Conduit (Enclosing 20A branch circuits)	75 mm
.10	Conduit (Enclosing 15A branch circuits)	65 mm
.11	Fluorescent luminaires	120 mm
.12	Pipes (gas, oil, water, etc.)	300 mm
.13	HVAC (equipment, ducts, etc.)	150 mm

.3 Any deviation from cable routing shown on drawings to be approved by Engineer and documented on as-built drawings.

.4 Avoid scraping, denting, crushing, twisting, kinking or otherwise damaging cables, before, during or after installation. Damaged cables to be replaced by the Contractor without additional compensation.

.5 Patch-panels and cable management panels to be mounted with clearance between equipment enclosure doors and patch cables.

.6 Proposed installation drawings to be submitted to the Engineer or Departmental Representative prior to installation.

3.2 **CABLING - GENERAL**

.1 Pull all UTP cables in a continuous run. Cable splices will not be permitted.

.2 Install all cables in accordance with manufacturer's specifications ensuring that proper installation techniques are observed and that the cable maximum pull-force and minimum bend radius specifications are adhered to.

.3 Utilize all indicated and available cable pathways such as slots, sleeves, conduits, cable trays, ducts, raceways and furniture system channels except where otherwise noted to route cable vertically and horizontally through the building. Exercise caution when pulling cables in such pathways to avoid damage to any existing cables and follow manufacturer's maximum pull-force and minimum bend radii.

.4 Where cables are exposed to risk of being damaged by sharp edges of furniture, cable tray, raceway etc. protect cables by feeding them through a length of flexible plastic conduit.

.5 Where cables exit the cable tray and are exposed to sharp bends, reduce the bending stress by covering the cable tray with protective flexible plastic conduit.

.6 Neatly bundle, secure and tie-wrap all cables. Ensure cable ties do not deform the cable jacket.

.7 Where cables are terminated on a patch panel, bundle and dress cables in groups of 12 or 24, each group consisting of cables from a single 12 or 24 port patch panel.

.8 Where cables are terminated on a cross-connect field, bundle and dress cables in groups of 12 or 24, each group consisting of cables from a single cross-connect panel.

.9 Where voice and data cables are separately identified on the Contract Drawings, separate voice and data cable into distinct bundles.

.10 Do not maintain bundles for distances greater than 1m in cable trays.

.11 For cables being terminated on a backboard mounted cross-connect field, pass all cables behind backboard in bundles and pass them through holes positioned in the center of the termination mount.

.12 When bundling Category 5E cable bundles, comply with manufacturer's recommended bundling practices for Category 5E installations. Ensure that no cable bundling puts excess pressure on the cable at any point which may result in compression or deformation of the cable jacket and internal pair/conductor geometry.

.13 Follow proper installation and termination practices for Category 5E UTP cabling. Do not kink or exceed manufacturer's restrictions on the UTP cable minimum bend radius.

.14 For UTP cables, maintain a minimum bending radius of 4 times cable diameter or 25 mm whichever is the greater.

.15 When terminating UTP cables to IDC blocks or outlet connections, observe the manufacturer's recommendations on stripping back insulation and the extent that pairs may be untwisted. Do not untwisted pairs for more than 13 mm.

.16 When terminating UTP cables follow manufacturer's installation instructions. Unless directed by the manufacturer's instructions otherwise, remove cable jacket only enough to perform termination and untwist pairs no more than 13 mm for Category 5E cable.

.17 Secure UTP distribution cables at rear of patch panels. Ensure cable approach to the patch panel is normal to the panel and stress is not transmitted to the termination.

.18 Ground all metallic strength members integral to cables and components to manufacturer's specifications and standard practices

.19 Do not strap cables to, or lay cables on, any length of conduit, pipe, ventilation duct or other building element not expressly installed for the purpose of cable support.

.20 When determining a cable routing pathway, give priority to air handling ducts, fire sprinkler pipes and electrical conduits.

.21 Except for spare cables, terminate all pairs of UTP cable at both ends.

.22 Terminate all pairs of spare UTP cable in telecommunication closet and store workstation end in ceiling space by coiling neatly and suspending. Do not rest cables on ceilings or air handling ducts.

.23 Spare cables to be of sufficient length to permit reaching any point in the room to which they apply.

3.3 **HORIZONTAL DISTRIBUTION**

.1 Where practicable and where the maximum allowable cable length is not exceeded, provide 3 m of slack UTP cable at the workstation end of each distribution cable to permit outlet relocation after installation. Neatly coil slack in ceiling space and store suspended.

.2 Secure and support cables every 1.2 m when running in free space. Bundle and tie-wrap all suspended cables so that droop between supports is minimized.

.3 Attach cable supports only to the building structure or to support wires installed expressly for cable suspension. Do not attach cable supports to ceiling support wires.

.4 Where the telecommunications outlet is mounted on a wall box or floor box or system furniture, provide working slack allowance for UTP cable of 300 mm. Coil neatly and secure.

.5 Where the telecommunications outlet is mounted on furniture, do not crimp or trap the cable between the outlet receptacle and furniture structure.

.6 Select least obstructed pathway through modular or system furniture. Where available, use eye-level pathways in preference to base-level pathways.

.7 Install blank filler plates for all unused modular jack positions on faceplates.

.8 Install blank cover plates for all unused or abandoned outlet boxes.

.9 Inform Departmental Representative immediately of any horizontal cable runs exceeding 90 m in length.

End of Section

1 General

1.1 **SUMMARY**

.1 Section includes:

.1 Labour, products, equipment and services necessary to complete the work of this Section.

1.2 **RELATED SECTIONS**

.1 Section 26 05 00: Common Work Results Electrical

.2 Section 26 05 21: Electrical Materials and Methods

1.3 **REFERENCES**

.1 Design, manufacture, install and test fire alarm system in accordance with good industry practice and in accordance with the following Codes and Standards:

.1 CAN/ULC-S524-06 - Standard for the Installation of Fire Alarm Systems

.2 CAN/ULC-S536-04 - Standard for the Inspection and Testing of Fire Alarm Systems

.3 CAN/ULC-S537-04 - Standard for the Verification of Fire Alarm Systems

.4 Alberta Building Code

.5 National Fire Code

.6 Canadian Electrical Code

.7 CAN/ULC-S525 - Audible Signal Appliance for Fire Alarm Signal

.8 CAN/ULC-S526 - Visual Signalling Appliances

.9 CAN/ULC-S527 - Control Units for Fire Alarm Systems

.10 CAN/ULC-S528 - Manually Actuated Signalling Boxes for Fire Alarm System

.11 CAN/ULC-S529 - Smoke Detectors for Fire Alarm Systems

.12 CAN/ULC-S530 - Heat Detectors for Fire Protective Signalling Systems

.13 CAN/ULC-S531 - Smoke Alarm

.14 CAN/ULC-S548 - Water Flow Indicators for Fire Protective Signalling System

.15 CSA 282 - Emergency Electrical Power Supply for Buildings

.16 CAN4-S101 - Methods of Fire Endurance Tests of Building Construction and Material

.2 If any of the requirements of the above Codes and Standards is in conflict with the Drawings or Specifications, the Code or Standard requirements shall govern, but,

in no instance shall the standards established by these Drawings and Specifications be reduced by any of the Codes and Standards listed above.

1.4 **SUMMARY**

.1 This Section covers fire alarm systems, including initiating devices, notification appliances, controls, supervisory devices and voice communication devices.

.2 Work covered by this section includes the furnishing of labour, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications.

.3 The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:

.1 Fire alarm and detection operations

.2 Control and monitoring of elevators, door hold-open devices, fire suppression systems, emergency power systems, and other equipment as indicated in the drawings and specifications.

.3 One-way supervised automatic voice alarm operations.

1.5 **MANUFACTURER'S ATTENDANCE**

.1 Provide services of manufacturer's representative in accordance with section 26 05 01.

1.6 **SUBMITTALS**

.1 Submit shop drawings in accordance with Division 01 and items noted below.

.1 Documentation to be project specific.

.2 Generic documentation and/or alternate or as-equal products are unacceptable.

.3 Product data for each type of system component including list of materials and Underwriters' Laboratories of Canada (ULC) listing. Product data to include technical documentation features, and/or functions, and parts list.

.4 Plan drawings illustrating location of all devices, system components, conduit runs with types and quantities of conductors.

.5 Dimensioned drawings illustrating minimum clearances and any required access space.

.6 Drawings illustrating all features and devices including circuiting and details of graphic annunciator.

.7 Dimensional elevation of fire alarm control panel and mounting instructions.

.8 Point to point wiring diagrams of the entire installed system differentiating clearly between factory and field installed wiring. Identify all terminals and interconnections including conductor numbering.

.9 System operation description to include method of operation and supervision of each type of circuit and sequence of operation for all manually and automatically initiated systems input and output.

.10 Operation and Maintenance Manuals: Data on each product type including all features and operating sequences for both automatic and manual operations including trouble shooting and maintenance instructions, schematic and wiring diagrams, final reviewed shop drawings, manufacturer's warranty and verification test report.

.11 Signed certified product documentation of system components confirming products comply with specified requirements.

.12 Final device address list and application program listing for the system as installed at the time of acceptance.

.13 A list of all input and output points in the system with a label indicating location or use of initiating device circuit, notification appliance circuit, relay, sensor, and auxiliary control circuits.

.14 System power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate per the prescribed backup time periods and under all voltage conditions per ULC standards

.15 Operating instructions for control panel.

.16 Installation and programming manuals covering the installed system.

.17 All final and certified documentation.

.18 Drawings in PDF format.

1.7 AUTHORITIES HAVING JURISDICTION SUBMISSIONS

.1 Contact authorities for required list of submissions for review.

.2 Submit contract drawings as required, to depict component location in order to facilitate review.

.3 Upon receipt of comments submit comments to Consultant for review.

.4 Resubmit, if required, for revision and/or clarification in order to obtain approval.

1.8 QUALITY ASSURANCE

.1 Testing Personnel Qualifications: In addition to the requirements specified in Division 1 Section "Quality Control", provide persons currently certified by the Canadian Fire Alarm Association (CFAA) for fire alarm system testing and verification, to supervise on-site testing and verification as specified in Part 3.

.2 Installer Qualifications: Engage an experienced factory-authorized installer to supervise work of this Section.

.3 Single-Source Responsibility: Obtain fire alarm components from a single source who assumes responsibility for compatibility of system components.

.4 Compliance with Local Requirements: Comply with the applicable building code, local ordinances, and regulations, and the requirements of the authorities having jurisdiction.

.5 Listing and Labelling: Provide fire alarm systems and components specified in this Section that are listed and labelled by ULC.

1.9 **TESTING AND COMMISSIONING**

.1 Perform testing and commissioning services described herein, after fire alarm and voice communication system has been installed and pretested.

1.10 **MAINTENANCE MATERIALS**

.1 Provide the following maintenance materials:

.1 5 spare audible signal appliances.

.2 5 spare visual signal appliances.

.3 5 spare manual pull stations.

.4 5 spare smoke detectors of each type used.

.5 5 spare heat detectors of each type used.

.6 3 spare fuses of each type and rating used.

.7 5 spare control switches of each type used.

.8 4 spare addressable input modules for non-addressable devices.

.9 4 spare addressable output modules for equipment control purposes.

.10 8 spare isolator modules

.11 1 spare amplifier

.12 1 power supply unit

.13 5 end of line resistors

.2 Provide a storage cabinet to hold spare parts, clearly labelled “FIRE ALARM SYSTEM SPARE PARTS”.

.3 Provide the above noted material prior to installation. Package material with protective cover for storage. Identify with labels clearly describing contents.

1.11 **DEMONSTRATION/TRAINING**

.1 Startup Services: Engage a factory-authorized service representative to provide startup service and to demonstrate and train Owner's maintenance personnel as specified below.

.1 Train Owner's maintenance personnel on procedures and schedules related to system operation, startup and shutdown, troubleshooting, servicing, adjusting, and preventive maintenance.

.2 Instruct and demonstrate programming procedures.

.3 Training Aid: Use the approved final version of the operation and maintenance manual as a training aid. Provide sufficient documentation to train 4 people.

.4 Provide course outline and list of documentation to be provided.

.5 Schedule training with Owner with at least 7 days' advance notice.

1.12 **WARRANTY**

.1 Provide a warranty for materials and workmanship, including microprocessor components and software, to be free of defects for period from date of acceptance of system by Owner in accordance with the General Conditions.

.2 Repair response times for problems defined as routine to be addressed and corrected within twenty-four (24) hours, excepting statutory holidays and weekends.

.3 Repair response times for problems defined as major to be addressed and corrected within four (4) hours, excepting statutory holidays and weekends.

.4 Contractor to provide a recommended list of spare components and devices.

.5 Manufacturers of the major components to provide written confirmation of full warranty, extended warranty and service back-up in case of the failure to perform or insolvency of the successful supplier.

.6 Maintain maintenance records for each system supplied, and must submit a monthly report containing a time and date record of all reported or detected problems, detail of corrective action taken and the cause of the problem.

.7 At end of warranty period, perform tests described above, and in accordance to CAN/ULC-S536 annual inspection and produce a final inspection report.

1.13 **MAINTENANCE MANUALS**

.1 Cable or Wiring Layout Manuals and Drawings: Prepare and submit in accordance with Division 01, showing external interconnecting cable and wiring diagram showing exact point to point connections and identifications, including junction and pull boxes.

.2 Operations and Maintenance Manuals: Submit such manuals in accordance with Division 01, and prior to completion of project, in triplicate, containing following:

.1 Actual system functional description, and sequence of operation of completed installation.

.2 Detailed maintenance instructions for control equipment and each device type, maintenance schedule in accordance with CAN/ULC-S536. Trouble shooting guide for control panels and devices.

.3 Pictorial drawing of control equipment layout, showing location of components, modules and parts, indicating catalogue numbers.

.4 Schematic diagrams of control equipment, except modules which can be exchanged as unit and internal interconnecting cables and wires.

.5 Copy of verification certificate, verification report and warranty certificates such as for fire alarm system, batteries, ancillary devices, including battery suppliers date coding for batteries.

.6 Name, address and telephone number of service representative of manufacturer to be contacted during warranty period.

.7 Name, address and telephone number of representative responsible for future software programming changes.

1.14 **SYSTEM DESCRIPTION**

.1 General: The Fire Alarm System is to be a SimplexGrinnell '4100ES' Series, multiplexed, two-stage, addressable, zoned, non-coded, indicating, fully integrated and field programmable system complete with emergency voice communications or approved equivalent. The entire system is designed as a distributed data communication and processing system.

.2 Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory. System shall be capable of storing dual configuration programs with one active and one in reserve. Panel shall be capable of full system operation during a new configuration download. To accommodate this capability, the download of a new Panel program will be transferred to a "secondary" configuration memory bank, while the Panel continues to function on the "primary" configuration memory bank.

.3 History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.

.4 Recording of Events: Record all alarm, supervisory, and trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the occurrence. The printout differentiates alarm signals from all other printed indications.

.5 Wiring/Signal Transmission:

.1 Transmission shall be hard-wired, using separate addressable signal transmission, dedicated to fire alarm service only.

.2 System connections for initiating circuits and notification appliance circuits shall be Class A and Class B respectively.

.3 Class B notification circuits shall be wired in an 'A' and 'B' circuit configuration to provide even 50% coverage in any one area should a circuit fail.

.4 Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the Fire Alarm Control Panel (FACP). Provide a distinctive indicating audible tone and alphanumeric annunciation.

.6 Remote Access:

.1 FACP shall have the capability to provide Remote Access through a Dial-Up Service Modem using the public switched telephone system of a private switched telephone system.

.2 A personal computer or technician's laptop, configured with terminal emulation software shall have the ability to access the FACP for diagnostics, maintenance reporting and information gathering.

.3 FACP shall have the capability to provide Remote Access through a ULC listed Internet Interface via a standard web browser user interface. In reaction to system events, the Interface will have the ability to broadcast email notification messages to recipients programmed via a standard web-browser interface.

.7 Required Functions: The following are required system functions and operating features:

.1 Priority of Signals: Alert and alarm events have highest priority. Subsequent alert and alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.

.2 Noninterfering: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent activations.

.3 Transmission to Remote Central Station: Automatically route alarm, supervisory, and trouble signals to a remote central station service transmitter provided under another contract.

.4 Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and the remote annunciator, indicating the location and type of device.

.5 A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.

.6 WALKTEST: The system shall have the capacity of 8 programmable passcode protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:

.1 The city circuit connection and suppression release circuits shall be bypassed for the testing group.

.2 Control relay functions associated to one of the 8 testing groups shall be bypassed.

.3 The control unit shall indicate a trouble condition.

.4 The alarm activation of any initiation device in the testing group shall cause the audible notification appliances to sound a voice announcement to identify the device or zone.

.5 The unit shall automatically reset itself after signaling is complete.

.6 Any momentary opening of an initiating or notification appliance circuit wiring shall cause the audible signals to voice announce the trouble condition.

.8 Audible Alarm Notification: By tone signals on loudspeakers throughout the building with voice communication capabilities.

.9 Speaker: Speaker notification appliances shall be listed to ULC-S541.

.10 Manual Voice Paging

.1 The system shall be configured to allow voice paging. Upon activation of any speaker manual control switch, the alarm tone shall be sounded over all speakers in that group.

.2 The control panel operator shall be able to make announcements via the push-to-talk paging microphone over the pre-selected speakers. Speaker selection should be based on floor by floor basis and on each floor.

.3 Facility for total building paging shall be accomplished by the means of an "All Call" switch.

.11 Fire Suppression Monitoring:

.1 Water flow: Activation of a water flow switch shall initiate the fire alarm sequence of operations.

.2 Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.

.3 WSO: Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device is in alarm on the initiating zone.

.12 Power Requirements

.1 The control unit shall receive AC power via a dedicated fused disconnect circuit.

.2 The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 30 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon

power failure. All battery charging and recharging operations shall be automatic.

.3 All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control unit.

.4 The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously while incoming power is present.

.5 The system batteries shall be supervised so that a low battery or depleted battery condition or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.

.6 The system shall support NAC Lockout feature to prevent subsequent activation of Notification Appliance Circuits after a Depleted Battery condition occurs in order to make use of battery reserve for front panel annunciation and control

.7 The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.

.8 Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

1.15 SEQUENCE OF OPERATION

.1 Implement the following sequence of operation for a two stage fire alarm system in a low rise building as defined by the Alberta Building Code Latest Edition.

.2 Actuation of any alarm initiating device on first stage (Alert) to:

.1 Cause electronic latch to lock-in alarm state at central control unit and data gathering panel/transponder as per local fire authority.

.2 Indicate zone of alarm at central control unit and remote annunciator display.

.3 Cause audible devices throughout building to sound at 20 strokes per minute.

.4 Cause visual devices to activate throughout building.

.5 Transmit signal to fire department and facilities via master fire alarm box.

.6 Cause air conditioning and ventilation fans to shut down.

.7 Cause fire doors and smoke control doors, if normally held open, to close automatically.

.8 Cause elevators to return to floor of egress, or to alternate floor, as required.

.9 Cause to release doors equipped with electromagnetic door locks.

.10 Cause to relay signal to security systems.

.11 Cause to relay signal to network lighting control system.

.12 Cause to relay signal to audio/visual systems.

.13 Cause to relay signal to electrical system (e.g. diesel generator load bank shunt breaker).

.14 Cause to relay signal to Building Management Systems (BMS).

.3 Actuation of alarm initiating device on second stage to:

.1 Cause speakers to sound evacuation tone throughout building to sound at 120 strokes per minute.

.4 If first stage alarm is not acknowledged within 5 minutes, system to automatically go into second stage.

.5 Possible to transmit voice message from central control unit to specific floor, group of floors or stairwells, while maintaining alert/evacuation tone to other floors, by means of master microphone and speaker circuit selection switches. Activating push-to-talk switch on master microphone to silence tones and allow one-way voice messages over system speakers. Releasing microphone switch to re-activate tones on speakers unless tones have been silenced.

.6 Acknowledging alarm: indicated at central control unit.

.7 Possible to silence signals by "alarm silence" switch at control unit, after silencing inhibit timer has timed out. If the "Alarm Silence" button is pressed, all audible and visible alarm signals shall cease operation.

.8 Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.

.9 Upon activation of a supervisory device including but not limited to fire pump power failure, low air pressure switch, and tamper switch, the system shall operate as follows:

.1 Cause electronic latch to lock-in supervisory state at central control unit and data gathering panel/transponder.

.2 Indicate respective supervisory zone at local and remote annunciator display.

.3 Cause audible signal at central control unit to sound.

.4 Activate common supervisory sequence.

.5 Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.

.6 Record the event in the FACP historical log.

.7 Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.

.10 System Reset

.1 The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."

.2 Should an alarm condition continue, the system will remain in an alarmed state.

.11 Trouble on system to:

.1 Indicate circuit in trouble on central control unit.

.2 Activate "system trouble" indication, buzzer and common trouble sequence.

.3 Acknowledging trouble condition to silence audible indication; visual indication to remain until trouble is cleared and system is back to normal.

.12 Troubles on system: suppressed during course of alarm.

.13 Trouble condition on any circuit in system not to initiate alarm conditions.

1.16 **SYSTEM SUPERVISION**

.1 The complete fire detection and alarm system comprising fire alarm system and emergency voice communication system, shall be electrically supervised for open circuits, ground faults, short circuit condition and loss of power supply, for all circuitry.

.2 Audible and visible trouble signals shall be individually indicated at the control panel, commonly indicated at the annunciator and the CFAP.

.3 Provide at the annunciator location, the following:

.1 Trouble and signal silence switch, with ring-back and subsequent alarm features. Access to these features only by direct key locked door.

.2 Loss of normal power indication.

.4 The Data Gathering Panels (DGPs) shall have standalone capabilities in the event that communication is lost between the central fire alarm panel and the DGPs. The DGPs shall be capable of receiving and processing alarms and all other functions for their respective areas in the event of a communication loss with the fire alarm control panel.

1.17 **SOFTWARE REPROGRAMMING**

.1 Carry and include allowance for additional costs for the system manufacturer to make necessary on site final changes to applicable system/equipment software. Reprograming changes are to be completed after successful testing and verification of the systems, but prior to turn over to Owner. After successful final verification of the work, confirm and obtain approval of final nomenclature in writing

from Owner and Consultant. The software revisions to incorporate final room names/area names/building names and equipment identification.

2 Products

2.1 **ACCEPTABLE MANUFACTURERS**

.1 SimplexGrinnell

.2 Edwards

.3 The following are also acceptable manufacturers subject to demonstrating that their Fire Alarm System has the capacity to be networked with the Main Campus SimplexGrinnell or Edwards Fire Alarm Systems:

.1 Notifier

.2 Siemens

.3 Mircom

2.2 **MATERIALS**

.1 All new material shall comply with the related IEEE, ANSI and ASTM standards.

.2 Control Panel

.1 Control panel shall be housed in a surface wall mounted cabinet of code gauge construction with baked enamel finish, full viewing window and hinged front door cover complete with lock and two keys. Opening cabinet door shall provide access to all operating controls, but will not expose live electrical connections.

.2 Control panel, with number of zones as identified on fire alarm schedule plus 20% spare capacity, shall contain the following:

.1 Reset button, LED test button, alarm signal silencing push button, ground fault indicator light, system trouble indicating light, trouble signal silencing button and annunciator trouble indicating light.

.2 Relays and control modules as required for door releases, fan shut-down, extinguishing system release and audible alarms.

.3 Alarm receiving modules for number of zones as indicated on drawings plus provision for 20% spares. Zone modules shall be capable of handling any type of device including pull stations, smoke detectors, and heat detectors to allow for future changing of devices without changing modules. Each module to contain a trouble alarm indicator.

.4 Power supply modules as required.

.5 Gate valve supervision module as required.

.6 Signal control modules as required.

.7 Fire department connection plug-in module complete with

disconnect switch and LED "Disconnect" indicator.

.8 All modules shall have visual supervision against removal.

.3 Central Processing Unit (CPU)

.1 Suitable for DCLA communication style: to CAN/ULC-S524

.2 Features specified are minimum requirements for microprocessor-based system with digital data control and digital multiplexing techniques for data transmission. Minimum capacity of 1000 addressable monitoring and 1000 addressable control/signal points. Points may be divided between 2 communication channels in distributed system, each channel operating independently of other. Faults on one communication channel not to affect operation of other.

.3 System to provide for priority reporting levels, with fire alarm points assigned highest priority, supervisory and monitoring lower priority, and third priority for troubles. Possible to assign control priorities to control points in system to guarantee operation or allow emergency override as required.

.4 Integral power supply, battery charger and standby batteries.

.5 Basic life safety software: retained in non volatile Erasable Programmable Read-Only-Memory (EPROM). Extra memory chips: easily field-installed. Random-Access-Memory (RAM) chips in panel to facilitate password-protected field editing of simple software functions (i.e. zone labels, priorities) [and changing of system operation software].

.6 Circuitry to continuously monitor communications and data processing cycles of microprocessor. Upon failure, audible and visual trouble indication to activate.

.7 Communication between CPU and remote DGP's/TPR's to be supervised, DCLA. Communications failure between CPU and remote units, audible and visual trouble to be indicated at CPU. Data communication to be binary DC, baseband, time-division multiplex, half-duplex. Each data channel: capable of communicating up to distance of 3,000 m.

.1 Communication between nodes in networked system to be supervised, DCLA. Communication failure between any 2 nodes, other nodes on loop to continue to communicate with each other and programmed functions on communicating nodes to continue operating.

.8 Support up to 6 RS-232-C I/O ports. CPU output: parallel ASCII with adjustable baud rates to allow interface of any commercially available printer, terminal or PC.

.9 Equipped with software routines to provide Event-Initiated-Programs (EIP); change is status of one or more monitor points, may be programmed to operate any or all of system's control points.

.10 Software and hardware to maintain time of day, day of week, day of month, month and year.

.11 Software to operate variable-sensitivity addressable smoke detectors and annunciate their status and sensitivity settings at control panel.

.12 Central processing unit shall come complete with alphanumeric display, keyboard and printer. Alphanumeric display and printer shall be fully operational while system is operating on standby batteries.

.13 CPU shall be housed in flush mounted surface mounted free standing cabinet with sufficient capacity to allow maximum system expansion and to house alphanumeric display and audio system microphone.

.14 CPU shall be equipped with a real time output for the purpose of synchronizing clocks.

.15 CPU shall display both alarm and trouble indication from each fire alarm zone, where each zone can be a device. The system shall indicate the exact location and description of activity.

.16 As a result of alarm conditions received at the CPU, the system shall have ability to automatically operate specified control points such as tripping municipal box to summon fire department, or stopping exhaust fans or air conditioning units and releasing magnetically held doors and other Fire Alarm related devices.

.17 System shall be equipped with a communication input/output "port" to allow use of commercially available remote printers, cathode ray tubes (CRT), and keyboards.

.18 Multiplex system shall be equipped with standby batteries to provide system operation and vital fire/security protection during commercial power outages. It shall also have provisions to operate an LED annunciator to provide a simple lamp type status indicator for critical system functions. These annunciators shall be operable from the system communication circuits (same wiring used to communicate with transponders), eliminating the need for special wiring.

.19 CPU shall be designed for use with transponders. Transponders shall have the capability to interface with all specified peripheral devices, such as smoke and thermal detectors, door holders, speakers, firefighter phones. Communication between CPU and transponders shall be one twisted shielded pair.

.20 Voice communication system shall be fully supervised and shall automatically report any faults within system. All faults shall be automatically reported to CPU and recorded on the printer.

.4 One way voice communication system.

.1 ULC listed for use with fire alarm system. Provide intelligible, low-level, voice reproduction and incorporate one-way voice communication to speaker circuits in building.

.2 Integrated dual channel system for use in fire alarm and emergency paging. Capability to sound either alert/alarm tone or voice message to whole building or parts.

.3 Manual control of building speaker circuits: via dedicated speaker circuit toggle switches at control panel.

.4 Master microphone: housed in CPU, push-to-talk, dynamic, noise-cancelling type, with frequency response of 200 to 4000 Hz. Any automatic alarm tone on system may be overridden (after initial inhibit period) by master microphone. Using microphone to enable authorized personnel to broadcast voice messages over system speakers. When such voice messages are completed, system to revert to previous state unless reset or manually controlled by authorized personnel.

.5 The cabinets shall house all components including amplifiers, preamplifiers, monitors, speaker circuit modules, power supplies, supervisory indications, relays and all other necessary components to provide the specified operation to ULC approval.

.6 All amplification and critical system components shall be supervised and continuously monitored for failure.

.7 Provide the emergency voice communication equipment cabinet with all necessary components to tie-in specified functions with the central fire alarm control panel, CAP, and speakers.

.8 Connect the incoming speaker lines so that a fault in any line will not adversely affect the output capability of any amplifier by more than 2 dB.

.9 Provide enough signalling circuits to feed speakers in an alternating configurations (e.g. A, B, A, B, etc.) to introduce speaker coverage redundancy throughout the building.

.10 Non-fire alarm paging includes zone control and zone volume adjustments that are bypassed when the panel is in alarm mode.

.11 Non-fire alarm features for night ringer tone activation, telephone page input, and background music.

.12 Supervised remote microphones with key switch control, beige or red for alarm paging, black for general paging.

.5 Transponders/Nodes/DGPs

.1 Fire control modules: distributed throughout building as shown on drawings in separately enclosed units (DGP'S) and interconnected to central control unit utilizing multiplex data transmission techniques.

.2 Modules: concentrated in single central location in modular central control panel.

.3 Fire alarm integrated DGP's: microprocessor based, provide interface between standard alarm input/output devices and central control unit.

.4 Each DGP: circuitry with ability to detect failure in communication with CPU resulting from faults in communication wiring. In event of loss of communication with CPU, DGP capable of operating in stand-alone mode. In this mode, DGP capable of reacting to connected input devices, and apply stand-alone programming to determine state of connected outputs.

.1 Stand-alone programming instructions: independent of, but capable of executing same type of algorithms as, that of CPU.

.5 Each DGP: self-contained unit, with integral power supply, battery charger and standby batteries. Short circuit, over voltage, and brown-out monitoring to protect powered components by automatically switching to standby batteries whenever trouble condition exists in power supply.

.6 Addressable DGP's:

.1 DGP's: addressable type, provide two-way data communication with up to 128 number of addressable devices/interface modules, utilizing digital poll/response protocol communication format. Each addressable device: uniquely identified by own address, set at time of installation.

.2 Addressable DGP's: stand-alone capability. Interface modules: facilitate connection of non-addressable devices (i.e. flow switch) to addressable DGP; provided in different types for connection to monitoring devices (i.e. flow/tamper switch), signalling devices (i.e. bells, horns, speakers), and control functions (i.e. fan shutdown, door release); communicate with addressable DGP over minimum number of wires (specified by manufacturer).

.3 Possible to connect all 3 types of addressable interface modules (monitoring, signal and control) to same addressable communication loop.

.4 Addressable DGP's: self-contained, as specified.

.5 Possible to connect variable-sensitivity addressable smoke detectors together with other addressable devices to same addressable communication loop.

.6 Remote Annunciator

.1 Alphanumeric Display and System Controls: Panel shall include an 854 character, expanded content multi-line QVGA LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.

.1 Operator prompts and six context sensitive soft-keys for intuitive operation.

.2 Programmable control switches and associated LEDs.

.3 Programmable general purpose LEDs.

.4 Support for both one-byte and two-byte characters.

.2 LED type with designation cards to indicate zone.

.3 LEDs to annunciate alarm.

.4 Trouble buzzer:

.5 Acknowledging trouble at main panel to silence trouble buzzers in system.

.6 Minimum wiring configuration with main panel and other remote annunciators.

.7 Supervised, including trouble signal for open circuit.

.8 LED test button.

.9 Remote annunciator to be complete a custom flush door to match the adjoining hairline brushed aluminum panels. Refer to Architectural details for further information.

.7 Power Supplies

.1 120 V, 60 Hz as primary source of power for system.

.2 Voltage regulated, current limited distributed system power.

.3 Primary power failure or power loss less than 102 V will activate common trouble sequence.

.4 Interface with battery charger and battery to provide uninterruptible transfer of power to standby source during primary power failure or loss.

.5 During normal operating conditions fault in battery charging circuit, short or open in battery leads to activate common trouble sequence and standby power trouble indicator.

.6 Continuous supervision of wiring for external initiating and alarm circuits to be maintained during power failure.

.7 Standby batteries: sealed, maintenance free, lead calcium sealed batteries.

.1 The batteries shall be sealed maintenance free type with expected life of ten years.

.2 Batteries shall be enclosed in a steel housing.

.3 A fully automatic battery charger shall be provided which shall be capable of restoring 90% of a dead batteries capacity within 24 hours.

.4 The battery shall be protected against excessive discharge by automatically disconnecting battery from system when voltage of battery drops to 60%.

.8 Initiating/ Input Circuits

.1 Receiving circuits for alarm initiating devices including but not limited to manual pull stations, smoke detectors, heat detectors and water flow switches, wired in DCLA configuration to central control unit.

.2 Alarm receiving circuits (active and spare): compatible with smoke detectors and open contact devices.

.3 Actuation of alarm initiating device: cause system to operate as specified in "System Operation".

.4 Receiving circuits for supervisory, N/O devices. Devices: wired in DCLA configuration to central control unit.

.5 Actuation of supervisory initiating device: cause system to operate as specified in "System Operation".

.9 Alarm Output Circuits

.1 Alarm output circuit: connected to speakers, and strobes, wired in Class B configuration to central control unit and GDP.

.1 Signal circuits' operation to follow system programming. Each signal circuit: rated at 3 A, 24 V DC; fuse-protected from overloading/overcurrent.

.2 Manual alarm silence, automatic alarm silence and alarm silence inhibit to be provided by system's common control.

.3 Speaker circuits operation: follow system programming; capable of reproducing tones and voice fed by audio channels.

.4 Audio channel available to each speaker circuit to be automatically and dynamically selected by system's microprocessor.

.10 Auxiliary Circuits

.1 Auxiliary contacts for control functions.

.2 Actual status indication (positive feedback) from controlled device.

.3 Alarm and or supervisory trouble on system to cause operation of programmed auxiliary output circuits.

.4 Four sets of separate contacts for elevator capture (to main floor of egress and to alternate floor of egress).

.5 Upon resetting system, auxiliary contacts to return to normal or to operate as pre-programmed.

.6 Auxiliary circuits: rated at 2 A, 24 V dc or 120 V ac, fuse-protected.

.11 Amplifiers

.1 Modular in construction, solid state in design, with power output of 25 or 70 V RMS, for constant voltage distribution to speaker circuits.

.2 Continuously supervised for proper operation. Loss of power, overload, open or short circuit on input or output of amplifier, or total amplifier failure, to activate trouble sequence at central control unit with visual indication.

.3 Integral power supply powered through system power supply and supported by standby batteries in case of power failure.

.4 Provide all preamplifiers and monitors with 100% backup components, arranged to automatically transfer operation to standby components upon failure. A trouble alarm indication shall activate upon transfer to standby components.

.5 Amplifiers shall be solid state, sized for required continuous output rating with 1% total harmonic distortion (THD) over a frequency range of 20 to 17 kHz + or -3 dB at rated output.

.6 Amplifier noise level shall be 75 dB below rated output and frequency response to be 20 Hz to 20 kHz + or -3 dB at rated output.

.7 Provide amplifiers in a standard wattage format with individual components not to exceed 250 watts.

.8 Equip each amplifier set with a monitor indicating amplifier operation. Should the monitor detect amplifier failure, it shall activate trouble alarm indication on the panel and automatically switch the back-up amplifier in place of the defective amplifier.

.9 Provide one back-up amplifier for the emergency voice system. Equip the back-up amplifier with an electronic switching circuit to switch in the back-up amplifier in the event of any amplifier failure.

.10 Amplifiers: 20% spare capacity for future expansion.

.12 Wiring

.1 Copper conductors: Type FAS 105

.2 To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.

.3 To signal circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.

.4 To speaker circuits: twisted, shielded pairs, and in accordance with manufacturer's requirements.

.5 To telephone circuits: twisted, shielded pairs, and in accordance with manufacturer's requirements.

.6 To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.

.7 Risers for DGPs: twisted, shielded pairs, 2 h fire-rated mineral insulated configured to eliminate interference and cross-talk.

.8 Fire alarm systems wiring to meet minimum sizes noted above and in accordance with the OESC, whichever is most stringent.

.13 Alarm Initiating Devices

.1 Heat detectors, fixed temperature, non- restorable, rated 57 degrees C.

.1 Moisture proof type, where indicated on drawings.

.2 Thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 88 degrees C, rate of rise 8.3 degrees C per minute.

.3 Addressable thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 88 degrees C, rate of rise 8.3 degrees C per minute.

.1 Electronics to communicate detector's status to addressable module/transponder.

.2 Detector address to be set on detector base head in field.

.4 Smoke detector: photo-electric air duct type.

.1 Provide integral control and power modules required for operation with main control panel.

.2 Ensure detectors and associated modules are compatible with main control panel and suitable for use in supervised circuit.

.3 Detector circuits: 4-wire type where detector operating power is transmitted over conductors separate from initiating circuit. Malfunction of electrical circuits to detector or its control or power modules to cause operation of system trouble signals. Provide a separate, fused power circuit for each smoke detection initiating circuit.

.4 Failure of power circuit: indicated as a trouble condition on corresponding initiating circuit.

.5 Provide duct detectors in accordance with NFPA 90A.

.6 Provide duct detectors with approved duct housing, mounted exterior to duct, with perforated sampling tubes extending across width of duct. Provide access door on duct for maintenance purposes.

.7 Activation of duct detectors to cause shutdown of associated air handling unit annunciation at control panel and tripping of master box transmitter and sounding of building evacuation alarms.

.8 Provide detectors with visible indicator lamp that flashes when detector is in normal standby mode and glows continuously when detector is activated.

.9 Provide remote indicator lamp for each detector.

.10 Permanently label remote indicator with description number of associated air handling unit(s).

.11 Provide each detector with remote test switch. Mount switch not

more than 1.8 m above finished floor.

.12 Permanently label test switch with description number of associated air handling unit(s).

.5 Addressable smoke detector:

.1 Photo-electric type. Electronics to communicate detector's status to addressable module/transponder.

.2 Detector address to be set on detector base in field.

.6 Addressable variable-sensitivity smoke detectors.

.1 Photo-electric type.

.2 Electronics to communicate detector's status to addressable module/transponder.

.3 Detector address to be set on detector base in field.

.4 Sensitivity settings: 7 settings, determined and operated by control panel. No shifting in detector sensitivity due to atmospheric conditions (dust, dirt) within certain parameters.

.5 Ability to annunciate minimum of 2 levels of detector contamination automatically with trouble condition at control panel.

.7 Air Aspiration Addressable Duct Smoke Detection.

.1 Photo-electric type.

.2 Available as either a single or dual inlet detection system

.3 Supports remote housing up to 25 m with 26.7 mm O.D. rigid pipe

.4 Supports remote housing up to 15 m with 19 mm O.D. flexible tubing

.5 Microprocessor controlled aspiration system provides:

.1 Adjustable air speed settings for easy setup

.2 Integral indicators located under the front cover for

.3 Convenient programming and status indications

.4 Easily accessible air filter element

.6 Separate 24 VDC power

.7 Duct sensor housing with supervised output for multiple remote relays

.8 Relay output is controlled through programming at the fire alarm control panel and can be activated / deactivated manually or in response to a separate alarm or other input or can be bypassed for unobtrusive system testing

.9 Remote functional smoke testing capability

.10 Magnetic test feature for alarm initiation at housing

.11 Sampling tubes:

.1 Multiple lengths to match elevator shaft dimensions or duct size.

.8 Projected Beam Smoke Detector

.1 Provide projected beam smoke detectors to protect spaces indicated.

.2 Integrated transmitter and receiver.

.3 Automatic gain control which will compensate for gradual signal deterioration from dirt accumulation on the lenses

.4 Wall mounting bracket

.5 Alarm latching or alarm auto-reset

.6 Separate alarm and trouble contacts

.7 Remote Test Station

.8 Provide detectors and associated controls compatible with main control panel and suitable for use in supervised circuit.

.9 Detector circuits: 4-wire type, where detector operating power is transmitted over conductors separate from initiating circuit.

.10 Provide separate, fused power circuit for each smoke detection initiating circuit.

.11 Failure of the power circuit: indicated as trouble condition on initiating circuit.

.12 Malfunction of detector or its control unit or blockage of projected beam to cause operation of system trouble signals.

.13 Install detectors in accordance with: NFPA 72, manufacturer's instructions, and ULC listing, with project beams parallel to ceilings.

.14 Beam length and distance between adjacent beams, and distance between beams and walls, not exceed maximum permitted by equipment listing.

.15 Do not use mirrors to alter direction of projected beam.

.9 Addressable Manual Alarm Stations

.1 Pull lever, push, semi-flush wall mounted type, double action, two stage, electronics to communicate station's status to addressable module/transponder over 2 wires and to supply power to station. Station address to be set on station in field. Bilingual English French signage.

.2 Auxiliary contact for exit door release that is electrically held closed by security system.

.3 Auxiliary contact for door held open device that is electrically controlled by security system.

.4 Key operated reset lock in order that they may be tested, and so designed that after actual Emergency Operation, they cannot be restored to normal except by use of a key.

.5 Provide protective cover to mitigate false alarms where indicated on plans. Cover to be ULC listed and labelled, hinged door Lexan cover. Where required by Code or by AHJ, include integral audible alarm to sound when cover is opened.

.6 For non-climate control applications, such the basement garage, provide weather-proof ULC listed and labelled, hinged door Lexan cover. Where required by Code or by AHJ, include integral audible alarm to sound when cover is opened.

.14 Addressable Circuit Interface Modules

.1 Addressable Circuit Interface Modules: Arrange to monitor or control one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of AHU systems.

.1 Addressable Dry Contact Monitor Module

.2 Addressable Control Module

.3 Addressable Relay Module

.2 Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line circuit or a separate two wire pair running from an appropriate power supply, as required.

.3 All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the CPU. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

.15 Isolators

.1 Provide isolators in accordance with code requirements and installed as per system manufacturer's requirements to isolate/monitor zones, loops, group of devices within the building and between buildings.

.16 Audio Signalling Devices

.1 Speakers:

.1 Cone type: recessed 200 mm round ceiling mounted.

.1 Fire-retardant, moisture-proof.

.2 Multiple taps adjustable from 0.25 to 2W and 2W to 8W.

.3 Frequency response: 400 to 4000 Hz.

.4 Output sound level: 85 dB at 3 m with 1W tap (025 to 2W) and 94dB at 3m with 8W tamp (2W to 8W).

.5 Dispersion angle: 120 degree range.

.2 The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted/shielded wire.

.17 Visual Alarm Signal Devices

.1 Strobe type: flashing, 24 V DC, synchronized, "FIRE" marking on polycarbonate lens; illumination of at least 75 cd @ 50' (15m) with other settings of 15/30/110 cd; suitable for mounting on surface/flush back boxes; red/white plastic housing

.2 Designed for recessed mounting in finished areas and surface mounted in service areas.

.3 Designed as weatherproof where required.

.4 Combined with speaker where shown on plans.

.18 End-of-line Resistors

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

.2 End-of-line resistors shall be mounted on a stainless steel plate and bear a ULC label.

.19 Door Holders

.1 Door holders shall be magnetic type, wall floor mounted, with approximately 35 lbs holding power, for operation on 12V DC 24C DC 24V AC 120C AC.

.20 Remote Alarm Indicators

.1 Remote alarm indicators shall be wall ceiling mounted and shall provide remote indication of a specific detector using an electrical connection. Unit shall consist of a red LED lamp on a mounting plate.

.21 Remote Test Station

.1 Remote test station shall provide testing of a detector and indication of an alarm condition at a remote location. Unit shall consist of a key test switch and a red LED lamp mounted on a single gang plate.

.22 Incident Commander

.1 Operation:

.1 When fire alarm network status changes occur, the screen displays

the type and location of the alarm (or other activity) and the appropriate header buttons appear.

.2 In the touchscreen monitor, the operator touches the screen area in alarm (or uses the mouse control) to access a more detailed view of the alarmed zone or device. With the proper password access, the operator has the ability to acknowledge alarm conditions, activate signal silence, and perform system reset directly from the Incident Commander screens.

.3 Programmable Activity Timeout allows an unattended monitor to revert to the login screen when the configured time period expires.

.4 Individual User Preferences appear when the user logs in. Options include: Font Size (default or large); Toolbar Size (small or large); Interface Theme (MS Office 2003 or System); Floating Window Options (select whether to show Menu bar or show Tool bar).

.5 Historical Log and List Details. The display format is similar to the display for active list items such as the alarm list. Displayed information can be sorted on-screen by each category shown (number, time, date, point name, etc.). List information can be reviewed on the screen, printed at a local or remote system printer, or can be written to an electronic file for compatibility with spreadsheet and database programs.

.6 Customized Response. Custom alarm and trouble messages can be added and field edited to provide operator response assistance. Point specific information, such as hazardous material storage and lists of people to notify, can be automatically or selectively displayed.

.2 Password Control:

.1 Multiple Access Levels. Operator access level is determined during log-in. Select functional access to match the training and responsibility of the operator. Operators with additional Incident Commander and fire alarm network training may be qualified for access to sensitive areas. For operators who are primarily concerned with immediate facility security, a lower level access will provide the information necessary for proper response but will not allow access to key parameters that determine overall system/network operation.

.3 Graphic Screens:

.1 Provide site and floor plan details. Graphics screens to provide easily recognizable site plan and floor plan information. The level of detail is to be customized for the specific facility to easily and accurately direct the operator to the immediate area of interest, including all the initiating, supervisory and monitored devices.

.2 Graphic screen controls icons are to be added to identify the location and type of the device of interest and the graphics control

toolbar (located at the top of the graphic) can be used to pan and zoom for more precise detail. Programmable coverage zones are to be added with selectable area and zoom level. A fixed area site plan (key plan) with action buttons and screen locator are to be added to the system. Pan and zoom are tracked by a green rectangle in the key plan.

.3 Custom Banner and Main Screen Background. The banner area can be customized (bitmap area is 1750 x 68 pixels). The main screen background (viewable prior to login) can be customized with a bitmap of up to 1000 x 525 pixels.

.4 Action Messages. In addition to screen text or graphic information, the operator can be presented with specific action messages that provide emergency response information and directions. These action messages are easily field edited for local requirements. The appropriate action message in a graphics screen would be found in an Acknowledge dialog box.

.5 Auto-Jump to Graphics or Alarm List. Select whether activity should cause a jump to a list format or to the associated graphic screen.

.6 Supported Graphics Formats:

.1 DWG Import Formats: AutoCAD R9, 10, 11-12, 13, 14, 2000-2002, 2004-2006, 2007-2009, 2010-2011.

.2 DXF Import Formats: AutoCAD R14 and 2000

.3 Export Formats: AutoCAD 2000 DWG/DXF format (allows editing in AutoCAD 2000 or later)

.4 Import drawing files: DWG, WGS, IMS/GCC DOC files, WMF, BMP, GIF, and JPG

.4 Network Diagnostics

.1 Graphical Network Status Views. Automatic, built-in diagnostics are available to provide graphical views of Network topology and Network status.

.2 Missing communications links due to wiring breaks or shorts as well as inactive network nodes are indicated clearly to guide in returning the system to normal.

.3 Information screens are available to provide detail about each specific network node.

.4 Network level functions such as timekeeper node and monitor node are indicated as well as identification of the node being used for the diagnostic.

.5 All-in-one touchscreen computer/monitor, powered from the fire alarm system power supply, including battery backup.

.1 Pan-and-zoom features allow precise navigation.

.2 Configurable coverage zones allow user defined zones within a graphics screen to highlight to indicate the area of activity without zooming into the point of interest.

.3 Auto-jump allows the screen view to jump to a graphic or alarm list menu.

.6 High resolution (1280 x 1024), 19” (483 mm) touchscreen computer/monitor with UL I/O Card, compact keyboard and mouse.

.7 Windows 7 Professional 32-bit operating system.

.8 Enable to be mounted at main front security desk console

.9 Connects to the fire alarm Network as a node allowing access to remote panel activity status, or a fire alarm event, can take control of remote panel activity over the fire alarm network.

.10 TCP/IP and LAN/WAN connections with dedicated and listed Fire Alarm LAN equipment, listed remote clients can have control access.

.11 Supports standard fire service annunciation icons to provide security personnel and first responders with critical fire response information.

.12 Color graphical annunciation and control capacity for up to 50,000 points or point groups.

.13 Floatable and dockable windows allows windows to either be fixed (docked) or floatable.

.14 Extensive historical logging; up to 500,000 events with operator notations.

.15 Optional interface to Digital Alarm Communicating Receiver (DACR) integrates multiple systems onto a single Incident Commander

.16 Available optional connections for printers or other compatible systems

3 Execution

3.1 **CONNECTIONS TO OTHER SYSTEMS**

.1 Sprinkler and Fire Standpipe Systems

.1 Provide wiring and connections from the fire alarm system to all alarm check valves, supervised valves and pressure switches supplied and installed under Mechanical Division.

.2 Provide wiring and connections from the fire alarm system to sprinkler and fire standpipe system pumps supervisory contacts supplied and installed under Mechanical Division, for "Loss of Power" and "Pump(s) Running" annunciation.

.3 Wire all excess pressure pumps.

.2 Motor Starter Connections

.1 The fire alarm panel shall be complete with shutdown relays to stop all motors of supply air fans, return air fans upon fire alarm activation.

.2 Provide all wiring and connections from the fire alarm system to designated new starters. All other starter controls wiring shall be under Mechanical Division.

.3 Elevator System Connection

.1 Provide all wiring and connections from the fire alarm system to the elevator controller required for fire mode operation.

.4 Security System Connection

.1 Provide all wiring and connection from the fire alarm system to the security system controller for specified operation.

.2 Provide all wiring and connection from the fire alarm system to the electromagnetic lock for especified operation.

.5 Network Lighting Control System Connection

.1 Provide all wiring and connection from the fire alarm system to the network lighting control system controller for specified operation.

.6 Audio/Visual System Connection

.1 Provide all wiring and connection from the fire alarm system to the audio/visual system controller for specified operation.

.7 Electrical System Connection

.1 Provide all wiring and connection from the fire alarm system to the generator set load bank (shunt) breaker for specified operation.

3.2 **INSTALLATION**

.1 Install to CAN/ULC S524.

.2 Install wiring for standard type initiating circuits in separate raceway system from alarm signal circuits, unless wiring is individually shielded and single point ground connected and acceptable to equipment manufacturer.

.3 Wire alarm signals in accordance with requirements by manufacturer and operation. Install end-of-line device for signal circuit in suitable box adjacent to last signal of signal circuit or mounted on suitable terminal strips in control panel.

.4 Install lightning protection units at each interior building local alarm initiating or signal circuit wire, connected to ground bus in control panel with #12 gauge copper conductor.

.5 Install surge protector at each external to building initiating or signal circuit as required by manufacturer.

.6 Equip raceways with separate green ground-wire and bond to ground lug at each outlet box of device and bond ground wires directly to ground bus in control panel.

.7 Take power for control panel from bus on load side of main disconnecting device as described in Section 32 of Canadian Electrical Code. Make connection using approved lugs. Bond ground cable to ground bus at control panel.

.8 Install external power regulator in electrical room close to electrical distribution supply and connect to 120 Volt AC, 60 Hz supply for fire alarm system in accordance with manufacturer's instructions.

.9 Clear wiring of shorts, opens and grounds on completion of work.

.10 Mount detectors on ceiling as per CAN/ULC-S524 Standard unless otherwise specified herein with minimum and maximum distances as required for respective type of detector, at highest point where variations in ceiling height exist. Do not mount detectors on sides, undersides, or less than 600 mm from walls, beams, joints, ducts, open web steel joists or any structure projecting below actual ceiling height and especially from lighting fixtures and air exhaust handling or heating outlets, but 900 mm from air supply handling or heating outlet.

.11 Should interference from obstruction, lamp positions, air outlets or heat radiating surfaces be encountered in locating any detector where indicated, locate detector as near as possible to indicated position, clear of obstacles, to satisfaction of Owner’s Designee, but maintain clear space of 600 mm on ceiling, below and around.

.12 Identify signal circuit, alarm initiating circuit, auxiliary circuit and other wiring at fire alarm control panel, annunciator, terminal boxes or elsewhere on completion of work with appropriate marking labels. Mark single conductors with suitable self adhesive type, indelible numbered markers, identify cables with clear polyester tag, attached with self-locking TY-RAP.

.13 Provide, install and connect wiring and interconnecting wires and cables as specified herein, as required by control panel manufacturer and as indicated on Drawings.

.14 Wire magnetic fire door holder and closing units, electro-magnetic locking devices, air conditioning fans and any other ancillary device in accordance with manufacturer instruction and their operational requirements.

.15 Provide electro-magnetic locking devices, fire door releases and/or magnetic fire door holder and closing units to Division 08. Supervise installation and ensure unit functions as per manufacturer's specifications.

.16 Supply and install 1- 15 A, 120 Volt AC duplex receptacle beside new control panel, connect into nearest receptacle circuit of adequate capacity.

.17 Where moisture-proof, corrosion resistant or waterproof detectors are used, use raintight connectors with waterproof gasketed back box and tape wiring connectors.

.18 Maintain following heights from finished floor to centre of box for

.1 Manual Station: 1200 mm

.2 Alarm signal: not less than 1800 mm.

.3 End of Line device: not more than 1800 mm.

.4 Annunciator: 1600 mm from finished floor to top of unit.

.5 Control Panel: as per Site instruction by Owner's Designee.

.19 Wiring:

.1 In no case shall the voltage drop exceed 5%.

.20 Class A wiring shall be used for all alarm initiating devices.

.21 Power to be provided by 120V AC emergency circuit.

.22 Provide EMT rigid conduits with steel set screw fittings with nylon insulated thread rigid coupling as manufactured by T & B or approved equal. Size conduits to Code requirements or larger sizes where indicated.

.23 Terminal cabinets shall be 460 x 610 mm type "T" with wood back, door within the trim complete with latch and lock.

.24 Outlet box for alarm signals shall be a single gang, masonry box unless indicated otherwise and shall be flush mounted in all areas with finished ceilings. In all other areas, outlet boxes shall be 101 mm square surface.

.25 Outlet boxes for manual stations shall be a single gang masonry box unless indicated otherwise and shall be flush mounted, in all areas with finished ceilings. In all other areas, outlet boxes shall be flush mounted if possible.

.26 Should interference from obstructions, lamp positions or heat radiating surfaces be encountered in locating any fire alarm device where shown, the device shall be located as near as possible to indicated position, clear of obstacles, to the satisfaction of Consultant.

.27 Install Fire Alarm System components as follows:

.1 Install fire alarm control panel and DGP, where shown on drawings

.2 Install fire alarm annunciator near the main entrance, where shown on plans

.3 Install Incident Commander in front security desk console.

.1 Coordinate with millwork trades for mounting hardware and proper supports.

.4 Install non-emergency paging handset at front security desk console.

.1 Coordinate with millwork trades for mounting hardware and proper supports.

3.3 FIELD QUALITY CONTROL

.1 Inspection and Verification

.1 Only directly prior to verification, remove smoke detector protectors and clean smoke detectors thoroughly.

.2 Inspect and verify each individual device in entire system for proper connection, supervision and function in accordance with CAN/ULC-S537. Identify detectors, manual pull stations and signal appliances not installed within requirements of CAN/ULC-S524 in remarks column of verification report and bring to Owner's Designee's attention prior to acceptance test.

.3 Hire the services of a professional engineer licensed in the province of Alberta to witness the fire alarm verification in accordance with the local AHJ. The electrical contractor is not obligated to hire NORR Architects Engineers Planners to witness the fire alarm verification. Another party may be utilized provided they are licensed to do so by the Authority Having Jurisdiction.

.4 If an alternate professional engineer is utilized to witness the fire alarm verification a copy of the fire alarm verification reports and certificates must be sent to NORR once completed. The building code C schedules will not be released until these documents have been received.

.5 If the electrical contractor chooses to carry NORR Architects Engineers Planners to witness the fire alarm verification refer to cash allowances in 26 05 01 - Common Work Results for Electrical for additional information.

.6 Obtain verification certificate and report from professional engineer showing each device checked, and that this work has been carried out.

.7 Obtain verification certificate and verification report from manufacturer showing each device checked, and that this work has been carried out. Utilize standard verification forms similar to Canadian Fire Alarm Association (C.F.A.A.) forms.

.8 Inspection and checking shall include smoke testing of each ionization or photoelectric smoke detector when installed with similar material found in area protected or as directed otherwise by Owner's Designee. Submit smoke detectors sensitivity calibration reading, as read on place of installation as part of verification report.

.9 Fire alarm manufacturer shall supply to electrical contractor reasonable amounts of technical assistance with respect to any changes necessary to execute work during period of inspection by manufacturer, electrical contractor shall make available, to manufacturer, electricians as designated by manufacturer.

.10 Verify only when entire system is fully operational and no subsequent work will be performed, unless project is designated for phased occupancy.

.11 For phased occupancy construction provide interim testing and verification service and retest entire system at the end of the project.

.12 Issue certificate of verification only after completion of deficiencies noted during verification have been corrected and re-verified.

3.4 FINAL COMMISSIONING

.1 After completion of above inspection and verification, make arrangement with Owner's Designee, manufacturer of control equipment and other installers of related and connected equipment (extinguishing systems, fans, doors, elevators and other equipment) to perform functional acceptance tests, giving ample notice to parties concerned to be present.

.2 Tests to include:

.1 Spot check of devices to ensure proper connections and supervision.

.2 Operation of at least 1 alarm initiating device on each detection circuit to verify required operation of alarm devices, annunciator and other installations.

.3 Testing of signal devices for correct operation and function.

.4 Testing of smoke detectors with similar material found in area to be protected.

.5 Record sound pressure levels in each room during an alarm condition and at ambient levels.

3.5 **DEMONSTRATION**

.1 Provide 20 hrs familiarization and instruction period, to familiarize user and Owner's maintenance staff with working and function of system and equipment and to instruct maintenance personnel about proper maintenance.

End of Section

1 GENERAL

1.01 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C117-95, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C131-96, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D422-63 (1998), Standard Test Method for Particle-Size Analysis of Soils.

.5 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft3) (600kN-m/m3).

.6 ASTM D1557-00, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft3) (2,700kN-m/m3).

.7 ASTM D1883-99, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.8 ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.02 WASTE MANAGEMENT AND DISPOSAL

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

.2 Divert unused granular material from landfill to local facility as approved by the Departmental Representative.

2 PRODUCTS

2.01 GENERAL

.1 Granular sub-base material for the road shall be Pit Run Gravel.

.2 Granular base material for the road shall be 25 mm Crushed Gravel:

2.02 MATERIALS

.1 Pit Run Gravel: River sand and gravel free from silt, clay, loam, friable or soluble materials, vegetative matter and conforming to the following grading:

.1 Gradation to be within the following limits when tested to ASTM C136-06 and ASTM C117-04 and giving a smooth curve without sharp breaks when plotted on a semi-log chart.

Sieve Sizes (Square Openings)	Percent Passing by Weight
200 mm	100 of Total Sample
150 mm	96 - 100 of Total Sample
75 mm	60 - 80 of Total Sample
25 mm	70 - 100 of Material Passing 75 mm Sieve
4.75 mm	25 - 63 of Material Passing 75 mm Sieve
1.18 mm	14 - 41 of Material Passing 75 mm Sieve
0.6 mm	7 - 30 of Material Passing 75 mm Sieve
0.15 mm	3 - 18 of Material Passing 75 mm Sieve
0.075 mm	2 - 9 of Material Passing 75 mm Sieve

.2 Any grading variation from the above is at the discretion of the Departmental Representative, however, the percent of material passing 0.075 mm sieve shall not exceed 2/3 of the material passing the 0.6 mm sieve.

.3 The pit run gravel shall be free of any form of coating.

.4 Pit run gravel containing clay, loam or other deleterious materials will be rejected.

.5 No oversize material is tolerated.

.2 25 mm Crushed Gravel conforming to the following grading:

.1 Gradation to be within following limits when tested to ASTM C136-06 and ASTM C117-04, and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart.

Sieve Sizes (Square Openings)	Percent Passing by Weight
25.0 mm	100
20.0 mm	95 - 100
10.0 mm	60 - 80
4.75 mm	40 - 60
2.36 mm	28 - 48
600 micron	13 - 29
300 micron	9 - 21
150 micron	6 - 15
75 micron	4 - 10

.2 At least 50% of the material retained on the 4.75 mm sieve shall have two or more fractured faces.

.3 Any gravel containing clay, loam or other deleterious materials will be rejected.

3 EXECUTION

3.01 PLACING

.1 Place granular sub-base after subgrade is inspected and approved by the Departmental Representative.

.2 Construct granular sub-base to depth and grade in areas indicated.

.3 Ensure no frozen material is placed.

.4 Place material only on clean unfrozen surface, free from snow or ice.

.5 Begin spreading sub-base material on crown line or high side of one-way slope.

.6 Place granular sub-base materials using methods which do not lead to segregation or degradation.

.7 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.

.8 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. The Departmental Representative may authorize thicker lifts if specified compaction can be achieved.

.9 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.10 Remove and replace portion of layer in which material has become segregated during spreading.

3.02 COMPACTION

.1 Compact to density of not less than 100% corrected Standard Proctor Density.

.2 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.

.3 Apply water as necessary during compaction to obtain specified density.

.4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by the Departmental Representative.

.5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.03 PROOF ROLLING

.1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm maximum.

.2 Obtain approval from the Departmental Representative to use non standard proof rolling equipment.

.3 Proof roll at level in sub-base as indicated. If non standard proof rolling equipment is approved, the Departmental Representative to determine level of proof rolling.

.4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.5 Where proof rolling reveals areas of defective subgrade:

.1 Remove sub-base and subgrade material to depth and extent as directed by the Departmental Representative.

.2 Backfill excavated subgrade sub-base material and compact in accordance with this section.

.3 Replace sub-base material and compact.

.6 Where proof rolling reveals areas of defective sub-base, remove and replace in accordance with this section at no extra cost.

3.04 SITE TOLERANCES

.1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

3.05 PROTECTION

.1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by the Departmental Representative.

END OF SECTION

1 GENERAL

1.01 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C117-[95], Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C131-[96], Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136-[96a], Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D422-[63(1998)], Standard Test Method for Particle-Size Analysis of Soils.

.5 ASTM D698-[00a], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600kN-m/m^3).

.6 ASTM D1557-[00], Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft^3) (2,700kN-m/m^3).

.7 ASTM D1883-[99], Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.8 ASTM D4318-[00], Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.02 WASTE MANAGEMENT AND DISPOSAL

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

.2 Divert unused granular material from landfill to local facility as approved by the Departmental Representative.

2 PRODUCTS

2.01 MATERIAL

.1 .1 25 mm Crushed Gravel conforming to the following gradation:

.1 Gradation to be within the following limits when tested to ASTM C136-01 and ASTM C117-95, and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart.

Sieve Sizes (Square Openings)	Percent Passing by Weight
25.0 mm	100
20.0 mm	95 - 100
10.0 mm	60 - 80
4.75 mm	40 - 60
2.36 mm	28 - 48
600 micron	13 - 29
300 micron	9 - 21
150 micron	6 - 15
75 micron	4 - 10

.2 At least 50% of the material retained on the 4.75-mm sieve shall have two or more fractured faces.

.3 Any gravel containing clay, loam or other deleterious materials will be rejected.

3 EXECUTION

3.01 SEQUENCE OF OPERATION

.1 Place granular base after sub-base surface is inspected and approved by the Departmental Representative.

.2 Placing

.1 Construct granular base to depth and grade in areas indicated.

.2 Ensure no frozen material is placed.

.3 Place material only on clean unfrozen surface, free from snow and ice.

.4 Begin spreading base material on crown line or on high side of one-way slope.

.5 Place material using methods which do not lead to segregation or degradation of aggregate.

.6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.

.7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.

.8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.9 Remove and replace that portion of layer in which material becomes segregated during spreading.

.3 Compacting

.1 Compact to density of not less than 100% corrected Standard Proctor Density

.2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.

.3 Apply water as necessary during compacting to obtain specified density.

.4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.

.5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

.4 Proof rolling

.1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.

.2 Obtain approval from Departmental Representative to use non standard proof rolling equipment.

.3 Proof roll at level in granular base as indicated. If use of non standard proof rolling equipment is approved, Departmental Representative to determine level of proof rolling.

.4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.5 Where proof rolling reveals areas of defective subgrade:

.1 Remove base, sub-base and subgrade material to depth and extent as directed by Departmental Representative.

.2 Backfill excavated subgrade with sub-base material and compact in accordance with Section 32 11 16.01 - Granular Sub-Base.

.3 Replace sub-base material and compact in accordance with Section 32 11 16.01 - Granular Sub-base.

.4 Replace base material and compact in accordance with this Section.

.6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Departmental Representative and replace with new materials in accordance with Section 32 11 16.01 - Granular Sub-base and this section at no extra cost.

3.02 SITE TOLERANCES

.1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.03 PROTECTION

.1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative.

END OF SECTION

1 GENERAL

1.01 REFERENCE STANDARDS

.1 American Association of State Highway and Transportation Officials (AASHTO)
- .1 AASHTO M320-[10], Standard Specification for Performance Graded Asphalt Binder.
- .2 AASHTO R29-[08], Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
- .3 AASHTO T245-[97(2008)], Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.

.2 Asphalt Institute (AI)
- .1 AI MS-2-[1994], Mix Design Methods for Asphalt Concrete and Other Hot-Mixes.

.3 ASTM International
- .1 ASTM C 88-[05], Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
- .2 ASTM D 698-[12], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.4 The Master Painters Institute (MPI)
- .1 Architectural Painting Specification Manual - [current edition].
  - .1 MPI #32, Traffic Marking Paint, Alkyd.

.5 U.S. Environmental Protection Agency (EPA)/Office of Water
- .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.02 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 [asphalt mixes and aggregate] and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit viscosity-temperature chart for asphalt cement to be supplied showing either Saybolt Furol viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175 degrees C [4] weeks prior to beginning Work.

.3 Samples:
- .1 Inform [Departmental Representative] [DCC Representative] [Consultant] of proposed source of aggregates and provide access for sampling [4] weeks prior to beginning Work.

1.03 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 When necessary to blend aggregates from one or more sources to produce required gradation, do not blend in stockpiles.

.3 Stockpile fine aggregate separately from coarse aggregate, although separate stockpiles for more than two mix components are permitted.

.4 Provide approved storage, heating tanks and pumping facilities for asphalt cement.

.5 Submit to Departmental Representative copies of freight and waybills for asphalt cement as shipments are received.

2 PRODUCTS

2.01 MATERIALS

.1 Granular subbase: [_____].

.2 Granular base: [_____].

.3 Prime coat: [_____].

.4 Tack coat: [_____].

.5 Traffic paint: [yellow] [and] [white] to MPI # 32.

.6 Paint thinner: to [_____].

3 EXECUTION

3.01 EXAMINATION

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

3.02 FOUNDATIONS

.1 Foundations for roadways comprise:
- .1 [300] mm compacted thickness of granular subbase [B Type II] [56-0].
- .2 [150] mm compacted thickness of granular base [A] [20-0].

.2 Foundations for parking lots to comprise:
- .1 [300] mm compacted thickness of granular base [A] [20-0].

.3 Construction of granular foundations: [OPSS 314] [CCDG].

.4 Compaction: compact each lift of granular material to [100]% maximum density to ASTM D 698. Maximum lift thickness: [150] mm.

3.03 PAVEMENT THICKNESS

.1 Pavements for roadways:
.2 Base course: [50] mm [HL8] [MB2].
.3 Wear course: [40] mm [HL3] [MB5].

.2 Pavements for parking lots:
.1 Wear course: [50] mm [HL3] [MB5].

3.04 PAVEMENT CONSTRUCTION

.1 Application of prime coat:.

.2 Construction of asphalt concrete:

.3 Surface preparation:

3.05 TRAFFIC MARKINGS

.1 Paint parking space divisions and other pavement markings in accordance with manufacturers recommendations and as indicated.

.2 Use paint thinner in accordance with manufacturer's requirements.

3.06 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
.1 Leave Work area clean at end of each day.

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

END OF SECTION