

PROJECT

LAN AND OFFICE RENOVATION

Regina, Saskatchewan

PROJECT No.

30/2014

SET No.

DATE

2015-06-10

	Pages
PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP	
<i>Procurement Requirements</i>	
Division 00 - Procurement and Contracting Requirements	
00 01 10 - Table of Contents	2
SPECIFICATIONS GROUP	
<i>General Requirements Subgroup</i>	
Division 01 - General Requirements	
01 11 00 - Summary of Work	2
01 14 00 - Work Restrictions	2
Security Clearance Forms and Instructions Appended to Section 01 14 00	4
01 31 19 - Project Meetings	2
01 32 16 - Construction Progress Schedules	2
01 33 00 - Submittal Procedures	4
01 35 29.06 - Health and Safety Requirements	3
01 41 00 - Regulatory Requirements	1
01 45 00 - Quality Control	2
01 51 00 - Temporary Utilities	2
01 52 00 - Construction Facilities	3
01 56 00 - Temporary Barriers and Enclosures	2
01 61 00 - Common Product Requirements	4
01 73 03 - Execution Requirements	2
01 74 11 - Cleaning	1
01 74 21 - Waste Management and Disposal	4
01 77 00 - Closeout Procedures	1
01 78 00 - Closeout Submittals	6
Division 07 - Thermal and Moisture Protection	
07 21 16 - Batt and Blanket Insulation	2
07 84 00 - Firestopping	5
07 92 00 - Joint Sealants	6
Division 08 - Openings	
08 11 00 - Metal Doors and Frames	7
08 71 00 - Door Hardware	7
08 80 50 - Glazing	5
Division 09 - Finishes	
09 21 16 - Gypsum Board Assemblies	5
09 22 16 - Non-structural Metal Framing	2
09 65 19 - Resilient Tile Flooring	4
09 91 23 - Interior Painting	10
Division 21 - Fire Suppression	
21 05 01 - Common Work Results - Mechanical	9
21 13 13 - Wet Pipe Sprinkler Systems	7
Division 23 - Heating, Ventilation, and Air-Conditioning (HVAC)	
23 05 05 - Installation of Pipework	7
23 05 23.01 - Valves - Bronze	4

23 05 23.03 – Valves – Cast Steel	4
23 05 29 – Hangers and Supports for HVAC Piping and Equipment	8
23 05 53.01 – Mechanical Identification	6
23 07 13 – Duct Insulation	5
23 07 15 – Thermal Insulation for Piping	8
23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa	7
23 33 00 – Air Duct Accessories	5
23 33 14 – Dampers - Balancing	3
23 33 46 – Flexible Ducts	3
Division 26 - Electrical	
26 05 01 – Common Work Results – Electrical	16
26 05 20 – Wire and Box Connectors (0-1000 V)	2
26 05 21 – Wires and Cables (0-1000 V)	4
26 05 28 – Grounding - Secondary	4
26 05 29 – Hangers and Supports	3
26 05 31 – Splitters, Junction Pull Boxes and Cabinets	3
26 05 32 – Outlet Boxes, Conduit Boxes and Fittings	5
26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings	5
26 05 36 – Cable Trays	3
26 05 37 – Wireways and Auxiliary Gutters	3
26 27 26 – Wiring Devices	5
26 28 21 – Moulded Case Circuit Breakers	3
26 50 00 – Lighting	7
Division 27 - Communications	
27 00 00 – Communication Requirements	6
27 05 14 – Communication Cable Inside Buildings	4
27 05 28 – Pathway for Communication Systems	4
27 11 19 – Patch Panels, Switches, Network Equipment	3
Division 28 – Electronic Safety and Security	
28 22 00 – Building Security and Access Control	3

LIST OF DRAWINGS

ARCHITECTURAL

- A1.0 LARGE SCALE FLOOR PLANS, SCHEDULES
- A1.1 SECOND FLOOR PLAN

MECHANICAL

- M1.0 FLOOR PLAN, EQUIPMENT SCHEDULE

ELECTRICAL

- E1.0 LOWER LEVEL, PANEL LOCATIONS, MECHANICAL PROVISIONS
- E1.1 MAIN FLOOR, POWER & SYSTEM PLAN
- E1.2 SECOND FLOOR, NEW DATA PLAN
- E1.3 SECOND FLOOR, POWER & SYSTEMS PLAN, GENERAL OFFICE
- E1.4 SECOND FLOOR, POWER & SYSTEMS PLAN, LAN ROOM LAYOUTS
- E2.1 PANEL SCHEMATICS
- E3.1 SECOND FLOOR SECURITY DETAILS

END OF SECTION

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises of updating 110m2 office space, providing electrical/mechanical updates, creation of an LAN room, and associated cable tray work. The project site is located in Regina, Saskatchewan and further identified as “LAN and Office Renovation, Regina, SK”.

1.2 WORK SEQUENCE

- .1 The General Contractor will be responsible for the coordination of all work.
- .2 Work to be scheduled to ensure Lan Room is completed in coordination with work defined in suite 209.01.

1.3 CONTRACTOR USE OF PREMISES

- .1 Coordinate use of premises under direction of Departmental Representative.
- .2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .3 Cooperate with other contractors employed by the Departmental Representative for other work within the building.

1.4 EXISTING SERVICES

- .1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. 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 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.
- .4 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.
- .5 Provide temporary services when directed by Departmental Representative to maintain critical building and tenant systems.
- .6 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .7 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

- .8 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .9 Record locations of maintained, re-routed, and abandoned service lines.
- .10 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

END OF SECTION

Part 1 General

1.1 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Normal hours of operation are between 07:00 – 17:00, Monday to Friday.
- .3 Noise generating activities and access to the occupied spaces are to be conducted outside of normal hours of operation.

1.2 EXISTING SERVICES AND BUILDING SYSTEMS

- .1 Notify, Departmental Representative of intended interruption of services or building mechanical or electrical systems, and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services or disruption to electrical or mechanical systems, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimal.
- .3 Carry out interruptions after normal working hours of occupants.

1.3 SPECIAL REQUIREMENTS

- .1 Submit schedule in accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Chart.
- .2 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .3 Keep within limits of work and avenues of ingress and egress.

1.4 SECURITY CLEARANCES

- .1 Contractor personnel must submit to local law enforcement verification by RCMP, prior to admittance to the facility site. The Client reserves the right to deny access to any facility / site or part thereof to any Contractor personnel, at any time.
- .2 All access to the building is to be through a designated entrance. Personnel will be signed in daily at start of work shift and provided with pass, which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.
- .3 Security documents are attached at the end of the Section.

1.5 SECURITY ESCORT

- .1 Personnel employed on this project must be escorted when executing work at all times.

1.6 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions. No smoking will be allowed in or around the building. Smoking is allowed only in areas indicated by Departmental Representative.
- .2 Turn off vehicles when they are parked next to building.

1.7 OCCUPIED SPACES

- .1 Coordinate the work to with the occupancy schedule, which will be provided by the Departmental Representative. The building will be occupied during construction. Schedule work outside of the occupancy schedule within the identified occupied spaces.

- .2 Work in all operational areas will be completed from 17:00hrs – 02:00hrs Monday to Friday. Work located in mechanical room areas can be completed between 07:00hrs – 17:00 hrs, this includes room 200.20 where the new LAN room 200.33 is located. Note, for this purpose the mechanical rooms will not be considered as operational areas.

END OF SECTION

RCMP Clearance Requirements (Law Enforcement Checks)

- .1 All personnel employed on this project will be subject to at a minimum, the RCMP Facilities Access Level 2 clearance requirements by the RCMP. The personnel to complete form 330-23 and submit completed form to Asset Management. Refer to attached form 330-23.
- .2 Prior to the commencement of the on-site activities, all personnel engaged in the execution of the work on the exterior or interior of an RCMP occupied and/or unoccupied building or outside on the grounds, shall have at a minimum, the requisite RCMP Facilities Access Level 2 clearance.
- .3 Immediately upon award of the contract, the Contractor shall prepare and submit the attached requisite forms, provided by the Departmental Representative (or failing that the RCMP Project Manager), for each Contractor employee and sub-contractor employee to be engaged in the work on the exterior or interior of an occupied and/or unoccupied building or outside on the grounds. In addition, Contractor's employees and sub-contractor employees must include with their requisite forms, government issued documents (driver's license/photo identification and birth certificate), for each Contractor employee and sub-contractor employee engaged in the work at the RCMP as noted above.

To eliminate delays in the clearance process, all clearance documents completed by the Contractor's employees and sub-contractor employees must be reviewed by the Contractor to ensure that all requested information has been provided, prior to submitting documents to the RCMP. Incomplete forms will be returned to the Contractor.

The Contractor's employees and sub-contractor employees shall only mobilize on site, once the requisite RCMP clearance has been granted.

- .4 The Contractor should batch the fully completed submissions, based on priority work on site and allow for a minimum twenty (20) working days processing time in the project schedule for the review to occur (from the date the completed documents are received by the RCMP). The inability to submit the fully completed requisite forms and documents will not be reason for an extension to the project schedule or additional compensation.
- .5 The Contractor's employees and subcontractor employees must be escorted at all times by a designate of the RCMP. This designate will be at no cost to the Contractor.



PERSONNEL SCREENING, CONSENT AND AUTHORIZATION FORM

OFFICE USE ONLY		
Reference number	Department/Organization number	File number

NOTE: For Privacy Act Statement refer to Section C of this form and for completion instructions refer to attached instructions. Please typewrite or print in block letters.

A ADMINISTRATIVE INFORMATION (To be completed by the Authorized Departmental/Agency/Organizational Official)

New
 Update
 Upgrade
 Transfer
 Supplemental
 Re-activation

The requested level of reliability/security check(s)

Reliability Status
 Level I (CONFIDENTIAL)
 Level II (SECRET)
 Level III (TOP SECRET)

Other _____

PARTICULARS OF APPOINTMENT/ASSIGNMENT/CONTRACT

Indeterminate
 Term
 Contract
 Industry
 Other (specify secondment, assignment, etc.) _____

Justification for security screening requirement

Position/Competition/Contract number	Title	Group/Level (Rank if applicable)	
Employee ID number/PRI/Rank and Service number (if applicable)	If term or contract, indicate duration period	From	To
Name and address of department / organization / agency	Name of official	Telephone number ()	Facsimile number ()

B BIOGRAPHICAL INFORMATION (To be completed by the applicant)

Surname (Last name) _____ Full given names (no initials) underline or circle usual name used _____ Family name at birth _____

All other names used (i.e. Nickname) _____

Sex: Male Female

Date of birth: Y | M | D Country of birth: _____ Date of entry into Canada if born outside Canada: Y | M | D

RESIDENCE (provide addresses for the last five years, starting with the most current)

Home address _____ Daytime telephone number () _____ E-mail address _____

1	Apartment number	Street number	Street name	Civic number (if applicable)	From Y M	To present
	City		Province or state	Postal code	Country	Telephone number ()

2	Apartment number	Street number	Street name	Civic number (if applicable)	From Y M	To Y M
	City		Province or state	Postal code	Country	Telephone number ()

Have you previously completed a Government of Canada security screening form? Yes No

If yes, give name of employer, level and year of screening. _____ Y

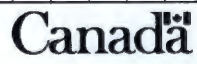
CRIMINAL CONVICTIONS IN AND OUTSIDE OF CANADA (see instructions)

Have you ever been convicted of a criminal offence for which you have not been granted a pardon? Yes No

If yes, give details. (charge(s), name of police force, city, province/state, country and date of conviction) _____

Charge(s)	Name of police force	City
-----------	----------------------	------

Province/State	Country	Date of conviction Y M D
----------------	---------	------------------------------





PERSONNEL SCREENING, CONSENT AND AUTHORIZATION FORM

Surname and full given names	Date of birth	Y	M	D
------------------------------	---------------	---	---	---

C CONSENT AND VERIFICATION (To be completed by the applicant and authorized Departmental/Agency/Organizational Official)

Checks Required (See Instructions)	Applicant's initials	Name of official (print)	Official's initials	Official's Telephone number
1. <input type="checkbox"/> Date of birth, address, education, professional qualifications, employment history, personal character references				()
2. <input type="checkbox"/> Criminal record check				()
3. <input type="checkbox"/> Credit check (financial assessment, including credit records check)				()
4. <input type="checkbox"/> Loyalty (security assessment only)				
5. <input type="checkbox"/> Other (specify, see instructions) *L.E.R.C.				()

The Privacy Act Statement
 The information on this form is required for the purpose of providing a security screening assessment. It is collected under the authority of subsection 7(1) of the *Financial Administration Act* and the *Government Security Policy (GSP)* of the Government of Canada, and is protected by the provisions of the *Privacy Act* in institutions that are covered by the *Privacy Act*. Its collection is mandatory. A refusal to provide information will lead to a review of whether the person is eligible to hold the position or perform the contract that is associated with this Personnel Screening Request. Depending on the level of security screening required, the information collected by the government institution may be disclosed to the Royal Canadian Mounted Police (RCMP) and the Canadian Security Intelligence Service (CSIS), which conduct the requisite checks and/or investigation in accordance with the GSP and to entities outside the federal government (e.g. credit bureaus). It is used to support decisions on individuals working or applying to work through appointment, assignment or contract, transfers or promotions. It may also be used in the context of updating, or reviewing for cause, the reliability status, security clearance or site access, all of which may lead to a re-assessment of the applicable type of security screening. Information collected by the government institution, and information gathered from the requisite checks and/or investigation, may be used to support decisions, which may lead to discipline and/or termination of employment or contractual agreements. The personal information collected is described in Standard PIB PSU 917 (Personnel Security Screening) which is used by all government agencies, except the Department of National Defence PIB DND/PPE 834 (Personnel Security Investigation File), RCMP PIB CMP PPU 065 (Security/Reliability Screening Records), CSIS PIB SIS PPE 815 (Employee Security), and PWGSC PIB PWGSC PPU 015 (Personnel Clearance and Reliability Records) used for Canadian Industry Personnel. Personal information related to security assessments is also described in the CSIS PIB SIS PPU 005 (Security Assessments/Advice).

I, the undersigned, do consent to the disclosure of the preceding information including my photograph for its subsequent verification and/or use in an investigation for the purpose of providing a security screening assessment. By consenting to the above, I acknowledge that the verification and/or use in an investigation of the preceding information may also occur when the reliability status, security clearance or site access are updated or otherwise reviewed for cause under the Government Security Policy. My consent will remain valid until I no longer require a reliability status, a security clearance or a site access clearance, my employment or contract is terminated, or until I otherwise revoke my consent, in writing, to the authorized security official.

*Law Enforcement Record Checks.

 Signature Date (Y/M/D)

D REVIEW (To be completed by the authorized Departmental/Agency/Organizational Official responsible for ensuring the completion of sections A, B and C)

Name and title	Telephone number
Address	Facsimile number

E APPROVAL (To be completed by authorized Departmental/Agency/Organizational Security Official only)

I, the undersigned, as the authorized security official, do hereby approve the following level of screening.

Reliability Status

Approved Reliability Status Not approved

 Name and title

 Signature Date (Y/M/D)

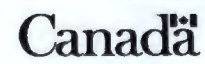
Security Clearance (if applicable)

Level I Level II Level III Not recommended

 Name and title

 Signature Date (Y/M/D)

Comments





INSTRUCTIONS FOR PERSONNEL SCREENING CONSENT AND AUTHORIZATION FORM TBS/SCT 330-23E (Rev. 2002/02)

Once completed, this form shall be safeguarded and handled at the level of Protected A.

General:

If space allotted in any portion is insufficient please use separate sheet using same format.

1. Section A (Administrative Information) Authorized Departmental/Agency/Organizational Official

The Official, based on instructions issued by the Departmental Security Officer, may be responsible for determining, based on five year background history, what constitutes sufficient verification of personal data, educational and professional qualifications, and employment history. References are to be limited to those provided on the application for employment or equivalent forms.

SUPPLEMENTAL INFORMATION REQUIREMENTS

Persons who presently hold a SECURITY CLEARANCE and subsequently marry, remarry or commence a common-law partnership, in addition to having to update sections of the *Security Clearance Form (TBS/SCT 330-60)*, are required to submit an original *Personnel Screening, Consent and Authorization Form*, with the following parts completed:

Part A - As set forth in each question

Part B - As set forth in each question, excluding CRIMINAL CONVICTIONS IN AND OUTSIDE OF CANADA.

Part C - Applicant's signature and date only are required

"Other". This should be used to identify if the security screening is for Site Access, NATO, SIGINT etc.

2. Section B (Biographical Information)

To be completed by the **applicant**. If more space is required use a separate sheet of paper. Each sheet must be signed.

Country of Birth - For "NEW" requests, if born abroad of Canadian parents, please provide a copy of your Certificate of Registration of Birth Abroad. If you arrived in Canada less than five years ago, provide a copy of the Immigration Visa, Record of Landing document or a copy of passport.

- List only criminal convictions for which a pardon has NOT been granted. Include on a separate attached sheet of paper, if more than one conviction. Applicant must include those convictions outside Canada.
- Offences under the *National Defence Act* are to be included as well as convictions by courts-martial are to be recorded.

3. Section C (Consent and Verification)

A copy of Section "C" may be released to institutions to provide acknowledgement of consent.

Criminal record checks (fingerprints may be required) and credit checks are to be arranged through the Departmental Security Office or the delegated Officer.

Consent: may be given only by an applicant who has reached the age of majority, otherwise, the signature of a parent or guardian is mandatory.

The age of majority is:

19 years in NFLD., N.S., N.B., B.C., Yukon, Northwest Territories and Nunavut;

18 years in P.E.I., Que., Ont., Man., Sask. and Alta.

The applicant will provide initials in the "applicant's initials box".

The official who carried out the verification of the information will print their name, insert their initials and telephone number in the required space.

- Reliability Screening (for all types of screening identified within Section A): complete numbers 1 and 2 and 3 if applicable.
- Security Clearance (for all types of screening identified within Section A): complete numbers 1 to 4 and 5 where applicable.
- Other: number 5 is used only where prior Treasury Board of Canada Secretariat approval has been obtained.

4. Section D (Review)

To be completed by authorized Departmental/Agency/Organizational Official who is responsible for ensuring the completion of sections A to C as requested.

5. Section E (Approval)

Authorized Departmental/Agency/Organizational Security Official refers to the individuals as determined by departments, agencies, and organizations that may verify reliability information and/or approve/not approve reliability status and/or security clearances. Approved Reliability Status and Level I, II and III, as well as the signature of the authorized security official or manager are added for Government of Canada use only. Applicants are to be briefed, acknowledge, and be provided with a copy of the "Security Screening Certificate and Briefing Form (TBS/SCT 330-47)".

Note: Private sector organizations do not have the authority to approve any level of security screening.

Photographs: Departments/Agencies/Organizations are responsible for ensuring that three colour photographs of passport size are attached to the form for the investigating agency. Maximum dimensions are 50mm x 70mm and minimum are 43mm x 54mm. The face length from chin to crown of head must be between 25mm x 35mm. The photographs must be signed by the applicant and an authorized security official. The photographs must have been taken within the last six months. It is required for new or upgrade Level III security clearances for identification of the applicant during the security screening investigation by the investigating agency. The investigating agency may in specific incidents request a photograph for a Level I or II clearances when an investigation is required.

Part 1 General

1.1 ADMINISTRATIVE

- .1 Project meetings will be scheduled throughout the progress of the work and at the call of Departmental Representative.
- .2 Provide physical space and make arrangements for meetings.
- .3 The Consultant shall chair meetings.
- .4 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Within 10 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work: in accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Chart.
 - .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .4 Requirements for temporary facilities, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
 - .5 Delivery schedule of specified equipment.
 - .6 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .8 Owner provided products and work.
 - .9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .10 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
 - .11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
 - .12 Monthly progress claims, administrative procedures, photographs, hold backs.
 - .13 Appointment of inspection and testing agencies or firms.
 - .14 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

- .1 During course of Work, progress meetings will be held on a regular basis. Schedule to be determined.

- .2 Contractor, major Subcontractors involved in Work, Departmental Representative, Consultant and Owner's representatives are to be in attendance.
- .3 Minutes of meetings will be recorded by the Consultant. Minutes will be distributed within 3 working days.
- .4 Agenda for project meetings 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 to determine how these will affect the construction schedule and on completion date.
 - .12 Other business.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

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

1.2 REQUIREMENTS

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

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative within 7 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Provide schedule in PDF format in sized so that description of work can be clearly read when printed out.

1.4 PROJECT MILESTONES

- .1 Project milestones form interim targets for Project Schedule.
 - .1 Project milestone will be identified through discussion with the Contractor and Departmental Representative at the outset of the project.

1.5 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule on a monthly basis reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.6 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

1.1 ADMINISTRATIVE

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Submit where required in the specifications, shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Saskatchewan, 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 7 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 6 copies of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
 - .11 Submit 6 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 6 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 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 6 copies of manufacturer's 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 6 copies of manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .16 Submit 6 copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .17 Delete information not applicable to project.
- .18 Supplement standard information to provide details applicable to project.
- .19 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .20 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of Work of sub-trades.

- .21 Electronic submission of Shop Drawings
 - .1 Electronic Shop Drawings (PDF format) shall not exceed 11x17 actual size. Electronic transfer of shop drawings relies on Architect and Engineering Consultants to print a record copy for their files - this can be done providing shop drawings do not exceed 11x17. Larger shop drawings would require hard copies for review.
 - .2 General Contractor to review shop drawing and place their electronic stamp signifying review.
 - .3 General Contractor to email all shop drawings to Architect with copy to Engineering Consultant as applicable.
 - .4 Engineering Consultant to review and place their electronic stamp / marks up, then email to Architect only (Engineering Consultant will not copy anyone else).
 - .5 Architect to check for coordination and transmit reviewed shop drawings by email to General Contractor.

1.3 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.

1.4 MOCK-UPS

- .1 Erect mock-ups in accordance with 01 45 00 - Quality Control and as specified in each applicable Section.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Province of Saskatchewan
 - .1 Occupational Health and Safety Act, 1993, S.S. 2005.

1.2 SUBMITTALS

- .1 Make submittals 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 1 copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Requirements and Section 02 81 01 - Hazardous Materials.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 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.
- .8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.
- .10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.3 FILING OF NOTICE

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

1.4 SAFETY ASSESSMENT

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

1.5 MEETINGS

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

1.6 REGULATORY REQUIREMENTS

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

1.7 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.8 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.9 COMPLIANCE REQUIREMENTS

- .1 Comply with Occupational Health and Safety Regulations, 1996.
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 HAZARDOUS MATERIALS

- .1 Where the contractor is in doubt or suspicious material is encountered, stop work and advise the Departmental Representative immediately.

1.11 UNFORSEEN HAZARDS

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

1.12 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 site-related working experience specific to activities associated with overhead work.
 - .2 Have working knowledge of occupational safety and health regulations.
 - .3 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.
 - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
 - .5 Be on site during execution of Work.

1.13 POSTING OF DOCUMENTS

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

1.14 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.15 BLASTING

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

1.16 POWDER ACTUATED DEVICES

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

1.17 WORK STOPPAGE

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

END OF SECTION

Part 1 General

1.1 REFERENCES AND CODES

- .1 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

- .1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Departmental Representative.
- .2 Note requirements in Contract Documents for removal or known asbestos containing materials. Notify Departmental Representative is suspicious material is encountered elsewhere within this work.

1.3 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions and municipal by-laws.
- .2 Smoking on site is restricted to within personal vehicles or designated smoking locations.

END OF SECTION

Part 1 General

1.1 INSPECTION

- .1 Allow Departmental Representative and Consultant 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 Consultant, instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.2 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.3 PROCEDURES

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

1.4 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.

- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, 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.

1.5 REPORTS

- .1 Submit two (2) copies of inspection and test reports to Departmental Representative.
- .2 Provide copies to subcontractor of work being inspected or tested.

1.6 TESTS AND MIX DESIGNS

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

1.7 MOCK-UPS

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
- .2 Construct in locations acceptable to Departmental Representative and as specified in specific Section.
- .3 Prepare mock-ups for Departmental Representative and Consultant's review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 If requested, Departmental Representative will assist in preparing schedule fixing dates for preparation.
- .6 Mock-ups may remain as part of Work.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

1.2 INSTALLATION AND REMOVAL

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

1.3 WATER SUPPLY

- .1 Departmental Representative will make available a continuous supply of potable water for construction use.

1.4 TEMPORARY HEATING AND VENTILATION

- .1 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.
- .2 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 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .3 Permanent heating system of building, to be used when available. Be responsible for damage to heating system if use is permitted.
- .4 On completion of Work for which permanent heating system is used, provide service maintenance to system at discretion of the Departmental Representative.
- .5 Pay costs for maintaining temporary heat, when not using permanent heating system. Owner will pay utility charges when temporary heat source is existing building equipment.
- .6 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.

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

1.5 TEMPORARY POWER AND LIGHT

- .1 Provide and maintain temporary lighting throughout project. Existing lighting and power systems may be utilized.

1.6 TEMPORARY COMMUNICATION FACILITIES

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

1.7 FIRE PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-S269.2-M1987(R2003), Access Scaffolding for Construction Purposes.

1.2 SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas which have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

1.4 SCAFFOLDING

- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, and temporary stairs.

1.5 HOISTING

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

1.6 ELEVATORS

- .1 Designated existing elevator to be used by construction personnel for transporting of materials only. Co-ordinate use with Departmental Representative.
- .2 Provide protective coverings for finish surfaces of cars and entrances.

1.7 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.

1.8 CONSTRUCTION PARKING

- .1 Parking will be permitted on site but may be limited. Parking arrangements will be provided by the Departmental Representative at project start up.
- .2 Provide and maintain adequate access to project site.

1.9 OFFICES

- .1 Provide and maintain, during the entire progress of the Work, a suitable office on the site, for own use, with suitable tables or benches for the examination of drawings, specifications, etc., and where all notices and instructions from the Consultant may be received and acknowledged. Provide suitable meeting space for site meetings. Provide adequate heating, ventilating and lighting. Location of these offices to be coordinated with the Departmental Representative.
- .2 Provide marked and fully stocked first-aid case in a readily available location.

1.10 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.

1.11 SANITARY FACILITIES

- .1 One female washroom and one male washroom will be designated on site, for Contractor's use during this project. Final location to be coordinated and confirmed with the Departmental Representative.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.
- .3 Contractor shall be responsible for cleaning and maintenance of designated facilities.

1.12 CONSTRUCTION SIGNAGE

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

1.13 PROTECTION AND MAINTENANCE OF TRAFFIC AND PEDESTRIANS

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

- .3 Protect travelling public from damage to person and property.
- .4 Do not disrupt training on site around building.
- .5 Do not block roads without obtaining approval to do so from the Departmental Representative.
- .6 Contractor's traffic on roads selected for hauling material shall not interfere with on-going training on site.
- .7 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
- .8 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

1.14 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 on an on-going basis.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

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

1.2 GUARD RAILS, BARRICADES, AND SIGNAGE

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.
- .2 Provide Construction Zone warning and access control signage.

1.3 WEATHER ENCLOSURES

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

1.4 DUST TIGHT SCREENS

- .1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- .2 Maintain and relocate protection until such work is complete.
- .3 Maintain negative pressure in area of dust generating work. Exhaust directly to the exterior.

1.5 ACCESS TO SITE

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

1.6 PUBLIC TRAFFIC FLOW

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

1.7 FIRE ROUTES

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

1.8 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

1.9 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

1.10 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

Part 1 General

1.1 REFERENCES

- .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 Owner in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY

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

1.3 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber, steel members, doors and frames on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.4 TRANSPORTATION

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

1.5 MANUFACTURER'S INSTRUCTIONS

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

1.6 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.7 CO-ORDINATION

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

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

1.8 CONCEALMENT

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

1.9 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.10 LOCATION OF FIXTURES

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

1.11 FASTENINGS

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

1.12 FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.

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

1.13 PROTECTION OF WORK IN PROGRESS

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

1.14 EXISTING UTILITIES

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

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

1.2 FORMS

- .1 Special forms required during the course of this Work may include the following. Forms will be supplied by the Departmental Representative.
 - .1 Hot work.
 - .2 Confined space entry.
 - .3 Site steam protocol.
 - .4 Ground disturbance.

1.3 MATERIALS

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

1.4 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.

1.5 EXECUTION

- .1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping or firestopping sealant material using UL or ULC rated assembly in accordance with manufacturer's instructions.
- .12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

END OF SECTION

1.1 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times. Do not burn waste materials on site.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Provide on-site containers for collection of waste materials and debris.
- .5 Dispose of waste materials and debris off site.
- .6 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 FINAL CLEANING

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy. Remove debris and surplus materials from accessible concealed spaces.
- .3 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .4 Vacuum carpet in renovated areas and where construction traffic occurs. If heavily soiled carpeting shall be commercially steam cleaned. This will be at the discretion of the Departmental Representative.
- .5 Clean and wax areas of resilient sheet and tile flooring in renovated areas, where required by specification section.
- .6 Dust all horizontal surfaces, clean all glass and wipe down walls in renovated areas.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .2 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .3 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .4 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.
- .5 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.
- .6 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .7 Separate Condition: refers to waste sorted into individual types.
- .8 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.
- .9 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.
- .10 Waste Management Co-ordinator (WMC) : contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .11 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (Schedule A).

1.2 SUBMITTALS

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

1.3 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare WRW prior to project start-up.
- .2 WRW should include but not limited to:
 - .1 Destination of materials listed.
 - .2 Deconstruction/disassembly techniques and sequencing.
 - .3 Schedule for deconstruction/disassembly.
 - .4 Location.
 - .5 Security.
 - .6 Protection.
 - .7 Clear labelling of storage areas.
 - .8 Details on materials handling and removal procedures.
- .3 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .4 Describe management of waste.
- .5 Identify opportunities for reduction, reuse, and recycling of materials.
- .6 Post WRW or summary where workers at site are able to review content.
- .7 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.
- .8 Monitor and report on waste reduction.

1.4 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

- .1 Prepare MSSP and have ready for use prior to project start-up.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.
- .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide containers to deposit reusable and recyclable materials.
- .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .6 Locate separated materials in areas which minimize material damage.
- .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
 - .1 Transport to users of material for recycling.
- .8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition.

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

1.5 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .2 Protect surface drainage, mechanical and electrical from damage and blockage.
- .3 Separate and store materials produced during dismantling of structures in designated areas.
- .4 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off-site processing facility for separation.
 - .3 Provide waybills for separated materials.

1.6 DISPOSAL OF WASTES

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

1.7 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Maintain security measures established by existing facility and where required provide temporary security measures approved by Departmental Representative.

1.8 SCHEDULING

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

Part 2 Execution

2.1 APPLICATION

- .1 Do Work in compliance with WRW.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

2.2 CLEANING

- .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.

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

END OF SECTION

Part 1 General

1.1 INSPECTION AND DECLARATION

- .1 Contractor's Inspection: Contractor and Subcontractors: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Departmental Representative Inspection.
- .2 Departmental Representative Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.
- .3 Completion: submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
 - .4 Certificates required by Fire Commissioner and Utility companies have been submitted.
 - .5 Operation of systems have been demonstrated to Owner's personnel.
 - .6 Work is complete and ready for final inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative, Consultants and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.
- .5 Where re-inspection is required due to uncompleted deficiencies, the time required by the Departmental Representative and Consultants will be recorded and reimbursement of this time may be charges back to the Contractor by deducting from amounts retained.

1.2 CLEANING

- .1 In accordance with Section 01 74 11 - Cleaning.
- .2 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .3 Copy will be returned after final inspection, with Departmental Representative's comments.
- .4 Revise content of documents as required prior to final submittal.
- .5 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of operating and maintenance manuals in English.
- .6 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .7 Furnish evidence, if requested, for type, source and quality of products provided.
- .8 Defective products will be rejected, regardless of previous inspections. Replace products at Contractor's own expense.
- .9 Pay costs of transportation.

1.2 FORMAT

- .1 Organize data as instructional manual.
- .2 Provide four (4) DVD or CD copies in PDF format.
- .3 When multiple disks are used, correlate data into related groupings. Identify contents of each label of each disk.
- .4 Cover: identify each disk with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Provide printed title on DVD/CD.
- .6 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .7 Provide cover page for each separate product and system, with typed description of product and major component parts of equipment.
- .8 Text: manufacturer's printed data, or typewritten data.
- .9 Drawings: Provide pdf scan of each.

1.3 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
 - .3 Schedule of products and systems, indexed to content of volume.
 - .4 Provide page numbers of each Division.
- .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 Shop Drawings: illustrating details of a portion of work.
- .4 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .5 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .6 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

1.4 AS-BUILTS 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. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

1.5 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of opaque drawings, provided by Departmental Representative.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: 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 References 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, and field test records, required by individual specifications sections.

1.6 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.

- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control.
- .15 Additional requirements: as specified in individual specification sections.

1.7 MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-Protection and Weather-Exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specifications sections.

1.8 SPARE PARTS

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

1.9 MAINTENANCE MATERIALS

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

- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.10 SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.11 STORAGE, HANDLING AND PROTECTION

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

1.12 WARRANTIES AND BONDS

- .1 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
- .2 Assemble approved information in binder and submit upon acceptance of work. 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.

- .3 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.
- .4 Respond in a timely manner to oral or written notification of required construction warranty repair work.
- .5 Written verification will follow oral instructions. Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.13 PRE-WARRANTY CONFERENCE

- .1 Meet with Departmental Representative, to develop understanding of requirements of this section. Schedule meeting prior to contract completion, and at time designated by Departmental Representative.
- .2 Departmental Representative will establish communication procedures for:
 - .1 Notification of construction warranty defects.
 - .2 Determine priorities for type of defect.
 - .3 Determine reasonable time for response.
- .3 Provide name, telephone number and address of licensed and bonded company that is authorized to initiate and pursue construction warranty work action.
- .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C553-11, Standard Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .2 ASTM C1320-10, Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S702-09, Standard for Thermal Insulation, Mineral Fibre for Buildings.
 - .2 CAN/ULC-S102.2, Standard Method of Test for Surface Burning Characteristics of Building Materials and assemblies.

1.2 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

Part 2 Products

2.1 INSULATION

- .1 Batt and blanket mineral fibre: CAN/ULC S702, Type 1
 - .1 Non-combustible: to CAN/ULC S114.

- .1 Flame spread: 0 to 10
- .2 Smoke developed: 0 to 10
- .2 Thickness: as indicated on drawings and to suit partition framing (fill cavity).
- .3 Zero formaldehyde content.
- .4 Acoustical performance:
 - .1 Airborne sound transmission loss: To ASTM E90
 - .2 Rating sound insulation: To ASTM E413
 - .3 Sound absorption co-efficients: To ASTM E423 (NRC 1.10 for 102mm thickness)
- .5 Density: To ASTM C612, 45 kg/m³

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSULATION INSTALLATION

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C1320.
- .2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .3 Do not compress insulation to fit into spaces.
- .4 Fill cavity to full depth for partitions and floor assemblies.
- .5 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 Type A chimneys and CSA-B149.1 and CSA-B149.2 Type B and L vents.

3.3 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC-S115-05, Fire Tests of Fire stop Systems.

1.2 DEFINITIONS

- .1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.
- .4 Tightly Fitted; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): penetrating items that are cast in place in buildings of non-combustible construction or have "0" annular space in buildings of combustible construction.
 - .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
- .3 Shop Drawings:
 - .1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.
 - .2 Construction details should accurately reflect actual job conditions.
- .4 Samples:
 - .1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.

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

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company specializing in fire stopping installations with 5 years' experience.
- .2 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 Upon completion of Work, after cleaning is carried out.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, and ULC markings.
- .2 Storage and Protection:
 - .1 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended

- .2 Fire stop system rating: as indicated on drawings.
- .2 Re-penetrable fire rated cable pathway system for power and communication cables.
 - .1 Square profile, heavy guage galvanized steel with intumescent material for rapid expansion.
 - .2 Wall and floor applications.
 - .3 Accessories including manufactured multi-gang plates, brackets, extensions and multi-slot frames.
 - .4 Minimum fire rating of 4 hours.
 - .5 Approved systems:
 - .1 ETI EZ Path 44+ fire rated pathway system complete with all accessories
- .3 Service penetration assemblies: systems tested to CAN-ULC-S115.
- .4 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.
- .5 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .6 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .7 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .8 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .9 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .10 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .11 Sealants for vertical joints: non-sagging.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
 - .1 Ensure that substrates and surfaces are clean, dry and frost free.

- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation [without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

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

3.4 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 Designed for re-entry, removable at: cable trays, electrical and communication rooms. Refer to Architectural & electrical drawings for locations and numbers of fire stopping systems.

3.5 SEQUENCES OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by Departmental Representative.
- .2 Install floor fire stopping before interior partition erections.
- .3 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.

3.6 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.

3.7 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.8 SCHEDULE

- .1 Fire stop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Top of fire-resistance rated masonry and gypsum board partitions.
 - .3 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .6 Openings and sleeves installed for future use through fire separations.
 - .7 Around mechanical and electrical assemblies penetrating fire separations.
 - .8 Rigid ducts: greater than 129 cm² : fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C919-12, Standard Practice for Use of Sealants in Acoustical Applications.
 - .2 ASTM E814-13, Standard Test Method for Fire Tests of Penetration Firestop Systems.
 - .3 ASTM E1966-07(2011), Standard Test Method for Fire-Resistive Joint Systems.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
 - .2 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
 - .3 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.2 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .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 manufacturer's instructions in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Instructions to include installation instructions for each product used.

1.3 QUALITY ASSURANCE/MOCK-UP

- .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
- .2 Construct mock-up to show location, size, shape and depth of joints complete with back-up material, primer, caulking and sealant.
- .3 Mock-up will be used:

- .1 To judge workmanship, substrate preparation, operation of equipment and material application.
- .4 Locate where directed.
- .5 Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with sealant work.
- .6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work. Approved mock-up may remain as part of finished Work.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .5 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .6 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Departmental Representative.
- .7 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

1.6 PROJECT CONDITIONS

- .1 Environmental Limitations:
 - .1 Do not proceed with installation of joint sealants under following conditions:
 - .1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.
 - .2 When joint substrates are wet.
- .2 Joint-Width Conditions:
 - .1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

- .3 Joint-Substrate Conditions:
 - .1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.
- .2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .3 Ventilate area of by use of approved portable supply and exhaust fans approved by Departmental Representative.

Part 2 Products

2.1 SEALANT MATERIALS

- .1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.
- .3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Type 1 - Urethanes Two Part.
 - .1 Non-Sag to CAN/CGSB-19.24, Type 2, Class B, colour as selected by Departmental Representative from manufacturer's standard range.
- .2 Type 2 - Urethanes One Part.
 - .1 Non-Sag to CAN/CGSB-19.13, Type 2, MCG-2-25 or MCG-2-40, colour as selected by Departmental Representative from manufacturer's standard range.
- .3 Type 3 - Silicones One Part.
 - .1 To CAN/CGSB-19.13.
 - .2 Mildew resistant: for use in interior areas where water may contact sealant.
- .4 Type 4 - Acrylic Latex One Part.
 - .1 To CAN/CGSB-19.17.
- .5 Type 5 - Acoustical Sealant.
 - .1 To ASTM C919.

.6 Type 6 – Acoustical Sealant and Firestopping.

- .1 To ASTM E-814 and ASTM E-1966.
- .2 Acceptable material: Metacaulk MC-150+.

2.3 PREFORMED COMPRESSIBLE AND NON-COMPRESSIBLE BACK-UP MATERIALS.

- .1 Polyethylene, Urethane, Neoprene or Vinyl Foam.
 - .1 Extruded closed cell foam backer rod.
 - .2 Size: oversize 30 to 50 %.
- .2 Neoprene or Butyl Rubber.
 - .1 Round solid rod, Shore A hardness 70.
- .3 High Density Foam.
 - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
- .4 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape which will not bond to sealant.

2.4 SEALANT SELECTION

- .1 Perimeters of exterior openings where frames meet exterior facade of building (i.e. brick, block, precast masonry): Sealant type: 1 or 2.
- .2 Control and expansion joints in exterior surfaces of unit masonry and stone veneer walls: Sealant type: 1 or 2.
- .3 Seal interior perimeters of exterior openings as detailed on drawings: Sealant type: 4.
- .4 Control and expansion joints on the interior of exterior surfaces of unit masonry walls: Sealant type: 1 or 2.
- .5 Perimeters of interior frames, as detailed and itemized: Sealant type: 4.
- .6 Exposed interior control joints in drywall: Sealant type: 4
- .7 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, water closets, basins, vanities): Sealant type: 3.
- .8 Perimeter of countertop edges: Sealant type: 3 (translucent)
- .9 Acoustic seal for sound rated walls: Sealant type: 5
- .10 Acoustic seal and firestopping: Sealant type: 6
- .11 In additional locations as noted on the drawings: confirm with Departmental Representative.

2.5 JOINT CLEANER

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

- .2 Primer: as recommended by manufacturer.

Part 3 Execution

3.1 PROTECTION

- .1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

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

3.6 APPLICATION

- .1 Sealant.
 - .1 Apply sealant in accordance with manufacturer's written instructions.
 - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
 - .3 Apply sealant in continuous beads.
 - .4 Apply sealant using gun with proper size nozzle.

- .5 Use sufficient pressure to fill voids and joints solid.
- .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .8 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing.
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.
- .3 Cleanup.
 - .1 Clean adjacent surfaces immediately and leave Work neat and clean.
 - .2 Remove excess and droppings, using recommended cleaners as work progresses.
 - .3 Remove masking tape after initial set of sealant.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A653/A653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM C591-13, Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
 - .3 ASTM C1289-13e1, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door Manufacturers' Association (CSDMA)
 - .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.
 - .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 2009.
- .5 National Fire Protection Association (NFPA)
 - .1 NFPA 80-2013, Standard for Fire Doors and Fire Windows.
 - .2 NFPA 252-2013, Standard Methods of Fire Tests of Door Assemblies.
- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC S104-10, Standard Method for Fire Tests of Door Assemblies.

1.2 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.
 - .2 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC S104 for ratings specified or indicated.
 - .3 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC S104, ASTM E152 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

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

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 MATERIALS

- .1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

2.2 DOOR CORE MATERIALS

- .1 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 Insulated core:
 - .1 Polyisocyanurate: Rigid, modified polyisocyanurate, closed cell board. Density; 32 kg/m³ (2.0 pcf) minimum, thermal values; RSI 1.9 (R 11.0) minimum, in accordance with ASTM C591 (un-faced) or C 1289 (faced).
- .3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door. Core to be tested as part of a complete door assembly, in accordance with CAN/ULC S104, ASTM E152 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

2.3 ADHESIVES

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
 - .1 Adhesive: maximum VOC content 50 g/L.
- .2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

2.4 PRIMER

- .1 Touch-up prime CAN/CGSB-1.181.
 - .1 Maximum VOC limit 50 g/L.

2.5 PAINT

- .1 Field paint steel doors and frames in accordance with Section 09 91 23 - Interior Painting. Protect weatherstripping from paint. Provide final finish free of scratches or other blemishes.

2.6 ACCESSORIES

- .1 Door silencers: single stud rubber/neoprene type.
- .2 Exterior and interior top and bottom caps: steel.
- .3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
- .4 Metallic paste filler: to manufacturer's standard.
- .5 Fire labels: metal riveted.
- .6 Sealant: in accordance with Section 07 92 00 – Joint Sealants.
 - .1 Maximum VOC limit 250 g/L.
- .7 Glazing: in accordance with Section 08 80 50 - Glazing.
- .8 Make provisions for glazing as indicated and provide necessary glazing stops.
 - .1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screw.
 - .2 Design exterior glazing stops to be tamperproof.

2.7 FRAMES FABRICATION GENERAL

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Exterior frames: 1.6 mm welded, thermally broken type construction using rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19MA.
- .4 Interior frames: 1.6 mm welded type construction.

- .5 Strike bucket: accept a 25 mm throw dead bolt. Grout or wedge in the area of the strike bucket to prevent spreading.
- .6 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.
- .7 Protect mortised cutouts with steel guard boxes.
- .8 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .9 Manufacturer's nameplates on frames and screens are not permitted.
- .10 Conceal fastenings except where exposed fastenings are indicated.
- .11 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .12 Insulate exterior frame components with polyurethane insulation.
- .13 Prepare frames to receive electronic monitoring and security devices. Refer to Section 08 71 10 - Door Hardware and Section 08 90 10 - Door, Frame and Hardware Schedule. Coordinate frame preparation with Electrical Divisions 26 and 28.
- .14 Frames to be prepped to accommodate hardware.

2.8 FRAME ANCHORAGE

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.
- .4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 FRAMES: WELDED TYPE

- .1 Welding in accordance with CSA W59.
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
- .3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.
- .6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.10 DOOR FABRICATION GENERAL

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.
- .2 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .3 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.
- .4 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .5 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .6 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .7 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN/ULC S104, ASTM E152, or 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.
- .8 Manufacturer's nameplates on doors are not permitted.

2.11 DOORS: HONEYCOMB CORE CONSTRUCTION

- .1 Form face sheets for exterior doors from 1.6 mm sheet steel with honeycomb core laminated under pressure to face sheets.
- .2 Form face sheets for interior doors from 1.6 mm sheet steel with honeycomb core laminated under pressure to face sheets.

2.12 THERMALLY BROKEN DOORS AND FRAMES

- .1 Fabricate thermally broken doors by using polyisocyanurate 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 from interior parts with continuous interlocking thermal break.
- .4 Apply insulation.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION GENERAL

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Caulk perimeter of frames between frame and adjacent material.

- .6 Maintain continuity of air barrier and vapour retarder.

3.4 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latchside and head: 1.5 mm.
 - .3 Finished floor, top of carpet, and thresholds: 13 mm.
- .3 Adjust operable parts for correct function.
- .4 Install louvres.

3.5 FINISH REPAIRS

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.6 GLAZING

- .1 Install glazing for doors and frames in accordance with Section 08 80 50 - Glazing.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).
 - .1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-69.18-M90/ANSI/BHMA A156.1-1981, Butts and Hinges.
 - .2 CAN/CGSB-69.19-93/ANSI/BHMA A156.3-1989, Exit Devices.
 - .3 CAN/CGSB-69.20-M90/ANSI/BHMA A156.4-1986, Door Controls (Closers).
 - .4 CAN/CGSB-69.21-M90/ANSI/BHMA A156.5-1984, Auxiliary Locks and Associated Products.
 - .5 CAN/CGSB-69.22-M90/ANSI/BHMA A156.6-1986, Architectural Door Trim.
 - .6 CAN/CGSB-69.24-M90/ANSI/BHMA A156.8-1982, Door Controls - Overhead Holders.
 - .7 CAN/CGSB-69.26-96/ANSI/BHMA A156.10-1991, Power-operated Pedestrian Doors.
 - .8 CAN/CGSB-69.28-M90/ANSI/BHMA A156.12-1986, Interconnected Locks and Latches.
 - .9 CAN/CGSB-69.29-93/ANSI/BHMA A156.13-1987, Mortise Locks and Latches.
 - .10 CAN/CGSB-69.32-M90/ANSI/BHMA A156.16-1981, Auxiliary Hardware.
 - .11 CAN/CGSB-69.35-M89/ANSI/BHMA A156.19-1984, Power Assist and Low Energy Power Operated Doors.

1.2 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Hardware List:
 - .1 Submit contract hardware list in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .3 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .4 Closeout Submittals
 - .1 Provide operation and maintenance data for door closers, locksets, door holders electrified hardware and fire exit hardware for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 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 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, Shipping, Handling and Unloading:
 - .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .2 Storage and Protection:
 - .1 Store finishing hardware in locked, clean and dry area.

1.5 WASTE DISPOSAL AND MANAGEMENT

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Dispose of corrugated cardboard, polystyrene, plastic, and packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.6 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Supply two sets of wrenches for door closers, locksets, and fire exit hardware.

Part 2 Products

2.1 HARDWARE ITEMS

- .1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

- .1 Locks and latches:

- .1 Interconnected locks and latches: to CAN/CGSB-69.28, series 5000 interconnected lock, grade 1, designed for function and keyed as stated in Hardware Schedule.
- .2 Mortise locks and latches: to CAN/CGSB-69.29, series 1000 mortise lock, grade 1, designed for function as stated in Hardware Schedule.
- .3 Knobs: Sargent 'B' design.
- .4 Lever handles: Sargent 'L' design
- .5 Roses: Sargent 'L.'
- .6 Escutcheons : Sargent 'LE1.'
- .7 Normal strikes: box type, lip projection not beyond jamb.
- .8 Cylinders: Sargent 6 pin, LA keyway, 0 bitted; keying by Owner.
- .9 Finish: 10B.
- .10 Acceptable manufacturer: Sargent.
- .11 List of locksets:
 - a) ANSI F01; Sargent Model 8215-LE1L-10B (Passage)
 - b) ANSI F05; Sargent Model 8237-LE1L-10B (Classroom)
 - c) ANSI F07; Sargent Model 8204-LE1L-10B (Storeroom)
 - d) ANSI F04; Sargent Model 8205-LE1L-10B (Office)
 - e) ANSI F13; Sargent Model 8225-LE1L-10B (Exit)
 - f) ANSI F22; Sargent Model 8265-LE1L-10B (Privacy)
 - g) Sargent Model 8251-LE1L-10B (Storeroom Deadbolt)
 - h) ANSI F15; Sargent Model 8251-LE1L-10B
- .2 Butts and hinges:
 - .1 Butts and hinges: to CAN/CGSB-69.18, listed in Hardware Schedule.
 - .2 Hinges on selected doors to be "NRP" Type (non-removable-pin) as scheduled.
 - .3 List of hinges: Finish 10B.
 - a) FBB 168 114 x 114.
 - b) FBB 168 114 x 144 NRP.
 - .4 Acceptable manufacturers: Stanley, Hager, Monthard, McKimmey or approved alternate.
- .3 Door Closers and Accessories:
 - .1 Door controls (closers): to CAN/CGSB-69.20, size in accordance with CAN/CGSB-69.20, table A1, Finish 690.
 - .1 Grade 1, heavy duty, adjustable hydraulic back check, separate regulation of closing speed and latching speed, rack and pinion action.
 - .2 List of closers:
 - .1 LCN 4040 with delayed action function.
 - .3 Acceptable manufacturers: LCN, Sargent, Norton, Rixson or approved alternate.
- .4 Auxiliary locks and associated products: to CAN/CGSB-69.21, as listed in Hardware Schedule, finished to match existing.
- .5 Architectural door trim: to CAN/CGSB-69.22, as listed in Hardware Schedule, finish 10B.

- .1 Door protection plates: kick plate type, 1.27 mm thick stainless steel, bevelled edges, 300 mm high by 25 mm less than door width.
- .2 Push plates: 1.27 mm thick stainless steel, bevelled edges, 125 mm wide by 400 mm high.
- .3 Pulls: 19 mm diameter "D" style, projecting 35 mm from door, height 300 mm, without rose.
- .1 Latch guard: Heavy gauge formed steel plate cover to protect lock strike area, 300 mm high, through bolt mounting formed to suit mortised locksets with standard strikes.
- .2 Auxiliary hardware: to CAN/CGSB-69.32, as listed in Hardware Schedule and as listed below. Finish 10B.
 - .1 Door check chain: heavy duty compression springs, heavy duty welded steel chain, vinyl cover. 650 mm long.
 - .2 Wall stop: concave wall stop with concealed mounting, 62 mm diameter, 30 mm projection, cast brass with rubber bumper.
 - .1 Acceptable products: Hager 234 or Richelieu 2205.
 - .3 Floor stop: to ANSI A156.16, low dome stop, 45 mm diameter, 3.2 mm thick base, cast brass.
 - .1 Acceptable products: Hager 241, or Richelieu 218.
- .3 Thresholds:
 - a) 127 mm wide x full width of door opening, 12.7mm height, 3.8 mm wall. finish to match existing, plain surface.
 - b) 127 mm wide x full width of door opening, finish to match existing, serrated surface, with lip and vinyl door seal insert. Pemko 2005_T or approved alternate.
 - c) 127 mm wide x full width of door opening, 12.7 mm height, finish to match existing, serrated surface, with thermal break of rigid PVC.
- .4 Weatherstripping:
 - .1 Head and jamb seal:
 - .1 Extruded aluminum frame and solid closed cell neoprene insert, finish to match existing.
 - .2 Door bottom seal:
 - .1 Heavy duty, extruded aluminum frame and closed cell neoprene weather seal, surface mounted, closed ends, adjustable, finish to match existing.
- .5 Sound Seals:
 - .1 Head and jamb seal:
 - .1 Self-adhesive silicone perimeter gasketing.
 - .2 Acceptable Manufacturer: Pemko S773, DraftSeal DS340CS or approved alternate.
 - .2 Door bottom seal:
 - .1 Auto door bottom: heavy duty, door seal of extruded aluminum frame and solid closed cell neoprene seal, surface mounted, closed ends, automatic retract mechanism when door is open, finish to match existing.

- .2 Acceptable manufacturer: Pemko 4131CPKL, Draft Seal DS343CR or approved alternate.
- .6 Electric strike:
 - .1 SDC Model 55 Uni-flex electric strike complete with ABCDU trim for the electric strike. No substitutions.
 - .2 Strike edge plate to match ANSI function of electric strike.
- .7 Card reader: provided by Owner.
- .8 Door Viewer
 - .1 Mount 1.57m above floor level.
 - .2 Acceptable manufacturer:
 - .1 VSI Hardware Industries, Loxem 180.
 - .2 Madison Products Company Limited, Madison No. 20 R35.
 - .3 Leigh Metal Products Ltd., Ives No. 698B3

2.3 FASTENINGS

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.
- .4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
- .5 Use fasteners compatible with material through which they pass.

2.4 KEYING

- .1 Construction keying:
 - .1 Provide construction cores. Contractor to install construction cores and perform operation verification for all locks. Construction cylinders to be "0" bitted Sargent. Perimeter doors may have random bitting.
- .2 Permanent keying:
 - .1 Provide 000000 bitted for keying by Owner.
 - .2 Provide two blank keys, in duplicate, for every lock in this Contract.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Furnish manufacturers' instructions for proper installation of each hardware component.

3.2 INSTALLATION

- .1 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association and as specified.
- .2 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .3 Use only manufacturer's supplied fasteners. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .4 Coordinate door and frame preparation with Section 08 11 00 Metal Doors and Frames to ensure the proper installation and operation of hardware.
- .5 Remove construction cores and locks when directed by Departmental Representative; install permanent cores and check operation of locks.

3.3 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 provide tight fit at contact points with frames.

3.4 TESTING

- .1 All locks must be tested by the Contractor with the installed permanent cores for proper installation. All doors and locks not installed and operating correctly will be rejected.

3.5 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .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 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.6 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.

3.7 SCHEDULE

- .1

Door 200.33 LAN Room

1 lockset:

- Full Mortise
- ANSI No.: F15

3 butts

1 electric strike (c/w deadbolt keeper)

1 door drop bottom seal

1 set weatherstripping

1 closer

1 wall stop

Card Access Controlled Door. Note 1 below.

Door 209.04 - Office 209.04

1 lockset:

- Full Mortise
- ANSI No.: F04

3 butts

1 set weatherstripping

1 door sweep

1 wall stop

Note 1: Prepare frame for installation of SDC Model 55 Uni-flex electric strike. Ensure Deadbolt keepers are installed and aligned in door frame where there are lock sets with deadbolts.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute (ANSI).
 - .1 ANSI/ASTM E330-02(2010), Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM C542-05(2011), Standard Specification for Lock-Strip Gaskets.
 - .2 ASTM D2240-05(2010), Standard Test Method for Rubber Property - Durometer Hardness.
- .3 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
- .4 Flat Glass Manufacturers Association (FGMA).
 - .1 FGMA Glazing Manual.

1.2 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Size glass to withstand wind loads, dead loads and positive and negative live loads as measured in accordance with ANSI/ASTM E330.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:
 - .1 For glazing materials during application and curing.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .5 Closeout Submittals:
 - .1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
 - .1 Provide testing and analysis of glass under provisions of Section 01 45 00 - Quality Control.
 - .2 Provide shop inspection and testing for glass.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Mock-ups:
 - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
 - .2 Construct mock-up to including glass glazing.
 - .3 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
 - .2 For testing to determine compliance with performance requirements.
 - .4 Locate where directed.
 - .5 Allow 48 hours for inspection of mock-up before proceeding with work.
 - .6 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

1.5 SITE CONDITIONS

- .1 Environmental Requirements:
 - .1 Install glazing when ambient temperature is 10 degrees C minimum. Maintain ventilated environment for 24 hours after application.
 - .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.6 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 uninstalled materials for reuse at nearest used building materials facility or similar type facility.
- .3 Divert unused caulking and sealant materials from landfill through disposal at special wastes depot.
- .4 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.
- .5 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .6 Dispose of corrugated cardboard, polystyrene, plastic, and packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

Part 2 **Products**

2.1 **MATERIALS: FLAT GLASS**

- .1 Float glass: to CAN/CGSB-12.3.
- .2 Safety glass: to CAN/CGSB-12.1, transparent, 6 mm (typical) and 9 mm thick as indicated on schedules or drawings.
 - .1 Type 2-tempered.
 - .2 Class B-float.
 - .3 Category 1.

2.2 **MATERIALS**

- .1 Sealant: as recommended by manufacturer.

2.3 **ACCESSORIES**

- .1 Setting blocks: Neoprene, 80-90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area.
- .2 Spacer shims: Neoprene, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self-adhesive on one face.
- .3 Glazing tape:
 - .1 Preformed butyl compound with integral resilient tube spacing device, 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; black colour.
- .4 Glazing splines: resilient polyvinyl chloride, extruded shape to suit glazing channel retaining slot, colour as selected.
- .5 Glazing clips: manufacturer's standard type.
- .6 Lock-strip gaskets: to ASTM C542.

Part 3 **Execution**

3.1 **MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 **EXAMINATION**

- .1 Verify that openings for glazing are correctly sized and within tolerance.
- .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.3 PREPARATION

- .1 Clean contact surfaces with solvent and wipe dry.
- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant.

3.4 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

- .1 Perform work in accordance with FGMA Glazing Manual, IGMAC, and Laminators Safety Glass Association - Standards Manual for glazing installation methods.
- .2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.
- .3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
- .4 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.
- .5 Place glazing tape on free perimeter of glazing in same manner described.
- .6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- .7 Knife trim protruding tape.

3.5 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Remove traces of primer, caulking.
- .3 Remove glazing materials from finish surfaces.
- .4 Remove labels after work is complete.
- .5 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacturer's instructions.
- .6 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.6 PROTECTION OF FINISHED WORK

- .1 After installation, mark light with an "X" by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

3.7 SCHEDULE

- .1 Refer to drawings.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C36/C36M-03e1, Specification for Gypsum Wallboard.
 - .2 ASTM C475-12, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .3 ASTM C840-11, Specification for Application and Finishing of Gypsum Board.
 - .4 ASTM C841-03(2008), Standard Specification for Installation of Interior Lathing and Furring.
 - .5 ASTM C1002-07, Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - .6 ASTM C1047-10a, Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .7 ASTM C1178/C1178M-11, Specification for Glass Mat Water-Resistant Gypsum Backing Board.
 - .8 ASTM C1396/C1396M-11, Standard Specification for Gypsum Board.
 - .9 ASTM C1629/C1629M-06(2011), Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels
- .2 Association of the Wall and Ceilings Industries International (AWEI)
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .4 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-2007, Surface Burning Characteristics of Building Materials and Assemblies.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in original packages, containers or bundles bearing manufacturers brand name and identification.
- .2 Store materials inside, level, under cover. Keep dry. Protect from weather, other elements and damage from construction operations and other causes.
- .3 Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.
- .4 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.

1.3 SITE ENVIRONMENTAL REQUIREMENTS

- .1 Maintain temperature minimum 10 degrees C, maximum 21 degrees C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.
- .2 Apply board and joint treatment to dry, 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.

Part 2 Products

2.1 MATERIALS

- .1 Standard board: to ASTM C36/C36M, Type X, 16 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges bevelled.
- .2 Moisture-and mold resistant gypsum board: to ASTM C1396/C1396M, regular, thickness as indicated in drawings thickness as indicated in drawings, 1200 mm wide x maximum practical length. Install behind ceramic tiles in Rooms 107 and 108.
- .3 Metal Access doors: frameless, welded construction, push latching door, removable door, accepts 12.7 mm or 15.9 mm gypsum board, exposed frames paintable.
- .4 Metal furring runners, hangers, tie wires, inserts, and anchors required for installation to ASTM C841.
- .5 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.
- .6 Resilient drywall furring: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.
- .7 Metal channel stiffener: 19 x 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.
- .8 Steel drill screws: to ASTM C1002.
- .9 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, metal, zinc-coated by electrolytic process, 0.5 mm base thickness, perforated flanges, one piece length per location.
- .10 Joint compound: to ASTM C475, asbestos-free.

Part 3 Execution

3.1 ERECTION

- .1 Do application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.

- .2 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C840 except where specified otherwise.
- .3 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .4 Install work level to tolerance of 1:1200.
- .5 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, and grilles.
- .6 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .7 Install gypsum board fire and sound stops and to form plenum areas to underside of steel roof deck above suspended ceilings as indicated.
- .8 Install wall furring for gypsum board wall finishes in accordance with ASTM C840, except where specified otherwise.
- .9 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .10 Furr duct shafts, beams, columns, pipes and exposed services where indicated.
- .11 Erect drywall resilient furring transversely across studs, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 25 mm drywall screw.

3.2 APPLICATION

- .1 Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical work are approved.
- .2 Apply single and double layer gypsum board (as indicated on drawings) to metal furring or framing using screw. Maximum spacing of screws, 300 mm on centre.
 - .1 Single-Layer Application:
 - .1 Apply gypsum board on ceilings prior to application of walls in accordance with ASTM C840.
 - .2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize 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 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.
- .4 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.
- .5 Install gypsum board with face side out.
- .6 Do not install damaged or damp boards.
- .7 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.
- .8 Apply moisture and mold resistant panels to interior side of all exterior walls. Thickness and type to match gypsum board specified in Wall Type.

3.3 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.
- .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.
- .4 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.
- .5 Provide continuous polyethylene dust barrier behind and across control joints.
- .6 Apply 12 mm diameter bead of acoustic sealant continuously around perimeter of first layer of multiple layers of gypsum board to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, and penetrations, in partitions where perimeter sealed with acoustic sealant.
- .7 Install access doors to electrical and mechanical fixtures specified in respective sections.
 - .1 Rigidly secure frames to furring or framing systems.
- .8 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.
- .9 Gypsum Board Finish: finish gypsum board walls and ceilings to Level 4 finish in accordance with Association of the Wall and Ceiling Industries (AWCI) International Recommended Specification on Levels of Gypsum Board Finish:
 - .1 Levels of finish for walls, ceilings, bulkheads:

- .1 Level 4: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
- .10 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.
- .11 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .12 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .13 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
- .14 Mix joint compound slightly thinner than for joint taping.
- .15 Apply thin coat to entire surface using trowel or drywall broadknife to fill surface texture differences, variations or tool marks.
- .16 Allow skim coat to dry completely.
- .17 Remove ridges by light sanding or wiping with damp cloth.
- .18 Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.

3.4 CONTROL JOINTS

- .1 Provide control joints at not greater than 9 m spacing on continuous gypsum board walls in a single plane and at not greater than 9 m spacing on ceilings and bulkheads except where indicated otherwise in the drawings.
 - .1 Confirm location of control joints with the Consultant prior to installation of gypsum board
- .2 Provide control joints of preformed units set in gypsum board facing and supported independently on both sides of joint. Interrupt top and bottom tracks at location of control joint.
- .3 Install control joints straight and true. Finish control joints as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM C645-11a, Specification for Nonstructural Steel Framing Members.
 - .2 ASTM C754-11, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding).

1.2 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.

Part 2 Products

2.1 MATERIALS

- .1 Non load bearing channel stud framing: to ASTM C645, stud size as noted on drawings and Partition Schedule, roll formed from 0.478 mm steel (25ga) and from 1.146 steel (18ga) as noted on drawings and Partition Schedule; hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock out service holes at 460 mm centres.
- .2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height. Thickness as noted for studs in Partition Schedule.
- .3 Metal channel stiffener: cold rolled steel, coated with rust inhibitive coating.
- .4 Acoustical sealant: in accordance with Section 07 92 00 – Joint Sealants.
- .5 Insulating strip: rubberized, moisture resistant 3 mm thick closed cell neoprene strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.
- .6 Welding materials: to CSA W59.

Part 3 Execution

3.1 ERECTION

- .1 Align partition tracks at floor and ceiling and secure at 400 mm on centre maximum.
- .2 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

- .3 Place studs vertically at 400 mm on centre or as noted on drawings.
- .4 Install studs not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling.
- .5 Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .6 Erect metal studding to tolerance of 1:1000.
- .7 Attach studs to bottom track using screws.
- .8 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .9 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .10 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Weld studs together, placed alongside frame anchor clips.
- .11 Do welding work in accordance with CSA W59 unless specified otherwise
- .12 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .13 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .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 joists, beams and structural slabs to avoid transmission of structural loads to studs. Use double track slip joint.
- .17 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .18 Install two continuous beads of acoustical sealant or insulating strip under studs and tracks around perimeter of sound control partitions.

3.2 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM F1066-04(2010)e1, Standard Specification for Vinyl Composition Floor Tile.
 - .2 ASTM F1344-12, Standard Specification for Rubber Floor Tile.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-25.20-95, Surface Sealer for Floors.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit duplicate tile in size specified and 300 mm long base.
- .4 Closeout Submittals:
 - .1 Provide maintenance data for resilient flooring for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 Maintain air temperature and structural base temperature at flooring installation area above 20 degrees C for 48 hours before, during and for 48 hours after installation.

1.5 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials of resilient tile flooring, base and adhesive in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Provide two boxes of each colour, pattern and type flooring material required for this project for maintenance use.

- .3 Extra materials from same production run as installed materials.
- .4 Identify each container of floor tile and each container of adhesive.
- .5 Deliver to Departmental Representative, upon completion of the work of this section.
- .6 Store where directed by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Static dissipative vinyl tile: to ASTM F1066, designated by SDT on Room Finish Schedule.
 - .1 Pattern: marbelized.
 - .2 Thickness: 3.0 mm.
 - .3 Size: 305 mm x 305 mm tile.
 - .4 1.0 x 10 (to 6th) ohms resistance.
 - .5 Colour: selected by Departmental Representative.
 - .6 51 wide x 609 long copper grounding connection strips for under tile.
 - .7 Acceptable manufacturers:
 - .1 Armstrong SDT
 - .2 Johnsonite Granit SD
 - .3 Or approved alternate.
- .2 Resilient base: continuous, top set, complete with premoulded end stops and external corners:
 - .1 Type: rubber.
 - .2 Style: cove.
 - .3 Thickness: 2.03 mm.
 - .4 Height: 101.6 mm.
 - .5 Lengths: cut lengths minimum 2400 mm.
 - .6 Colour: selected by Departmental Representative.
- .3 Primers and adhesives: waterproof, recommended by flooring manufacturer for specific material on applicable substrate, above, at or below grade.
 - .1 Flooring adhesives: maximum VOC limit 50 g/L.
 - .1 Static Dissipative Tile adhesive with 51 wide x 609 long copper grounding connection strips for under tile.
 - .2 Cove base adhesives: maximum VOC limit 50 g/L.
- .4 Sub-floor filler and leveller: white premix latex requiring water only to produce cementitious paste as recommended by flooring manufacturer for use with their product.
- .5 Metal edge strips: aluminum extruded, smooth, mill finish with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.
- .6 Sealer: type recommended by flooring manufacturer.
 - .1 Sealant: maximum VOC limit 50 g/L.

- .7 Wax: type recommended by flooring manufacturer.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSPECTION

- .1 Ensure concrete floors are dry, by using test methods recommended by tile manufacturer.

3.3 SUB-FLOOR TREATMENT

- .1 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.
- .2 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- .3 Prime and seal concrete to flooring manufacturer's printed instructions.

3.4 TILE APPLICATION

- .1 Provide high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours after installation. If possible, vent directly to outside. Do not let contaminated air recirculate through district or whole building air distribution system. Maintain extra ventilation for at least one month following building occupation.
- .2 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .3 Lay flooring with joints parallel to building lines to produce symmetrical tile pattern. Border tiles minimum half tile width.
- .4 Install flooring to square grid pattern with joints aligned to produce symmetrical tile pattern. Border tiles minimum half tile width.
- .5 As installation progresses, and after installation, roll flooring in 2 directions including resilient tile with 45 kg minimum roller to ensure full adhesion.
- .6 Cut tile and fit neatly around fixed objects.
- .7 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.
- .8 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.

- .9 Install metal edge strips at unprotected or exposed edges where flooring terminates.

3.5 BASE APPLICATION

- .1 Lay out base to keep number of joints at minimum. Base joints at maximum length available or at internal or premoulded corners.
- .2 Clean substrate and prime with one coat of adhesive.
- .3 Apply adhesive to back of base.
- .4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.
- .5 Install straight and level to variation of 1:1000.
- .6 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.
- .7 Cope internal corners. Use premoulded corner units for right angle external corners. Use formed straight base material for external corners of other angles, minimum 300 mm each leg.

3.6 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
- .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.7 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Remove excess adhesive from floor, base and wall surfaces without damage.
- .3 Clean, seal and wax floor and base surface to flooring manufacturer's instructions. In carpeted areas clean, seal and wax base surface before carpet installation.
- .4 Do not wax rubber tile floor.

3.8 PROTECTION

- .1 Protect new floors from time of final set of adhesive until final inspection]
- .2 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33
- .2 Environmental Protection Agency (EPA)
 - .1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 1995, (for Surface Coatings).
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 Master Painters Institute (MPI)
 - .1 MPI Architectural Painting Specifications Manual, 2004.

1.2 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Contractor: minimum of five years proven satisfactory experience. Provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit product data and instructions for each paint and coating product to be used.
 - .2 Submit product data for the use and application of paint thinner.
 - .3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application and curing.
- .3 Samples:
 - .1 Submit full range colour sample chips to indicate where colour availability is restricted.
 - .2 Submit three 200 x 300 mm sample panels of each paint, stain and clear coating with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards.
 - .3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.
 - .1 Submit manufacturer's installation application instructions.

- .4 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour numbers.

1.4 MAINTENANCE

- .1 Extra Materials:
 - .1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.
 - .2 Quantity: provide one four litre can of each type and colour of primer, stain and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.
 - .3 Delivery, storage and protection: comply with Owner requirements for delivery and storage of extra materials.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, Shipping, Handling and Unloading:
 - .1 Pack, ship, handle and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.
- .2 Acceptance at Site:
 - .1 Identify products and materials with labels indicating:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
- .3 Remove damaged, opened and rejected materials from site.
- .4 Storage and Protection:
 - .1 Provide and maintain dry, temperature controlled, secure storage.
 - .2 Store materials and supplies away from heat generating devices.
 - .3 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.
- .5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.
- .7 Remove paint materials from storage only in quantities required for same day use.

- .8 Fire Safety Requirements:
 - .1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.
- .9 Waste Management and Disposal:
 - .1 Handle and dispose of hazardous materials in accordance with Regional and Municipal, regulations.
 - .2 Ensure emptied containers are sealed and stored safely.
 - .3 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Dispose of according to Authorities with Jurisdiction.
 - .4 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
 - .5 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

1.6 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces.
 - .2 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.
 - .3 Provide continuous ventilation for seven days after completion of application of paint.
 - .4 Coordinate use of existing ventilation system with Consultant and ensure its operation during and after application of paint as required.
 - .5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
 - .6 Provide minimum lighting level of 323 Lux on surfaces to be painted.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 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 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.
- .2 Perform painting work when maximum moisture content of the substrate is below:
 - .1 Allow new concrete and masonry to cure minimum of 28 days.
 - .2 15% for wood.
 - .3 12% for 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.
- .3 Surface and Environmental Conditions:
 - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
 - .3 Apply paint when previous coat of paint is dry or adequately cured.

Part 2 Products

2.1 MATERIALS

- .1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Provide paint materials for paint systems from single manufacturer.
- .3 Only qualified products with E2 or 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 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.
- .6 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.
- .7 Provide paint products meeting MPI "Environmentally Friendly" minimum E2 ratings based on VOC (EPA Method 24) content levels.

- .8 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .9 Flash point: 61.0 degrees C or greater for water-borne surface coatings and recycled water-borne surface coatings.
- .10 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E2 rating.

2.2 COLOURS

- .1 Colours will be based upon the following:
 - .1 Walls: Maximum One field colour and one feature wall colour to match existing colours.
 - .2 Metal Door and Window Frames: Match existing colour.
- .2 Selection of colours from manufacturer's full range of colours.
- .3 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site. Obtain written approval from Departmental Representative DCC Representative Consultant for tinting of painting materials.
- .2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.
- .3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.
- .4 Thin paint for spraying in accordance with paint manufacturer's instructions.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

- .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 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 as noted on Finish Schedule.

2.5 INTERIOR PAINTING SYSTEMS

- .1 Galvanized metal: (doors, frames and as indicated on drawings).
 - .1 INT 5.3M - High performance architectural latex Gloss Level 5 – Semi-Gloss finish. Premium grade, 1 coat primer, two top coats.
- .2 Dressed lumber: (doors and as indicated on drawings):
 - .1 INT 6.3W - Waterborne clear acrylic Gloss Level 5 – Semi-Gloss finish (over stain). Premium grade, 1 coat stain, two coats varnish.
- .3 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
 - .1 INT 9.2B - High performance architectural latex Gloss Level 3–egg shell finish. Premium grade, 1 coat primer, two top coats.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 GENERAL

- .1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Correct damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Proceeding with work is acceptance of substrate.
- .3 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .4 Maximum moisture content as follows:
 - .1 Stucco, plaster and gypsum board: 12%.
 - .2 Concrete: 12%.
 - .3 Clay and Concrete Block/Brick: 12%.
 - .4 Wood: 15%.

3.4 PREPARATION

- .1 Protection:
 - .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces.
 - .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
 - .3 Protect factory finished products and equipment.
 - .4 Protect passing pedestrians, building occupants and general public in and about the building.
- .2 Surface Preparation:
 - .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
 - .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
 - .3 Place "WET PAINT" signs in occupied areas as painting operations progress.
- .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.
 - .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 vinyl 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 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.
- .8 Touch up of shop primers with primer as specified.

3.5 APPLICATION

- .1 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.

3.6 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 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .5 Do not paint over nameplates.
- .6 Keep sprinkler heads free of paint.
- .7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .8 Paint fire protection piping red.
- .9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .10 Paint natural gas piping yellow.
- .11 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.
- .12 Do not paint interior transformers and substation equipment.
- .13 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.7 FIELD QUALITY CONTROL

- .1 Standard of Acceptance:
 - .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
 - .2 Ceilings: no defects visible from floor at 45 degrees degrees to surface when viewed using final lighting source.
 - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.8 RESTORATION

- .1 Clean and re-install hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

- .4 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition.
- .5 Touch up scratches, abrasions, voids and other defects in painted surfaces.

3.9 CLEANING

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

END OF SECTION

Part 1 - General

1.1 RELATED WORK

- .1 Heating, Ventilating and Air Conditioning Division 23

1.2 INTENT

- .1 Provide a complete and fully operational mechanical system with facilities and services to meet requirements described herein and in complete accord with applicable codes and ordinances.
- .2 Contract documents for mechanical scope are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.
- .3 Should any discrepancies occur on drawings or in specifications which leaves doubt as to the intent and meaning of the drawings and specifications, obtain a ruling from the designer before submitting tender. If this is not done, it will be assumed that the most expensive alternate has been allowed for.
- .4 Follow manufacturer's recommended installation details and procedures for equipment supplemented by details given herein and on plans subject to approval of the Departmental Representative.
- .5 Install equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment to satisfaction of the Departmental Representative at no extra cost.
- .6 Provide labour and materials required to install, test and place into operation complete mechanical system. Provide additional material for modifications required to correct minor job conflicts.
- .7 Connect to equipment furnished in other Sections and by Departmental Representative, including uncrating equipment, moving in place and installing complete, start-up and test.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Store and manage hazardous materials in accordance with cepa, tdga AND Regional and Municipal Regulations.
- .2 Waste Management and Disposal:
- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

- .3 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
- .4 Unused sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .5 Fold up metal and plastic banding, flatten and place in designated area for recycling.
- .6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .7 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial.

3. MATERIALS

- .1 Replace materials or workmanship below specified quality and relocate work wrongly placed to satisfaction of the Departmental Representative.
- .2 Materials and equipment installed shall be new, full weight and of the best quality specified. Use same brand or manufacturer for each specific application. Statically and dynamically balance rotating equipment for minimum vibration and low operating noise level.
- .3 Each major component of equipment shall have manufacturer's name, address, catalog and serial number in a conspicuous place.
- .4 Install materials and equipment in a neat and workmanlike manner by competent specialists.

4. CUTTING AND PATCHING

- .1 Locate and provide holes and sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves at no extra cost.
- .2 Drill for expansion bolts, hanger rods, brackets, and supports.
- .3 Do no cutting or burning of structural members of building frame without obtaining prior written approval from the Departmental Representative.
- .4 Provide openings and holes required in precast members for mechanical work. Cast holes larger than 100 mm (4") in diameter. Field-cut smaller than 100 mm (4").
- .5 All patching of finished construction of building shall be performed under the sections of specifications covering these materials.

5. SEMI-FINAL AND FINAL INSPECTIONS

- .1 Perform the following items prior to semi-final inspection.
 - .1 Heating and air conditioning systems capable of operation with alarm controls functional and automatic controls in operation generally, but not necessarily finally calibrated.
 - .2 Necessary tests on equipment made including those required by authorities and certificates of approval obtained.
 - .3 Rough balance of air and water systems completed.
 - .4 Valve tagging completed and equipment identified. Equipment and piping painted and escutcheons installed.
 - .5 Equipment lubricated as per manufacturer's data.

- .6 Warranty forms have been mailed to manufacturer. Provide copy of original warranty for equipment which has warranty period longer than one year.
 - .7 Systems chemically cleaned, flushed and water treatment initiated. Provide report from manufacturer's representative to confirm status of treatment.
 - .8 Submit sample of Operating/Maintenance Manuals. Arrange Operating and Maintenance Instructions and submit schedule for approval.
 - .9 Review and ensure access doors are suitably located and equipment easily accessible including plumbing cleanouts.
 - .10 Have noise and vibration control devices and flexible connections inspected by manufacturer's representative and submit written report.
 - .11 Equipment alignment carried out by qualified millwright and certified report submitted.
 - .12 Check operations of plumbing systems and fixtures and ensure fixtures are solidly supported.
 - .13 Fan plenums cleaned, temporary filters removed and permanent filters installed.
- .2 Provide declaration in writing that semi-final deficiencies and the following items have been completed prior to the final inspection:
- .1 Equipment cleaned inside, outside and lubricated. Plumbing fixtures and brass cleaned.
 - .2 Final balancing completed and rough data of balance reports submitted.
 - .3 Final calibration of controls completed.

6. SHOP DRAWINGS

- .1 Submittal procedures in accordance with Division 1.
- .2 Submit materials and equipment by manufacturer, trade name and model number. Include copies of applicable brochure or catalog material. Do not assume applicable catalogues are available in the Departmental Representative's office. Maintenance and operating manuals are not suitable submittal material.
- .3 Clearly mark each sheet of printed submittal material (using arrows, underlining or circling) to show particular sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pump seals, materials or painting.
- .4 Include dimensional data for roughing in and installation, technical data sufficient to check that equipment meets requirements of drawings and specifications, wiring, piping, and service connection data, motor sizes complete with voltage ratings and schedules as applicable.
- .5 Shop drawings to show all information identified under individual product specifications and in general shall show the following:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .3 Detailed drawings of bases, supports, and anchor bolts.
 - .4 Acoustical sound power data, where applicable.
 - .5 Points of operation on performance curves.
 - .6 Manufacturer to certify current model production.
 - .7 Certification of compliance to applicable codes.

- .6 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.

7. OPERATING AND MAINTENANCE MANUALS

- .1 Provide services of qualified and experienced personnel to prepare proper documentation and to instruct the Operating Staff in the operation and preventative maintenance of each piece of equipment and system supplied and installed. Complete and turn over documentation prior to final inspection.
- .2 Provide 215 mm x 280 mm (8-1/2" x 11") capacity extension type catalogue binders bound with heavy fabric, hot stamped in gold lettering front and spine. Refer to Division 1 for colour and quantity.
- .3 Each binder shall be indexed according to the following indexing system:
- .4 Tab-1.0 Mechanical Systems: Title page with clear plastic protection cover.
- .5 Tab-1.1 List of Mechanical Drawings.
- .6 Tab-1.2 Description of Systems: Provide complete description of each system. Include detailed system description and components comprising that system, explanation of how each component interfaces with others to complete the system, location of each thermostat, controller or operating setpoints. Refer to 21 0-5 01, 1.1.5 for additional required information.
- .7 Tab-1.3 Operation Division: Provide complete and detailed operation of each major component. Include how to energize and exact location of switches and controls, how the component interfaces with other components, operation of controls, including the operational sequence, operational characteristic changes for summer or winter operation, and how to accomplish the changeover, complete troubleshooting sequence, setpoints cannot be maintained, and safeguards to check if equipment goes off line. Refer to 21 0-5 01, 1.1.5 for additional required information.
- .8 Tab-1.4 Maintenance and Lubrication Division: Provide detailed preventative maintenance and lubrication schedule for each of the major components to include daily, weekly, monthly, semi-annual and yearly checks and tasks. Explain how to proceed with each task required for each piece of typical equipment such as bearings, drives, motors and filters. Compile this information for each typical piece of equipment separate from the shop drawings section. Refer to 21 0-5 01, 1.1.5 for additional required information.
- .9 Tab-1.5 List of Equipment Suppliers and Contractors: Provide complete list of equipment suppliers and contractors, including address and telephone number. Outline procedures for purchasing parts and equipment. Include steps to take in order to purchase new parts.
- .10 Tab-Certification (2.0, 2.1, etc.): Include copy of test data degreasing and flushing of heating system analysis of system water taken at time system was put into operation, hydrostatic or air tests performed on piping systems, equipment alignment certificates, copy of balancing data for air and water systems, copy of valve tag identification and pipe colour code, inspection approval certificates for plumbing system, hot air heating and ventilation systems and fire damper schedule.

- .11 Tab-Shop Drawings and Maintenance Bulletins (3.0, 3.1, etc.): Provide materials as received in compliance with clause "Shop Drawings".
- .12 The divider tabs shall be laminated mylar plastic, and coloured according to section. The colouring is as follows: Mechanical Systems - 1.0 - 1.5 - Orange, Certification - 2.0 - 2.4 - Green, Shop Drawings and Maintenance - 3.0 - 3.17 - Yellow. Plastic tabs with typed insertions will not be accepted.
- .13 Submit documents to the Departmental Representative for approval prior to being turned over to the Departmental Representative. At completion of project, hold a Seminar to instruct the Operating Staff in operation and preventative maintenance of each piece of equipment and system supplied and installed.
- .14 Provide one digital copy on compact disk of the final operation and maintenance manual in each of the manuals (six in total).

8. RECORD DRAWINGS

- .1 Refer to Division 1.
- .2 Keep on site, an extra set of white prints and specifications recording changes and deviations daily. Allow for the work required to transfer site changes to Engineer's original tracings and for providing the Departmental Representative with set of sepias marked "Record Drawings". Co-ordinate through Departmental Representative's office. Addenda corrections and Departmental Representative initiated construction changes to original tracings will be the responsibility of the Departmental Representative.
- .3 Contractor shall utilize a different colour water proof ink for each service.
- .4 Contractor shall ensure that white prints are available on site for reference purposes and inspection.
- .5 Record drawings shall identify location of fire dampers, major control lines, access doors, tagged valves and actual room names or numbers.
- .6 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).
- .7 Submit to Departmental Representative for approval and make corrections as directed.

9. IDENTIFICATION

- .1 Refer to Section 23 05 54, Mechanical Identification.

10. TEMPORARY FACILITIES

- .1 Refer to General Requirements - Division 01.

11. SUPERVISION

- .1 Refer to General Requirements - Division 01.

12. TEMPORARY HEAT AND/OR VENTILATION

- .1 Refer to General Requirements - Division 01.
- .2 Do not use the permanent system for temporary heating or ventilation purposes, without written permission from the Departmental Representative.
- .3 Thoroughly clean and overhaul permanent equipment used during the construction period, replacing worn or damaged parts. Exchange equipment or components operating improperly at final inspection with new equipment or components.
- .4 Use of permanent systems for temporary heat shall not modify the terms of warranty.
- .5 Operate heating systems under conditions which ensure no temporary or permanent damage. Operate fans at proper resistance with filters installed. Change filters at regular intervals. Operate with proper safety devices and controls installed and fully operational. Operate water systems with proper water treatment.
- .6 Where air systems are used during temporary heating, provide filter media on return and exhaust air outlets. Clean duct systems which have become dirty.
- .7 When permanent systems are used for temporary heat, provide alarm indicating system failure. Connect alarm to independent alarm company system.
- .8 Replace mechanical seals in pumps used for temporary heating purposes with new mechanical seals, regardless of condition.
- .9 Provide one year warranty from date of Substantial Completion.

13. EQUIPMENT PROTECTION AND CLEAN-UP

- .1 Protect equipment and materials in storage on site, during and after installation until final acceptance. Leave factory covers in place and take special precautions to prevent entry of foreign material into working parts of piping and duct systems.
- .2 Protect equipment with polyethylene covers and crates.
- .3 Operate, drain and flush out bearings and refill with new change of oil, before final acceptance.
- .4 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances.
- .5 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.
- .6 Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not re-use existing materials and equipment unless specifically indicated.

14. TEMPORARY OR TRIAL USAGE

- .1 Temporary or trial usage by the Departmental Representative of mechanical equipment supplied under contract and claimed complete before final acceptance shall not represent acceptance.
- .2 Repair or replace permanent equipment used temporarily.

- .3 Take responsibility for damage caused by defective materials or workmanship during temporary or trial usage.

15. ELECTRICAL MOTORS

- .1 Supply mechanical equipment complete with electrical motors.
- .2 Provide NEMA premium efficiency motors to CEMA and CSA standards for hard, continuous service, designed to limit temperature rise to 40 deg.C (100 deg.F) for open housing and 50 deg.C (125 deg.F) for drip proof housing, and operate at 1800 RPM unless otherwise specified.
- .3 Motors shall have ball or roller type bearings with grease lubrication fittings.
- .4 Motors used in conjunction with variable frequency drives shall be suitable for inverter duty, as specified by NEMA MGI-1993, Part 31. Refer to electrical specifications for inverters.
- .5 Refer to electrical specification for voltage, phase and cycle.

16. WASTE MANAGEMENT AND DISPOSAL

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle all mechanical components in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle all materials in accordance with manufacturer's written instructions.
 - .3 Store and manage hazardous materials in accordance with cepa, tdga AND Regional and Municipal Regulations.
- .2 Waste Management and Disposal:
 - .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .3 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
 - .4 Unused sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
 - .5 Fold up metal and plastic banding, flatten and place in designated area for recycling.
 - .6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
 - .7 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.
 - .8 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial.

17. DEMOLITION

- .1 Mechanical Contractor shall include in his Base Price the cost to provide the removal of all existing mechanical equipment and material that is not to be reused under this contract. Equipment shall be Departmental Representatives' salvage unless noted otherwise.

18. COMMISSIONING

- .1 Mechanical Contractor is responsible to ensure all mechanical systems are fully commissioned and detailed commissioning forms are completed and reviewed with Departmental Representative. Refer to Sections 01 91 13 General Commissioning (Cx) Requirements, 01 91 33 Commissioning Forms, 01 91 41 Commissioning Training for details on Mechanical Contractors responsibilities in addition to all commissioning activities identified under Division 21, 22, 23 and 25. As part of the commissioning process, the contractor is required to complete the Site Standard Equipment Labelling and Tracking sheets for the equipment they supplied, the sheets will be provided by the owner.

19. INSTRUCTION OF OPERATING STAFF

- .1 Provide trained personnel to instruct operating staff on maintenance, adjustment and operation of mechanical equipment. Instruct staff on changes or modification in equipment made under terms of guarantee.
- .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 Where specified elsewhere in Mechanical manufacturers to provide demonstrations and instructions.
- .4 Use operation and maintenance data manual for instruction purposes. On completion of instruction, turn one manual over to chief operating personnel, the balance to Departmental Representative.
- .5 Record every instruction and training session on digital video.
- .6 Time allocated for Instruction:
Split AC Units One (1) hour instruction

20. SUBSTANTIAL COMPLETION

- .1 The mechanical portion of the project shall be deemed substantially complete when ALL mechanical systems are operational as designed. In addition, the air and/or water balance must be completed with the report submitted and approved by the Departmental Representative and the temperature control system must be complete, as designed, operational, with all control components calibrated and the maintenance manuals in final form must be submitted. The date will be established by the Departmental Representative and will set the date for the start of the one (1) year warranty on all mechanical systems.

21. EXCESSIVE ADMINISTRATION

- .1 Following the "Substantial Completion" Inspection a "Final" Inspection will be conducted and a follow up inspection will be conducted to "check off" all outstanding mechanical deficiencies.
- .2 If the mechanical portion of the project is not 100 percent complete at the time of the deficiency "checkoff" inspection, the cost of the failed deficiency "check-off" inspection and any and all additional inspections will be back charged directly to the Mechanical Contractor.

- .3 The cost of each excessive inspection will be \$750.00 plus travel, and will be deducted directly from the total Mechanical Contract amount.
- .4 If the contractor fails the deficiency “checkoff” inspection, no additional money will be released and a subsequent inspection will be scheduled when the Contractor re-verifies that they are 100% complete.
- .5 This process will repeat until the contractor can demonstrate that the project is 100% complete with all deficiencies rectified.

22. ALTERNATE MATERIALS & EQUIPMENT

- .1 The design is based on the materials and equipment as specified. Any alternate materials or equipment that meet or exceed the performance, quality and design intent of that specified will be accepted unless specifically noted otherwise under this article.
- .2 If alternate material or equipment will alter the design intent, make proposals to supply said materials or equipment in writing to the Departmental Representative at least ten working days prior to closing date of tender for Mechanical Trade. Any material or equipment that alters the design intent must be formally approved to be accepted.
- .3 All proposed equipment is subject to the requirements of the drawings and specifications. Revisions required to adapt equipment other than that specified shall be made without extra charge to the contract. All suppliers, except those specified, shall guarantee in writing that their individual proposed products meet or exceed the performance and quality of specified products. If the departmental representative determines at any time that the equipment or material being supplied does not meet or exceed the performance, quality or design intent of that being specified, the contractor shall replace the article in question with a suitable product at the contractors expense.
- .4 The following products shall be supplied as specified, there is no other products/manufacturers that will be accepted:
 - .1 EMCS (Building Controls): shall be Andover Controls or Honeywell only
 - .2 Steam Traps: Spirax Sarco

Part 2 - Materials

2.1 NOT USED

- .1 Not Used

Part 3 - Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

1 General

1.1 REFERENCES

- .1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
 - .1 ANSI/NFPA 13- 2010, Installation of Sprinkler Systems.
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 ULC S543- 1984, Internal Lug Quick Connect Couplings for Fire Hose.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures and in accordance with ANSI/NFPA 13, working plans and design requirements.
- .2 Sprinklers shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.3 ENGINEERING DESIGN CRITERIA

- .1 Design system in accordance with required and advisory provisions of ANSI/NFPA 13, using following parameters:
 - .1 Hazard:
 - .1 To suit occupancy as indicated.
 - .2 Pipe size and layout:
 - .1 Hydraulic design.
 - .2 Sprinkler head layout: to ANSI/NFPA 13.
 - .3 Water supply:
 - .1 Conduct flow and pressure test of water supply in vicinity of project to obtain criteria for bases of design in accordance with ANSI/NFPA 13. Base design for bidding in accordance with the following: Water pressure at nearest existing municipal hydrant as measured in September 2014 with town pump operating is:
Static 65 psi
Flowing – 489 GPM at 36 PSI
Flowing - 594 GPM at 34 PSI
 - .2 New 150mm service line as indicate on site plan.
 - .3 New fire pump to increase pressure and reduce pipe sizes.
 - .4 Zoning:
 - .1 System zoning as indicated.
- .2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.
- .3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings

- .4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.
- .5 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.
- .6 Location of Sprinkler Heads:
 - .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 required hazard occupancy.
 - .2 Uniformly space sprinklers on branch.
 - .3 Sprinklers in secure areas shall be located in accordance with RCMP Security standards, as indicated on drawings.
- .7 Water Distribution:
 - .1 Make distribution uniform throughout the area in which sprinkler heads will open.
 - .2 Discharge from individual heads in hydraulically most remote area to be 100% of specified density.
- .8 Density of Application of Water:
 - .1 Size pipe to provide specified density when system is discharging total maximum required flow.
 - .2 Sprinkler Discharge Area:
 - .1 Area: hydraulically most remote area as defined in NFPA 13.
 - .3 Outside Hose Allowances:
 - .1 Include allowance in hydraulic calculations for required outside hose streams.
 - .4 Friction Losses:
 - .1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.

1.4 CLOSEOUT SUBMITTALS

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

1.5 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide spare sprinklers and tools as required by ANSI/NFPA 13.

2 Products

2.1 PIPE, FITTINGS AND VALVES

- .1 Pipe:
 - .1 Steel Pipe: ASTM A53 or A120, Schedule 40 black, with malleable iron or forged steel welding type fittings, screwed or welded.
 - .2 Fittings and joints to ANSI/NFPA 13:
 - .1 Ferrous: screwed, welded, flanged or roll grooved.
 - .1 Grooved joints shall consist of two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts.
 - .1 Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity. Couplings shall be fully installed at visual pad-to-pad offset contact. (Tongue and recess type couplings, or any coupling that requires exact gapping of bolt pads on each side of the coupling at specified torque ratings, are not allowed.) Victaulic Style 009-EZ, 005, and 07.
 - .2 Flexible Type: For use in locations where vibration attenuation and stress relief are required, and for seismic applications. Victaulic Style 77.
 - .2 Copper tube: screwed, soldered, brazed, or roll grooved.
 - .1 Grooved joints shall be manufactured to copper-tube dimensions, with housings cast with offsetting angle-pattern bolt pads. Victaulic Style 606.
 - .3 Provide welded, threaded, grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.
 - .4 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.
 - .5 Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.
 - .6 Fittings: ULC approved for use in wet pipe sprinkler systems.
 - .7 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
 - .8 Side outlet tees using rubber gasketed fittings are not permitted.
 - .9 Sprinkler pipe and fittings: metal.
 - .2 Copper tube: screwed, soldered, brazed, or roll grooved.
 - .1 Grooved joints shall be manufactured to copper-tube dimensions, with housings cast with offsetting angle-pattern bolt pads. Victaulic Style 606.
 - .3 Provide welded, threaded, grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.
 - .4 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.
 - .5 Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.
 - .6 Fittings: ULC approved for use in wet pipe sprinkler systems.
 - .7 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
 - .8 Side outlet tees using rubber gasketed fittings are not permitted.
 - .9 Sprinkler pipe and fittings: metal.
 - .3 Valves:
 - .1 ULC listed for fire protection service.
 - .2 Up to NPS 2: bronze, screwed or grooved ends, OS & Y; gate or indicating ball valve. Victaulic Style 728.
 - .3 NPS 2 1/2 and over: cast ductile iron, flanged or roll grooved ends, indicating butterfly valve. Victaulic Style 705W.
 - .4 Swing or spring-actuated check valves. Victaulic Series 717.
 - .5 Ball drip.
 - .6 Gate valves: open by counterclockwise rotation.
 - .7 Provide rising stem valve beneath each alarm valve in each riser when more than one alarm valve is supplied from same water supply pipe.
 - .8 Check valves: flanged clear opening swing-check type with flanged inspection and access cover plate for sizes 10 cm and larger.
 - .9 Provide gate valve in piping protecting elevator hoistways.

- .4 Pipe hangers:
 - .1 ULC listed for fire protection services in accordance with NFPA.
 - .2 Refer to 23 05 05 and 23 05 29 for more detail.

2.2 GATE VALVES

- .1 50 mm and under: Bronze body, bronze trim, non-rising stem, handwheel, inside screw, double disc, solder or threaded ends. To ASTM B61.
- .2 Over 50 mm: Iron body, bronze trim, rising stem, handwheel, OS&Y, double disc or wedge, flanged or grooved ends. Victaulic series 771.
- .3 Valves: Bear UL label or marking, manufacturer's name and pressure rating on valve body.

2.3 GLOBE VALVES

- .1 Valves Up to 50 mm: Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable composition disc, solder or screwed ends, with back seating capacity. To ASTM B61.
- .2 Valves Over 50 mm: Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.
- .3 Valves: Bear UL label or marking, manufacturer's name and pressure rating on valve body.

2.4 BALL VALVES

- .1 Valves 50 mm (2") nominal and under: bronze to ASTM B584, chrome-plated brass ball, stainless steel stem, with weatherproof actuator, handwheel, supervisory switches, and grooved or threaded. UL/FM approved. Victaulic Series 728.

2.5 BUTTERFLY VALVES

- .1 Valves: UL/FM approved, Iron Body, Bronze disc, resilient replaceable liner seat, wafer or lug ends, extended neck, handwheel and gear drive.
- .2 Weatherproof actuator with handwheel, supervisory switches.
- .3 Victaulic Series 705W.

2.6 SWING CHECK VALVES

- .1 Valves Up to 50 mm: Bronze swing disc, renewable disc and seat, flanged ends to ASTM B61. Design for either horizontal or vertical mounting.
- .2 Valves over 50mm: UL/ULC/FM pattern, iron body, bronze mounted, regrind-renew bronze or elastomer coated ductile iron disc and seat ring, bolted cap or one-piece body, flanged or grooved ends. Design for either horizontal or vertical mounting with stainless steel spring and shaft. Victaulic Series 717.

2.7 SPRINKLER VALVE

- .1 Provide approved Automatic Sprinkler Valve with one or two pole (as required) flow detectors with alarm circuits, pressure switch, pressure retard chamber, outside water motor gong, outside electric gong, inside electric gong, and circuit breaker.

2.8 ABOVE GROUND PIPING SYSTEMS

- .1 Provide fittings for changes in direction of piping and for connections.
 - .1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.
 - .2 Perform welding in shop; field welding will not be permitted.
 - .3 Conceal piping in areas with suspended ceiling and as indicated on drawings.

2.9 SPRINKLER HEADS

- .1 General: to ANSI/NFPA 13 and ULC listed for fire services.
- .2 New sprinkler heads to match equivalent types. Confirm on site.
- .3 Temperature rating on fusible links shall suit specific hazard area with minimum of safety 10 deg.C.
- .4 Sprinklers shall be listed with and bear certification marking of nationally recognized testing agency.
- .5 Sprinklers with O-rings are not allowed.
- .6 Provide minimum 12 mm (1/2") nominal diameter discharge orifice, except when approved by authorities having jurisdiction.
- .7 Provide chrome plated finish for sprinklers in all areas: except mechanical rooms where bronze finish is acceptable.
- .8 All pendant type heads to be semi-recessed where possible.
- .9 All sprinkler heads located in Mechanical Rooms, Storage Rooms, IT/Equipment and other areas susceptible to damage to be complete with wire guards.
- .10 Sprinkler heads shall be located in the centre half or quarter point of ceiling tiles.
- .11 Provide quick response heads in all light hazard areas.
- .12 Sprinkler body shall be integrally cast with hex-shaped wrench boss to reduce the risk of damage during installations.
- .13 Wrenches shall be provided by the sprinkler manufacturer that directly engage the hex-shaped wrench boss integrally cast in the sprinkler body
- .14 Provide security sprinkler heads in provost area.

2.10 UPRIGHT SPRINKLER HEAD

- .1 Provide glass bulb type in areas indicated on drawings or specified. Bronze in mechanical rooms, chrome elsewhere.

2.11 PENDANT SPRINKLER HEAD

- .1 Provide semi-recessed polished chrome glass bulb type in areas indicated on drawings or specified.

2.12 SIDE WALL SPRINKLER HEAD

- .1 Provide polished chrome glass bulb type in areas indicated on drawings or specified.

2.13 ESCUTCHEON PLATES

- .1 Provide one piece type metal plates for piping passing through walls, in exposed spaces.
- .2 Provide polished stainless steel plates in finished spaces.
- .3 Provide paint finish on metal plates in unfinished spaces.

3 Execution

3.1 GENERAL INSTALLATION

- .1 Install piping in accordance with NFPA 13 for sprinkler systems and in accordance with manufacturer's recommendations.
- .2 Allow for expansion and contraction when installing pipe hangers.
- .3 Install signs required by local Fire Protection Department.
- .4 Secure outdoor signs with stainless steel bolts.
- .5 Locate outside alarms on wall of building adjacent to fire department connection.
- .6 Mechanical grooved joints may be used instead of threaded or welded joints.
- .7 Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be moulded and produced by the coupling manufacturer.
- .8 Die cut screw joints with full cut standard taper pipe threads with read lead and linseed oil or other non-toxic joint compound applied to male threads only.
- .9 Provide gate valves or approved butterfly valves, low points of piping and apparatus.
- .10 Provide drain valves at main shut-off valves, low points of piping and apparatus.

3.2 SYSTEM TESTS

- .1 Hydrostatically test entire system. Test shall be witnessed by Fire Marshall.

3.3 INSPECTION

- .1 Do not recess, paint or conceal piping accessories or work prior to inspection and approval by authorities having jurisdiction or authorized representative.

3.4 PROTECTION OF COMPLETE WORK

- .1 Paint exposed steel pipe and fittings, except special finishes, in accordance with Architectural Specifications.
- .2 Assume responsibility for protecting sprinkler heads during painting. Replace damaged and painted components.
- .3 Provide red wire guards for sprinkler heads in mechanical and electrical rooms and around ventilation equipment, and all other areas required by code or intended usage. Provide wire guards in gymnasiums.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
 .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

Part 2 Products**2.1 PIPE**

	<u>Service</u>	<u>Material</u>
.1	Equipment drains and overflows	Steel Schedule 40, galvanized, PVC or PVC-XFR-15/50
.2	Fire protection	Lightwall pipe, as approved by NFPA, Schedule 30. For sizes 200 mm and larger, pressfit pipe.
.3	Refrigeration	ACR copper

2.2 FITTINGS

	<u>Service</u>	<u>Material</u>	<u>Joint</u>
.1	Equipment drains	Malleable iron 1034 kPa banded, galvanized.	Threaded
		Steel, same thickness as pipe, galvanized.	Welded
		Malleable iron, grooved galvanized.	Grooved mechanical
		Wrought copper or cast brass.	95-5 solder, grooved mechanical
.2	Fire protection	PVC	Solvent weld or grooved mechanical
		Malleable iron or cast iron	Screwed or flanged
		Malleable iron or steel grooved	Grooved mechanical
.3	Refrigeration	Steel, same thickness as pipe	
		Wrought copper or forged brass	95-5 solder

Part 3 Execution**3.1 CONNECTIONS TO EQUIPMENT**

- .1 In accordance with manufacturer's instructions unless otherwise indicated.

- .2 Use valves and unions or flanges (as indicated) for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.3 DRAINS

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

3.4 DIELECTRIC COUPLINGS

- .1 General: Compatible with system, to suit pressure rating of system.
- .2 Locations: Where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.
- .4 Over NPS 2: Isolating flanges.

3.5 ROUTE AND GRADES

- .1 Route piping in orderly manner and maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls. Group piping wherever practical at common elevations. Install concealed pipes close to the building structure to keep furrings to a minimum.
- .2 Slope water piping 25 mm in 12 m and arrange to drain at low points.
- .3 On closed systems, equip low points with 20 mm drain valves and hose nipples. Provide, at high points, collecting chambers and high capacity float operated automatic air vents.
- .4 Slope steam piping 12 mm in 3 m in direction of flow and condensate return piping 20 mm in 3 m. Provide drop trap assembly at low points and points where condensate may back-up in front of control valves. Run condensate lines from traps to nearest

condensate receiver. Where condensate lines form a trap, provide vent loop over the trapped section.

- .5 Make reductions in water pipes with eccentric reducing fittings installed to provide drainage and venting.
- .6 Grade horizontal drainage and vent piping 20 mm per meter minimum.

3.6 PIPEWORK INSTALLATION

- .1 Screwed fittings jointed with Teflon tape.
- .2 Protect openings against entry of foreign material.
- .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
 - .2 Do not project branch pipe inside the main pipe.
- .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .9 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .10 Provide clearance for proper installation of insulation and for access to valves, air vents, drains and unions. Valves to be complete with valve handle extensions where insulation is thicker than 25mm, extension to suit insulation thickness.
- .11 Group piping wherever possible.
- .12 Ream pipes, remove scale, welding slag and other foreign material, inside and outside before assembly.
- .13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .14 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.
- .15 Screw joint steel piping up to and including 38 mm . Weld piping 63 mm and larger, including branch connections. Screw or weld 50 mm piping.

- .16 Make screwed joints with full cut standard taper pipe threads with red lead and linseed oil or other approved non-toxic joint compound applied to male threads only.
- .17 Clamp cast iron water pipe at fittings with 20 mm rods and properly anchor and support.
- .18 Use grooved mechanical couplings and mechanical fasteners in accessible locations, risers, pipe chases, and in other locations as approved by Departmental Representative. Use flexible couplings at pumps, coils and all vibration isolated equipment in lieu of flexible connectors, all other couplings to be rigid.
 - .1 Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions.
 - .2 The grooved coupling manufacturer's factory trained representative shall provide on-site training for Contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the job site and review Contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or job site visits.)
- .19 Make connections to equipment and branch mains with unions or flanges, as indicated:
 - .1 Unions are not required in installations using grooved mechanical joint couplings (The couplings shall serve as disconnect points.)
- .20 Provide non-conducting type connections wherever jointing dissimilar metals in systems. Brass adaptors and valves are acceptable. Refer to dielectric couplings.
- .21 Pressfit piping and fittings are not permitted.
- .22 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.
 - .1 For mechanical pipe jointing systems, use adequate numbers of Victaulic Style 77 flexible couplings in header piping to accommodate thermal growth and contraction, and for the elimination of expansion loops. (In accordance with Victaulic instructions and as approved by the Departmental Representative.) Where expansion loops are required, use Victaulic Style 77 couplings on the loops.
- .23 Install piping material specified as inside the building to 2.4 meters outside of building.
- .24 Use of PVC plastic pipe allowed where approved by the authority having jurisdiction. PVC pipe run in plenum spaces shall have flame and smoke rating for that purpose. PVC pipe to be complete with ULC labelled fire stopping wherever penetrating fire separations.
- .25 Valves:
 - .1 Shall be flanged for steam and condensate 38 mm and larger.
 - .2 Install in accessible locations.
 - .3 Remove interior parts before soldering.
 - .4 Install with stems upright or horizontal, not inverted.
 - .5 Valves accessible for maintenance without removing adjacent piping.
 - .6 Install globe valves in bypass around control valves.
 - .7 Use ball valves up to 50 mm or butterfly valves 63 mm and larger at branch take-offs for isolating purposes except where otherwise specified.
 - .8 Install butterfly valves on chilled water and related condenser water systems only.

- .9 Install butterfly valves between weld neck flanges to ensure full compression of liner.
- .10 Install ball valves for glycol service and domestic water.
- .11 Install gate valves on steam and condensate.
- .12 Use chain operators on valves NPS 2-1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.
- .13 Install gate, ball and butterfly valves for isolating service, to isolate equipment, part of systems or vertical risers.
- .14 Install globe, ball or angle valves for throttling service.
- .15 Use plug cocks in water systems for throttling service. Use non-lubricated plug cocks only when shut-off or isolation valves are also provided.
- .16 Grooved end triple service valves shall be 2068 kPa bubble tight dead end shutoff and non-slamming backflow prevention. Victualic Tri-Service valve assembly.
- .17 Use butterfly valves in fire protection systems where approved.
- .18 Provide drain valves at main shut-off valves, low points of piping and apparatus.
- .19 Valve operators to be complete with extensions on systems with insulation thicker than 25mm, extension to suit insulation thickness.

- .26 Check Valves:
 - .1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and elsewhere as indicated.
 - .2 Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.
 - .3 Provide spring loaded check valves on discharge of condensate pumps and condenser water.

- .27 Provide thermometers, thermometer wells, and DDC sensor wells where thermometers are indicated on drawings and schematics.

- .28 Provide plug cocks at all pressure tapping locations.

3.7 SLEEVES

- .1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.
- .2 Material: Schedule 40 black steel pipe.
- .3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.
- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
 - .1 Concrete, masonry walls, concrete floors on grade: Terminate flush with finished surface.
 - .2 Other floors: Terminate 25 mm above finished floor.
 - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

- .6 Sealing:
 - .1 Foundation walls and below grade floors: Fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.
 - .3 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.
 - .4 Ensure no contact between copper pipe or tube and sleeve.

3.8 ESCUTCHEONS

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

3.9 PREPARATION FOR FIRESTOPPING

- .1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Firestopping.
- .2 Uninsulated unheated pipes not subject to movement: No special preparation.
- .3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.
- .4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.10 FLUSHING OUT OF PIPING SYSTEMS

- .1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11-Cleaning supplemented as specified in relevant sections of Mechanical.
- .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
- .2 Piping: Test as specified in relevant sections of Mechanical or to 1.5 times maximum operating pressure. All installed piping to be tested unless noted otherwise.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of Mechanical.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

- .5 Conduct tests in presence of Departmental Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

3.12 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by Departmental Representative.
- .2 Request written approval 10 days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.
- .4 Ensure daily clean-up of existing areas.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Bronze - valves.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).
 - .1 ANSI/ASME B1.20.1-1983(R2001), Pipe Threads, General Purpose (Inch).
 - .2 ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A276-04, Specification for Stainless Steel Bars and Shapes.
 - .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.
 - .3 ASTM B283-99a, Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
 - .4 ASTM B505/B505M-02, Specification for Copper-Base Alloy Continuous Castings.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
 - .1 MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
 - .2 MSS-SP-80-2003, Bronze Gate Globe, Angle and Check Valves.
 - .3 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
 - .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit data for valves specified in this section.
- .3 Closeout Submittals:
 - .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

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

Part 2 Products

2.1 MATERIALS

- .1 Valves:
 - .1 Except for specialty valves, to be single manufacturer.
 - .2 All products to have CRN registration numbers.
- .2 End Connections:
 - .1 Connection into adjacent piping/tubing:
 - .1 Steel pipe systems: Screwed ends to ANSI/ASME B1.20.1.
 - .2 Copper tube systems: Solder ends to ANSI/ASME B16.18.
 - .3 Provide flanged ends as indicated under 23 05 05, Installation of Pipework.
- .3 Lockshield Keys:
 - .1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.
- .4 Gate Valves:
 - .1 Requirements common to gate valves, unless specified otherwise:
 - .1 Standard specification: MSS SP-80.
 - .2 Bonnet: union with hexagonal shoulders.
 - .3 Connections: screwed with hexagonal shoulders.
 - .4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
 - .5 Packing: non-asbestos.
 - .6 Handwheel: non-ferrous.
 - .7 Handwheel Nut: bronze to ASTM B62.
 - .2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125
 - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
 - .2 Operator: Handwheel.
 - .3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:
 - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
 - .2 Operator: Handwheel.
 - .4 NPS 2 and under, rising stem, split wedge disc, Class 125:
 - .1 Body: with long disc guides, screwed bonnet.
 - .2 Disc: split wedge, bronze to ASTM B283, loosely secured to stem.
 - .3 Operator: Handwheel.
 - .5 NPS 2 and under, rising stem, solid wedge disc, Class 125:
 - .1 Body: with long disc guides, screwed bonnet.
 - .2 Operator: Handwheel.
 - .6 NPS 2 and under, rising stem, solid wedge disc, Class 150:
 - .1 Body: with long disc guides, screwed bonnet.
 - .2 Operator: Handwheel.
- .5 Globe Valves:
 - .1 Requirements common to globe valves, unless specified otherwise:
 - .1 Standard specification: MSS SP-80.
 - .2 Bonnet: union with hexagonal shoulders.
 - .3 Connections: screwed with hexagonal shoulders.

- .4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.
- .5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.
- .6 Handwheel: non-ferrous.
- .7 Handwheel Nut: bronze to ASTM B62.
- .2 NPS 2 and under, composition disc, Class 125:
 - .1 Body and bonnet: screwed bonnet.
 - .2 Disc and seat: renewable rotating PTFE disc, composition to suit service conditions, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
 - .3 Operator: Handwheel.
- .3 NPS 2 and under, composition disc, Class 150:
 - .1 Body and bonnet: union bonnet.
 - .2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
 - .3 Operator: Handwheel.
- .4 NPS 2 and under, plug disc, Class 150, screwed ends:
 - .1 Body and bonnet: union bonnet.
 - .2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem.
 - .3 Operator: Handwheel.
- .5 Angle valve, NPS 2 and under, composition disc, Class 150:
 - .1 Body and bonnet: union bonnet.
 - .2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.
 - .3 Operator: Handwheel.
- .6 Check Valves:
 - .1 Requirements common to check valves, unless specified otherwise:
 - .1 Standard specification: MSS SP-80.
 - .2 Connections: screwed with hexagonal shoulders.
 - .2 NPS 2 and under, swing type, bronze disc, Class 125:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
 - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
 - .3 NPS 2 and under, swing type, bronze disc:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
 - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
 - .4 NPS 2 and under, swing type, composition disc, Class 200:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
 - .2 Disc: renewable rotating disc of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.
 - .5 NPS 2 and under, horizontal lift type, composition disc, Class 150:
 - .1 Body: with integral seat, union bonnet ring with hex shoulders, cap.

- .2 Disc: renewable PTFE rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62.
- .6 NPS 2 and under, vertical lift type, bronze disc, Class 125:
 - .1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.
- .7 Silent Check Valves:
 - .1 NPS 2 and under:
 - .1 Body: cast high tensile bronze to ASTM B62 with integral seat.
 - .2 Pressure rating: Class 125.
 - .3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders.
 - .4 Disc and seat: renewable rotating disc.
 - .5 Stainless steel spring, heavy duty.
 - .6 Seat: regrindable.
- .8 Ball Valves:
 - .1 NPS 2 and under:
 - .1 Body and cap: cast high tensile brass to C37700.
 - .2 Pressure rating: Class 150 WSP/600 WOG.
 - .3 Connections: Screwed ends to ANSI B1.20.1 and with hexagonal shoulders or solder ends to ANSI.
 - .4 Stem: tamperproof ball drive.
 - .5 Stem packing nut: external to body.
 - .6 Ball and seat: replaceable solid hard chrome full port ball and teflon seals.
 - .7 Stem seal: TFE with external packing nut.
 - .8 Operator: removable lever handle.

Part 3 Execution

3.1 INSTALLATION

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Remove internal parts before soldering.
- .3 Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal. Refer to 23 05 05 - Installation of Pipework.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Valves Cast Steel, gate, globe, and check.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
 - .1 ANSI/ASME B16.5-2003, Pipe Flanges and Flanged Fittings.
 - .2 ANSI/ASME B16.10-1992, Face-to-Face and End-to-End Dimensions Valves.
 - .3 ANSI/ASME B16.25-1997, Buttwelding Ends.
 - .4 ANSI/ASME B16.34-1996, Valves - Flanged, Threaded and Welding End.
- .2 American Petroleum Institute (API).
 - .1 API 598-1996, Valve Inspection and Testing.
- .3 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A49-01, Specification for Heat-Treated Carbon Steel Joint Bars.
 - .2 ASTM A193/A193M-04, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
 - .3 ASTM A194/A194M-03b, Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
 - .4 ASTM A216/A216M-1993(03), Specification for Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service.
 - .5 ASTM B85-03, Specification for Aluminum-Alloy Die Castings.
- .4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
 - .1 MSS SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
 - .2 MSS SP-61-2003, Pressure Testing of Steel Valves.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
 - .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit data for valves specified this section.
 - .3 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Closeout Submittals:
 - .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

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

Part 2 Products

2.1 MATERIAL

- .1 Valves:
 - .1 Except for specialty valves, to be of single manufacturer.
 - .2 Valves to be individually tested.
- .2 Requirements common to valves, unless specified otherwise:
 - .1 Pressure-temperature ratings: to ANSI B16.34.
 - .2 Inspections and tests: to API 598.
 - .3 Pressure Testing: to MSS SP-61.
 - .4 Flanged valves:
 - .1 Face-to-face dimensions: to ANSI B16.10.
 - .2 Flange dimensions: to ANSI B16.5 with 1.6 mm raised face.
 - .5 Butt-weld valves:
 - .1 End-to-end dimensions: to ANSI B16.10.
 - .2 End dimensions: to ANSI B16.25 bored for standard pipe schedule.
 - .6 Handwheel: non-heating type with raised rim of die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49.
 - .7 Markings: to MSS SP-25.
 - .8 Identification:
 - .1 Plate showing catalogue number, size, material of body disc, stem seat, fluid, pressure-temperature rating.
 - .2 Body markings: manufacturer, size, primary service rating, material symbol.
 - .9 CRN registration number required for all products.

2.2 GATE VALVES

- .1 NPS 2 1/2 - 12, rising stem, OS&Y, solid flexible wedge disc, flanged or butt-weld ends, Class 300:
 - .1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A216/A216M WCB, with full length disc guides designed to ensure correct re-assembly.
 - .2 Body/bonnet joint: Flat face with corrugated metallic gasket.
 - .3 Bonnet studs: to ASTM A193/A193M Type B7.
 - .4 Bonnet nuts: to ASTM A194/A194M Type 2H.
 - .5 Stuffing box: including non-galling two-piece ball jointed packing gland, with swing-type eye bolts and nuts.
 - .6 Gland packing: containing corrosion inhibitor to prevent stem pitting.
 - .7 Yoke sleeve: Ni-Resist, minimum melting point above 954 degrees C.
 - .8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.

- .9 Disc: with disc stem ring to connect to stem, guided throughout its travel.
 - .1 NPS 2 1/2 - 6: Solid corrosion and heat resistant 13% chromium steel with minimum hardness of 350 HB.
 - .2 NPS 8 and larger: Carbon steel faced with corrosion and heat resistant 13 chromium steel with minimum hardness of 350 HB.
- .10 Seat ring: seamless carbon steel with hard-faced cobalt-chromium-tungsten alloy seating surface, slipped in, seal welded, ground to match disc.
- .11 Stem: heat treated corrosion and heat resistant 13% chromium steel with accurately-cut precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut, T-head disc-stem connection.
- .12 Operator: see elsewhere this section.

2.3 GLOBE VALVES

- .1 NPS 2 1/2 - 12, rising stem, OS&Y, flanged or butt-weld ends, Class 300:
 - .1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A216/A216M WCB.
 - .2 Body/bonnet joint: Flat face with corrugated metallic gasket.
 - .3 Bonnet studs: to ASTM A193/A193M Type B7.
 - .4 Bonnet nuts: to ASTM A194/A194M Type 2H.
 - .5 Stuffing box: including non-galling two-piece ball-jointed packing gland, with swing-type eye bolts and nuts.
 - .6 Gland packing: containing corrosion inhibitor to prevent stem pitting.
 - .7 Yoke bushing: Ni-Resist, minimum melting point above 954 degrees C.
 - .8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.
 - .9 Disc: Plug type with 15 degrees taper seat and bottom guide or ball type with 35 degrees taper seat.
 - .10 Seat rings: with 1.6 mm thick cobalt-chromium-tungsten alloy facings with minimum hardness of 375 HB (cold), slipped in, seal welded, ground to match disc.
 - .11 Stem: heat treated corrosion and heat resistant 13% chromium steel with bonnet bushing, long engagement with yoke bushing for accurate seating, accurately-cut precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.
 - .12 Operator: see elsewhere this section.

2.4 VALVE OPERATORS

- .1 Handwheel: on all valves except as specified.
- .2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in Boiler Rooms and Mechanical Equipment Rooms.

2.5 BYPASSES FOR GATE AND GLOBE VALVES

- .1 Locations: on valves as indicated.
- .2 Position of bypass valve on main valves.

- .3 Size of bypass valve:
 - .1 Main valve up to NPS 8: NPS 3/4.
- .4 Type of bypass valves:
 - .1 On gate valve: globe, with composition disc, bronze trim, to Section 23 05 22 - Valves - Bronze.
 - .2 On globe valve: globe, with composition disc, bronze trim, to Section 23 05 22 - Valves - Bronze.

2.6 CHECK VALVES

- .1 NPS 2 1/2 and over, flanged or butt-weld ends, Class 300: swing check.
 - .1 Body and multiple-bolted cap: cast steel to ASTM A216/A216M WCB.
 - .2 Cap studs: to ASTM A193/A193M Type B7.
 - .3 Cap nuts: to ASTM A194/A194M Type 2H.
 - .4 Body/cap joint: male-female face with corrugated metallic gasket.
 - .5 Disc: heat treated corrosion and heat resistant 13% chromium steel.
 - .6 Seat rings: heat treated corrosion and heat resistant 13% chromium steel, slipped in, seal welded, ground to match disc.
 - .7 Hinge: cast carbon steel.
 - .8 Hinge pin: stainless steel (410).

2.7 SILENT CHECK VALVES

- .1 Construction:
 - .1 Body: Cast steel to ASTM A216 WCB with integral seat.
 - .2 Pressure rating: Class 300.
 - .3 Connections: Flanged or Wafer ends.
 - .4 Double bronze disc with SS seat and stem. Renewable disc, seat, stem and spring. Spring rating must match system design for silent operation and installation.
 - .5 Stainless steel spring, heavy duty.
 - .6 Seat: regrindable.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's recommendations in upright position with stem above horizontal.
- .2 Install valves with unions or flanges to each piece of equipment arranged to allow servicing, maintenance, and equipment removal. Refer to Section 23 05 05 Installation of Pipework.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.
 - .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1-04, Power Piping.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A125-1996(R2001), Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-04, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563-04a, Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM)
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 ANSI/MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .6 Underwriter's Laboratories of Canada (ULC)

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
 - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment and prevent vibration.
 - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.
 - .6 Pipe supports shall meet the requirements of ASME B31.1 Power Piping and ASME B31.9 Building Services Piping.

- .7 Automatic sprinkler pipe supports shall meet the requirements of NFPA No. 13, Standard for Installation of Sprinkler Systems.
- .8 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.
- .9 Select hangers and supports for the service and in accordance with the manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.
- .10 Fasten hangers and supports to building steel in accordance with the requirements of Structural or inserts in concrete construction.
- .11 Provide and set sleeves required for equipment, including openings required for placing equipment.
- .12 Obtain approval prior to drilling for inserts and supports for piping systems.
- .13 Obtain approval prior to using percussion type fastenings.
- .14 Use of existing piping or equipment for hanger supports is not permitted.
- .15 Use of perforated band iron, wire or chain as hangers is not permitted.

1.4 QUALITY ASSURANCE

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

Part 2 Products

2.1 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ASME B31.1, ASME B31.9 and MSS SP58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.
- .3 Design hangers so they cannot become disengaged by movements of supported pipe.

2.2 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Use electro-plating galvanizing process or hot dipped galvanizing process.
 - .3 Ensure steel hangers in contact with copper piping are copper plated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .1 Rod: to be UL listed.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS-SP58 and MSS-SP69.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP69.

- .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.
- .4 Upper attachment to concrete:
 - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS SP69.
- .5 Shop and field-fabricated assemblies:
 - .1 Trapeze hanger assemblies: Steel channels with welded spacers and hanger rods, cast iron roll and stand for hot pipe sizes 150 mm and over.
 - .2 Steel brackets: Welded and wrought steel clamp.
- .6 Hanger rods: threaded rod material to MSS SP58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 threaded both ends, one end or continuous.
- .7 Pipe attachments: material to MSS SP58:
 - .1 Attachments for steel piping: carbon steel black.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.
- .8 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.
- .10 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
 - .1 Finishes for steel pipework: black.
 - .2 Finishes for copper, glass, brass or aluminum pipework: black, with formed portion plastic coated.
- .11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.
- .12 Wall Support:
 - .1 Up to 75 mm: Cast iron hook.
 - .2 100 mm and over: Welded steel bracket and wrought steel clamp.
- .13 Floor Support:
 - .1 Pipe sizes up to 100 mm and all cold pipe sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier to steel support.
 - .2 Hot pipe sizes 150 mm and over: Adjustable cast iron roll and stand, steel screws and concrete pier or steel support.
- .14 Insulation:
 - .1 Supports shall be coordinated with requirements of insulation. Oversized hangers are required for all pipe systems that require insulation with a vapour barrier to maintain integrity of vapour barrier.
 - .2 Oversized hangers shall also be required for steam pipe systems.

2.3 RISER CLAMPS

- .1 Steel or cast iron pipe: black carbon steel to MSS SP58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

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

2.5 CONSTANT SUPPORT SPRING HANGERS

- .1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).
- .2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
- .3 Provide upper and lower factory set travel stops.
- .4 Provide load adjustment scale for field adjustments.
- .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 VARIABLE SUPPORT SPRING HANGERS

- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
- .2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.
- .3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.
- .4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.7 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 50 00 - Metal Fabrications.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

2.9 HOUSEKEEPING PADS

- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.
- .2 Concrete: to Section 03 30 00 - Cast-in-place Concrete.

2.10 SLEEVES

- .1 Pipes through floors: Form with 18 gauge galvanized steel.
- .2 Pipes through beams, walls, fire proofing, footings, potentially wet floor: Form with steel pipe or 18 gauge galvanized steel.
- .3 Size large enough to allow for movement due to expansion and to provide for continuous insulation.

2.11 OTHER EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 50 00 - Metal Fabrications.
- .2 Submit structural calculations with shop drawings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install in accordance with:
 - .1 manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
 - .1 Install on piping systems at pumps, at all vibration isolated equipment and as indicated.
- .3 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

- .2 Bolt-tightening torques to industry standards.
- .3 Steel pipes: install below coupling or shear lugs welded to pipe.
- .4 Cast iron pipes: install below joint.
- .4 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6 Use approved constant support type hangers where:
 - .1 vertical movement of pipework is 13 mm or more,
 - .2 transfer of load to adjacent hangers or connected equipment is not permitted.
- .7 Use variable support spring hangers where:
 - .1 transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 variation in supporting effect does not exceed 25% of total load.

3.3 INSERTS

- .1 Use inserts for suspending hangers for reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.
- .2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over 100 mm.
- .3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.
- .4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

3.4 HANGER SPACING

- .1 Plumbing piping: to Canadian Plumbing Code, Provincial Code, authority having jurisdiction.
- .2 Fire protection: to applicable Fire Code.
- .3 Copper piping: up to NPS 1/2: every 1.5 m.
- .4 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.
- .5 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper	Rod Diameter
up to 32 mm	1.8 m	1.8 m	9.5 mm
38 mm	1.8 m	1.8 m	9.5 mm
50 mm and 63 mm	3.0 m	3.0 m	9.5 mm
75 mm - 100 mm	3.6 m	3.0 m	15.8 mm
150 mm - 200 mm	4.3 m	4.3 m	22.2 mm

- .6 Install hangers to provide a minimum 12 mm clear space between finished covering and adjacent work.

3.5 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.
- .4 Use hangers which are vertically adjustable 38 mm minimum after piping is erected.
- .5 Support horizontal soil pipe near each hub, with 1.5 m maximum spacing between hangers.
- .6 Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.
- .7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- .8 Where practical, support riser piping independently of connected horizontal piping.
- .9 Hangers: Pipe sizes 12 mm to 38 mm: Adjustable wrought steel ring.
- .10 Hangers: Pipe sizes 50 mm to 100 mm and Cold Pipe Sizes: Adjustable wrought steel clevis.

3.6 SLEEVES

- .1 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.
- .2 Extend sleeves through potentially wet floors 25 mm above finished floor level. Caulk sleeves full depth and provide floor plate.
- .3 Where piping passes through floor, ceiling or wall close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.
- .4 Install chrome plated escutcheons where piping passes through finished surfaces.
- .5 All penetrations through fire rated walls, floors or partition assemblies shall be sealed/fire stopped with fire stop materials that will remain in place and prevent the passage of smoke, toxic gases, flame, etc., when subjected to the standard test method Can 4-S115, "Standard Method of Fire Tests for Firestop Systems" for a period of time equal to fire protection rating required for the grade of fire separation of the penetrated wall or floor.

- .6 Acceptable Product: According to instructions provided, all penetrations in fire rated walls, floors, or partition assemblies shall be sealed/fire stopped with:
 - .1 3M Brand Intumescent, "Fire Barrier" Caulk CP-25, Putty 303, Penetration Sealing Systems 7902 or 7904 Series, Composite Sheet CS-195, or Wrap Strip FS-195.
 - .2 Tremco Firestop Systems: Fyresil, Fyreshield for penetrations and perimeters. Dymeric ULC, THC 900 ULC

3.7 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.8 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems

1.2 REFERENCES

- .1 ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

- .1 Section 01 33 00: Procedures for submittals.
- .2 Submit list of wording, symbols, letter size, and colour coding for mechanical identification.
- .3 Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- .4 Product Data: Provide manufacturers catalogue literature for each product required.

1.4 PROJECT RECORD DOCUMENTS

- .1 Section 01 78 00: Submittals for project closeout.
- .2 Record actual locations of tagged valves.

2 Products

2.1 LANGUAGE

- .1 Identification in English.

2.2 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this section

2.3 PIPING SYSTEMS GOVERNED BY CODES

- .1 Identification of Natural gas: to CSA/CGA B149.1 and authority having jurisdiction.
- .2 Identification of Sprinkler System: to NFPA 13

2.4 NAMEPLATES

- .1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

- .2 Colours:
- .1 Hazardous: red letters, white background
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable Codes)

- .3 Sizes: Conform to following table using a maximum of 25 characters per line.

Size #	mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1		10 x 50	1	3
2		13 x 75	1	5
3		13 x 75	2	3
4		20 x 100	1	8
5		20 x 100	2	5
6		20 x 200	1	8
7		25 x 125	1	12
8		25 x 125	2	8
9		35 x 200	1	20

Description: Laminated three-layer plastic with engraved black letters on light contrasting background colour.

2.5 TAGS

- .1 Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background colour. Tag size minimum 40 mm diameter.
- .2 Control Tag: Laminated plastic card with black letters on light contrasting background colour in multiple lines. Tag size minimum 85mm x 55mm. Inscriptions to include function and (where appropriate) fail-safe position
- .3 Metal Tags: Brass with stamped letters; tag size minimum 40 mm diameter with smooth edges.
- .4 Chart: Typewritten letter size list in anodized aluminum frame.

2.6 STENCILS

- .1 Stencils: With clean cut symbols and letters of following size:
 - .1 20-30 mm Outside Diameter of Insulation or Pipe: 200 mm long colour field, 15 mm high letters.
 - .2 40-50 mm Outside Diameter of Insulation or Pipe: 200 mm long colour field, 20 mm high letters.
 - .3 65-150 mm Outside Diameter of Insulation or Pipe: 300 mm long colour field, 30 mm high letters.
 - .4 200-250 mm Outside Diameter of Insulation or Pipe: 600 mm long colour field, 65 mm high letters.
 - .5 Over 250 mm Outside Diameter of Insulation or Pipe: 800 mm long colour field, 90 mm high letters.
 - .6 Ductwork and Equipment: 65 mm high letters.
- .2 Stencil Paint: As specified in Section 09 91 10, semi - Painting.1.

2.7 PIPE MARKERS

- .1 Colour: Conform to ASME A13.1.
- .2 Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- .3 Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- .4 Underground Plastic Pipe Markers: Bright coloured continuously printed plastic ribbon tape, minimum 150 mm wide by 0.10 mm thick, manufactured for direct burial service.

2.8 CEILING TACKS

- .1 Description: Steel with 20 mm diameter colour coded head.
- .2 Colour code as follows:
 - .1 Yellow - HVAC equipment
 - .2 Red - Fire dampers/smoke dampers
 - .3 Green - Plumbing valves
 - .4 Blue - Heating/cooling valves

2.9 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Pictograms: where required to Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend: Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .4 Arrows showing direction of flow:
 - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
 - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
 - .3 Use double-headed arrows where flow is reversible
- .5 Extent of background colour marking.
 - .1 To full circumference of pipe or insulation.
 - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Extent of background colour marking.
- .7 Materials for background colour marking, legend, arrows:
 - .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 Other pipes: pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of

100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C

- .8 Colours and Legends:
 - .1 Where not listed, obtain direction from Departmental Representative.
 - .2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE
 - .3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Sanitary	Green	SAN
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS

2.10 IDENTIFICATION OF DUCTING SYSTEMS

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: back, or co-ordinated with base colour to ensure strong contrast

2.11 VALVES AND CONTROLLERS

- .1 Valves to be complete with brass tags with 12 mm stamped identification data filled with black paint coordinated with Valve Tag List.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.
- .3 Controllers to be complete with controls laminated identification tag.
- .4 Identify all control systems components including but not limited to equipment, components, controls, sensors with control tags specified in this section.

2.12 FIRE DAMPERS

- .1 All new fire dampers shall be tagged with unique tag (FD-1, FD-2 etc.), 12 mm stamped identification data filled with black paint. Contractor shall compile a Fire Damper Tag List and include in O&M. List to identify fire damper tag and location in building.

2.13 EQUIPMENT WITHIN CEILING SPACE

- .1 Provide identification (equipment labels and colour coded dots) on the ceiling for all equipment concealed within a ceiling space in addition to identification on equipment.
- .2 Equipment Labels:
 - .1 Colours: Black lettering on transparent background.
 - .2 Height of letter: 5 mm.

- .3 T-bar ceilings: Label shall be located on the metal ceiling grid beside the ceiling tile that provides service access to the equipment. The label shall include the equipment tag and an arrow indicating the ceiling tile to remove for servicing and access to the equipment.
 - .4 Solid ceilings: Label shall be located on the trim of the access panel used for servicing the equipment and include the equipment tag.
- .3 Colour Coded Dots:
- .1 Confirm site standard colour coding with the Departmental Representative prior to commencing work. Coordinate with all trades.
 - .2 Provide a Legend in the operating and maintenance manual identifying the colour coding utilized on site.
 - .3 T-bar ceilings: Dot shall be located on the metal ceiling grid beside the ceiling tile that provides service access to the equipment.
 - .4 Solid ceilings: Dot shall be located on the trim of the access panel used for servicing the equipment.

3 Execution

3.1 PREPARATION

- .1 Degrease and clean surfaces to receive adhesive for identification materials.
- .2 Prepare surfaces to Section 09 91 23 for stencil painting.

3.2 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- .3 Install tags with corrosion resistant chain.
- .4 Apply stencil painting to Section 09 91 23.
- .5 Install plastic pipe markers to manufacturer's written instructions.
- .6 Install plastic tape pipe markers complete around pipe to manufacturer's written instructions.
- .7 Install underground plastic pipe markers 150 to 200 mm below finished grade, directly above buried pipe.
- .8 Identify equipment including air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as small in-line pumps, may be identified with tags.
- .9 Identify control panels and major control components outside panels with control tags.
- .10 Identify thermostats relating to terminal boxes or valves with nameplates.
- .11 Identify valves in main and branch piping with tags.

- .12 Identify air terminal units and radiator valves with numbered tags.
- .13 Tag automatic controls, instruments, and relays. Key to control schematic.
- .14 Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Location of identification not to exceed 6 m on straight runs including risers and drops, adjacent to each valve and Tee, adjacent to each change in direction, at each side of penetration of structure or enclosure, and at each obstruction. Provide additional identification at point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side
- .15 Identify ductwork with stencilled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- .16 Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.
- .17 Identify electric starting switches and remote push button stations with nametags.
- .18 Provide identification on the ceiling for all equipment concealed within a ceiling space in addition to identification on the equipment.
- .19 Tag new fire dampers sequentially and record on Fire Damper Tag List.

3.3 VALVE, CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Owner. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1-01, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
 - .2 ASTM C335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C547, Specification for Mineral Fiber Pipe Insulation.
 - .6 ASTM C553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .7 ASTM C612, Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .8 ASTM C795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
 - .9 ASTM C921-(1998)e1, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

- .4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (R1999).

- .5 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701, Thermal Insulation Polyotrene, Boards and Pipe Covering.

1.2 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein.
 - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

- .2 TIAC Codes:
 - .1 CRD: Code Round Ductwork,
 - .2 CRF: Code Rectangular Finish.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.4 MANUFACTURERS' INSTRUCTIONS

- .1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Installation instructions to include procedures used, and installation standards achieved.

1.5 QUALITY ASSURANCE

- .1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.
- .2 Materials: UL listed; flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.
- .3 Do work to TIAC standards.
- .4 Deliver material to job site in original non-broken factory packaging, labelled with manufacturer's density and thickness.
- .5 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

Part 2 Products

2.1 FIRE AND SMOKE RATING

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

2.2 INSULATION

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335. Maximum "K" factor to be 0.035 W/m. deg.K (0.24 BTU in/hr/sq.ft. Deg.K) to ASTM C5553.
- .3 TIAC Class C-1: Rigid mineral fibre board to ASTM C612, unfaced or faced with vapour retarder jacket; ksi value of 0.035 at 24 degrees C.

- .4 TIAC Code C-2: mineral fibre blanket to ASTM C553 with or without factory applied vapour retarder jacket; ksi value of 0.035 at 24 degrees C
- .5 Flexible Duct Liner: Flexible non-combustible mineral fiber blanket to ASTM C 1071 Type 1; ksi value of 0.035 at 24 degrees C, 24 kg/cu m minimum density; coated air side for maximum 20.3 m/s air velocity. Minimum NRC value of 0.65 at 25mm to ASTM 423.
- .6 Rigid Duct Liner: semi-rigid non-combustible mineral fiber to ASTM C 1071 Type 2; ksi value of 0.035 at 24 degrees C, 48 kg/cu m minimum density; coated air side for maximum 20.3 m/s air velocity. Minimum NRC value of 0.7 at 25mm to ASTM 423.

2.3 JACKETS

- .1 Interior Applications:
 - .1 Vapour Barrier Jackets: to CGSB 51-GP-52Ma.
 - .2 PVC Jackets: One piece, high-gloss pre-moulded type, 0.8 mm (30mls) thick. Jackets exposed to outdoor use or flourescent lighting shall be ultra-violet ray resistant.
 - .3 Canvas Jackets: ULC listed treated cotton fabric, 220 g/sq.m. to ASTM C 921
 - .4 Aluminum Jackets: 0.51 mm thick; stucco embossed.
- .2 Exterior Applications:
 - .1 Aluminum Jackets: 0.51 mm thick; stucco embossed.
 - .2 Stainless Steel Jackets: Type 304 stainless steel; 0.25 mm thick, stucco embossed
 - .3 Outdoor Jacket: Coated glass fibre sheet, 16 kg/sq m.

2.4 ACCESSORIES

- .1 Bands: 20 mm wide; 0.38 mm thick stainless steel.
- .2 Insulating Cement: Hydraulic setting on mineral wool.
- .3 Fibrous Glass Cloth: Untreated; 305 g/sq m weight.
- .4 Adhesives: Compatible with insulation, waterproof, fire-retardant type.
- .5 Impale Anchors: Galvanized steel, 2 mm diameter with 35mm diameter head, length as required for insulation.
- .6 Joint Tape: self adhesive reinforced aluminum, minimum 50mm wide
- .7 Tie Wire: stainless steel, 1.5 mm.
- .8 Outdoor vapour retarder mastic:
 - .1 Vinyl emulsion type acrylic, compatible with insulation
 - .2 Fibrous glass cloth

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure testing of ductwork systems complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

- .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 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.
- .6 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .7 Locate insulation or cover seams in least visible location.
- .8 Provide recovering jackets on exposed insulation throughout, including equipment room. Insulation located in crawl spaces, shafts and suspended ceiling spaces is not considered exposed. Use pre-sized paper under recovering at uneven insulated surfaces.
- .9 External Duct Insulation:
 - .1 Secure insulation with vapour barrier with wires and seal jacket joints with vapour barrier adhesive or tape to match jacket.
 - .2 Secure insulation without vapour barrier with staples, tape, or wires.
 - .3 Install without sag on underside of duct work. Use adhesive or mechanical fasteners to prevent sagging. Seal vapour barrier penetrations with vapour barrier adhesive. Stop and point insulation around access doors and damper operators.
- .10 Exposed Rectangular: Secure rigid insulation with 50% coverage of adhesive and 12 gauge galvanized impale anchor tabs on 400 mm (16") centres. Seal joints and breaks with 250 mm (10") wide strips of open mesh glass cloth or tape imbedded between 2 coats of vapour barrier sealant. Point up other joints and breaks with hydraulic setting cement.
- .11 Round Duct and Concealed Rectangular Duct: Adhere flexible insulation to ductwork with adhesive applied in 150 mm (6") wide strips on 400 mm (16") centres. Provide 16 gauge annealed tie wire tied, spiral wound or half hitched at 200 mm (8") centres for securing duct insulation until adhesive sets. Butt insulation and seal joints and breaks with 50 mm (2") lap of foil adhered over joint.

- .12 Acoustic lining: Apply to interior of ducts where shown.
 - .1 Adhere insulation with adhesive for 100 percent coverage. Secure insulation with mechanical fasteners on 375 mm centres maximum on top and side of duct work with dimension exceeding 500 mm. Seal and smooth joints. Seal vapour barrier penetrations with vapour barrier adhesive. Cut off excess fastener length and cover with brush coat of mastic.
 - .2 Use 25 mm (1") thick insulation unless otherwise noted.
 - .3 Provide vapour barrier located on the warm side for outside air intakes.
 - .4 Ducts with acoustic insulation do not require external thermal insulation
 - .5 Ductwork dimensions indicated on drawings include insulation thickness.

3.3 INSTALLATION - JACKETS

- .1 Install in accordance with TIAC standards and manufacturers written requirements.
- .2 Provide recovering jackets on exposed insulation throughout, including equipment room. Insulation located in crawl spaces, shafts and suspended ceiling spaces is not considered exposed. Use pre-sized paper under recovering at uneven insulated surfaces.

3.4 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thicknesses: conform to following table:

System	TIAC Code	Vapour Retarder	Thickness (mm)
Round cold and dual temperature supply air ducts	C-2	yes	50
- .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 TIAC codes noted in table:

	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

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Thermal insulation for piping and piping accessories.

1.2 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) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (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.

1.3 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as specified.
- .2 TIAC ss:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.

1.4 QUALITY ASSURANCE

- .1 Applicator: Company specializing in mechanical insulation application with three years minimum experience.
- .2 Materials: UL listed; flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.
- .3 Do work to TIAC standards.
- .4 Deliver material to job site in original non-broken factory packaging, labelled with manufacturer's density and thickness.
- .5 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

Part 2 Products

2.1 FIRE AND SMOKE RATING

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

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre and rock wool. Insulation on steam lines to be rock wool only, glass fibre is not permitted.
 - .1 TIAC Code A-1; rigid pre-moulded mineral fibre to ASTM C 547 with or without factory applied vapour retarder jacket; ksi value of 0.035 at 24 degrees
 - .2 TIAC Code A-2: rigid moulded calcium silicate to ASTM C533 in sections and blocks, and with special shapes to suit project requirements, asbestos free; ksi value of 0.060 at 147 degrees C
 - .3 TIAC Code A-3: rigid pre-moulded mineral fibre to ASTM C 547 with or without factory applied vapour retarder jacket for high temperature applications; ksi value of 0.072 at 260 degrees C
 - .4 TIAC Code A-6: flexible unicellular tubular elastomer to ASTM C534; ksi value of 0.04 at 24 degrees C

- .5 TIAC Class C-1: Rigid mineral fibre board to ASTM C612, unfaced or faced with CGSB 51-GP-52Ma vapour retarder jacket; ksi value of 0.035 at 24 deg.C.
- .6 TIAC Code C-2: mineral fibre blanket to ASTM C553 with or without factory applied vapour retarder jacket. Thermal conductivity; ksi value of 0.04 at 24 deg.C

2.3 REMOVABLE, PRE-FABRICATED INSULATING ENCLOSURES

- .1 Use of insulating materials other than those stated in this specification requires Departmental Representative's approval. Standard of acceptance for re-usable insulation blankets shall be Reflex Re-usable flexible insulation covers.
- .2 All materials shall be of flame resistant materials.
- .3 Re-usable flexible insulation blanket outer jacket material shall be 0.26 kg/m2. Teflon coated fibreglass cloth.
- .4 Material used to secure seams and attachments on re-usable flexible insulation blankets shall be 10 strand stainless steel thread with polyester wrap.
- .5 Re-usable flexible insulation blanket liner material shall be 560 grams/m2 Teflon coated fibreglass cloth for operating temperatures up to 232 deg.C.
- .6 Minimum insulation thickness shall be 25 mm insulation for operating temperatures up to 232 deg.C.
- .7 Insulation materials shall be Type E needled fibreglass mat containing no organic binders and no less than 11 pound density for operating temperatures up to 538 deg.C.
- .8 Fasteners shall be velcro closures incorporated with seam flaps in conjunction with sewn on straps and stainless steel D rings.
- .9 Flaps shall be used to cover all closing seams and cover slots. The flaps shall be 50 mm wide plain flaps for operating temperatures up to 232 deg.C.
- .10 6 mm matrix braded Nomex draw-cord closures shall be used on cover openings over 50 mm in diameter. Close the ends of covers over adjacent insulation or piping.
- .11 Quilting fasteners shall be 14 gauge stainless steel quilt pins and locking washers.
- .12 A stainless steel drain grommet, 11 mm in diameter, shall be installed at the low point on the cover.
- .13 A permanent stainless steel or aluminum identification tag shall be attached to each blanket. Tags shall be secured to the re-usable blanket with aluminum rivets and shall be installed in the most visible location on the blanket.

2.4 ACCESSORIES

- .1 Bands: 20 mm wide; 0.38 mm thick stainless steel.
- .2 Insulating Cement: Hydraulic setting on mineral wool.
- .3 Fibrous Glass Cloth: Untreated; 305 g/sq m weight.

- .4 Adhesives: Compatible with insulation, waterproof, fire-retardant type.
- .5 Impale Anchors: Galvanized steel, 2 mm diameter with 35mm diameter head, length as required for insulation.
- .6 Joint Tape: self adhesive reinforced aluminum, minimum 50mm wide
- .7 Tie Wire: stainless steel, 1.5 mm.
- .8 Outdoor vapour retarder mastic:
 - .1 Vinyl emulsion type acrylic, compatible with insulation
 - .2 Fibrous glass cloth

2.5 JACKETS

- .1 Interior Applications:
 - .1 Vapour Barrier Jackets: to CGSB 51-GP-52Ma.
 - .2 PVC Jackets: One piece, high-gloss pre-moulded type, 0.8 mm (30mls) thick. Jackets exposed to outdoor use or fluorescent lighting shall be ultra-violet ray resistant.
 - .3 Canvas Jackets: ULC listed treated cotton fabric, 220 g/sq.m. to ASTM C 921
 - .4 Aluminum Jackets: 0.51 mm thick; stucco embossed.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PRE-INSTALLATION REQUIREMENT

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

3.3 INSTALLATION ON PIPING

- .1 Install materials in accordance with manufacturer's instructions and TIAC National standards.
- .2 Continue insulation with vapour barrier through penetrations. pack around pipes with fire proof self-supporting insulation material, properly sealed.
- .3 In exposed piping, locate insulation and cover seams in least visible locations.
- .4 Provide insulation with vapour barrier when medium conveyed may be below ambient temperature and as noted on schedules.
- .5 Insulate fittings and valves on pipe systems.

- .6 On insulated piping with vapour barrier, insulate fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints. Cover with open mesh glass cloth sealed with vapour barrier sealant.
- .7 On insulated piping without vapour barrier and piping conveying fluids 60 degrees C or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation at such locations.
- .8 Provide an insert of cork or other heavy density material not less than 150 mm long, of same thickness and contour as adjoining insulation, between support shield and piping, but under the finish jacket, on piping 50 mm diameter or larger.
- .9 Neatly finish insulation at supports, protrusions, and interruptions.
- .10 Handicap Plumbing Fixtures: Insulate trap and drain with 25 mm (1") fibreglass insulation complete with high gloss white PVC jacket. Refer to Plumbing specifications.
- .11 Each and every chilled water pipe fitting and accessories located outside of the mechanical room shall be insulated to prevent sweating on exposed parts, this includes all unions, balancing valves, strainers, drains, air vent stems, etc. All parts utilized in maintaining the system shall be insulated with removable insulation. In mechanical rooms, insulation may be omitted on equipment where drain pans are provided including pumps and associated inlet valves.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 Removable insulation bags must be provided for the following: control valves, unions or flanges at equipment, steam traps and flanged valves.
- .2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Blankets on flanged valves and equipment shall be designed to cover adjacent mating flanges and overlap line insulation by a minimum of 50 mm. Allowance of stud length plus 25 mm from the back of the mating flange shall be used to calculate the cut back distance of line insulation. Draw-cold flaps shall not be considered as part of the overlap.
- .4 Blankets on valves shall be designed to cover the valve body and the bonnet flange of the valve.
- .5 Blankets for pressure gauges include block and bleed valve.
- .6 Blankets for PSV's shall include the outlet flange. Blanket shall cover entire spring chamber.
- .7 All blankets shall be fitted with an identification tag clearly marked with the following information:
 - .1 Equipment size and type i.e. 6" 300# Control Valve
 - .2 Equipment location and tag number i.e. 21-PV-129
 - .3 Manufacturer's Serial Number i.e. SN01010

- .8 All equipment shall be field measured by blanket supplier. Measurements shall be performed after equipment is installed. All necessary allowances for the blankets shall be coordinated between the blanket supplier and the mechanical, electrical and insulation Contractors.
- .9 Re-usable flexible insulation blanket construction:
 - .1 Blankets up to 25 mm thick shall be inside seam construction with double stitching, with the liner and jacket material sewn together to form the insulation pocket.
 - .1 Perimeter flaps shall be formed as an extension of the liner and jacket, and shall not be attached to blanket as separate pieces.
 - .2 All blankets up to 25 mm thick must be double stitched. First stitch will be performed with cloth layers sewn together inside out. Blanket will then be turned right side out and top stitched around all penetrations and around the perimeter of the insulation pocket to create a separation between the insulation pocket and the perimeter flaps.
 - .3 All draw-cord and closure flaps, required inside the perimeter of the blanket shall be attached inside the seam, between the liner and jacket layers of the blanket.
 - .2 Blankets over 25 mm thick shall be constructed using boxed corners and gussets in order to maintain consistent thickness across the entire area of the blanket.
 - .1 Perimeter flaps shall be formed as an extension of the outer jacket, and shall not be attached to the blanket as separate pieces.
 - .2 All draw-cord and closure flaps, required inside the perimeter of the blanket, shall be attached inside the seam, between the liner and jacket layers of the blanket.

3.5 INSTALLATION - JACKETS

- .1 Install in accordance with TIAC standards and manufacturers written requirements.
- .2 Indoor, Concealed Pipes: Apply pipe insulation with an integral all-service jacket complete with vapour barrier if specified. Secure jacketing using appropriate fastenings on approximately 100mm centres. Cover longitudinal and circumferential joints with jacket finishing tape neatly applied. Alternately secure jacketing using integral self-sealing lap and self-sealing circumferential joint strips. Fittings, (valves and strainers if specified) not finished with PVC covers shall be covered with a hard coat cement and finish with treated fitting fabric applied with fabric adhesive. Finish jackets as scheduled.
- .3 Indoor, Exposed Applications: Insulate as for concealed applications. Finish jacket to be as indicated in schedule. Where indicated by Architect to be painted, finish insulation with canvas jacket; size for finish painting.
- .4 Exterior Applications: Vapour barrier jacket, covered with aluminum jacket with seams located on bottom side of horizontal piping. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapour barrier cement. Lap joints 75 mm (3") minimum and seal with compatible waterproof lap cement.
- .5 Provide recovering jackets on exposed insulation throughout, including equipment room. Insulation located in crawl spaces, shafts and suspended ceiling spaces is not considered exposed. Use pre-sized paper under recovering at uneven insulated surfaces.

- .6 Metal Jackets: Over the pipe insulation apply metal jacketing using necessary fastenings on approximately 150mm centres. Over insulated fittings, (valve bodies, valve bonnets, strainers and flanges etc. as specified) apply metal jacket or preformed metal fitting covers to provide a complete jacket system. Secure with necessary fastenings.
- .7 PVC Jackets: Over the pipe insulation apply PVC jacketing using necessary fastenings on approximately 100mm centres. Cover longitudinal and circumferential joints with finishing tape neatly applied. Over insulated fittings, valve bodies, valve bonnets, strainers and flanges if specified) apply PVC jacket or preformed PVC fitting covers to provide a complete jacket system. Secure with appropriate fastenings and jacket finishing tape.

3.6 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges, fittings and all associated equipment unless otherwise specified.
- .2 TIAC Code: A-1.
 - .1 Seals: lap seal adhesive, lagging adhesive.
 - .2 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
 - .1 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .2 Installation: TIAC Code: 1501-C.
- .4 TIAC Code: A-6.
 - .1 Seals: lap seal adhesive, lagging adhesive.
 - .2 Installation: to TIAC standards.
- .5 TIAC Code: C-2 vapour retarder jacket.
 - .1 Seals: lap seal adhesive, lagging adhesive.
 - .2 Installation: TIAC Code: 1501-C.
- .6 TIAC Code: A-2.
 - .1 Seals: lap seal adhesive, lagging adhesive.
 - .2 Installation: TIAC Code: 1501-H.
- .7 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.
 - .3 Chilled water insulation thicknesses are listed such that a minimum of 25mm is maintained over all fittings, valves and accessories.
 - .4 Note that in accordance with the National Energy Code of Canada for Buildings HVAC piping located outside the building envelope shall be insulated to the thickness specified for steam over 175 Deg.C. This requirement does not alter the TIAC Code defining the type of insulation to be used.

Application	Temp deg.C.	TIAC code	Pipe sizes (NPS) & insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Refrigerant	4 - 13	A-6	25	25	25	25	25	25
Refrigerant	below 4	A-6	25	25	38	38	38	38
cond. drain and pan		C-2	25	25	25	25	25	25

- .8 Finishes:
 - .1 Exposed indoors: canvas or PVC
 - .2 Exposed in mechanical rooms: PVC jacket.
 - .3 Concealed, indoors: canvas on valves, fittings. No further finish.
 - .4 Use vapour retarder jacket on TIAC code A-3, A-6 and C-2 insulation compatible with insulation.
 - .5 Outdoors: water-proof aluminum jacket.
 - .6 Finish attachments: SS screws, at 150 mm on centre. Seals: wing.
 - .7 Installation: to appropriate TIAC code CRF/1 through CPF

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Metal duct work.
- .2 Duct cleaning.

1.2 REFERENCES

- .1 ASTM A36/A36M - Carbon Structural Steel.
- .2 ASTM A90/A90M - Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
- .3 ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .4 ASTM A480/A480M - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
- .5 ASTM A568/A568M - General Requirements for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
- .6 ASTM A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .7 ASTM A1008/A1008M - Steel, Sheet, Cold-Rolled Carbon, Structural, High-Strength Low-Alloy and High Strength Low-Alloy with Improved Formability.
- .8 ASTM A1011/A1011M - Standard Specification for Steel, Sheet, and Strip Hot-Rolled, Carbon, Structural, High-Strength, Low-Alloy with Improved Formability.
- .9 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- .10 ASTM C14/C14M - Concrete Sewer, Storm Drain, and Culvert Pipe.
- .11 ASTM C443 - Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
- .12 AWS D9.1 - Sheet Metal Welding Code.
- .13 NBS PS 15 - Voluntary Product Standard for Custom Contact-Moulded Reinforced-Polyester Chemical Resistant Process Equipment.
- .14 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- .15 NFPA 90B - Installation of Warm Air Heating and Air-Conditioning Systems.
- .16 NFPA 91 - Exhaust Systems for Air Conveying of Vapours, Gases, Mists, and Noncombustible Particulate Solids.
- .17 NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .18 SMACNA - HVAC Air Duct Leakage Test Manual.
- .19 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- .20 SMACNA - Fibrous Glass Duct Construction Standards.
- .21 UL 181 - Factory-Made Air Ducts and Connectors.

1.3 DEFINITIONS

- .1 Low pressure/low velocity: static pressure in duct less than 498 Pa (2" w.g.) and velocities less than 10 meters/second (2000 fpm).
- .2 Medium pressure/high velocity: Static pressure in duct less than 996 Pa (4" w.g.) and velocities between 10 meters/second (2000 fpm) and 20 meters/second (4000 fpm).
- .3 High pressure/high velocity: Static pressure in ducts more than 996 Pa (4" w.g.) And velocities greater than 4000 fpm.
- .4 Duct sizes: as shown on drawings are outside dimensions. For acoustically lined or internally insulated ducts, sizes shown are actual duct sizes and the insulation thickness has been accounted for.

1.4 PERFORMANCE REQUIREMENTS

- .1 No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts to ASHRAE table of equivalent rectangular and round ducts.

1.5 SUBMITTALS

- .1 Section 01 33 00: Procedures for submittals.
- .2 Shop Drawings: Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work for 1000 kPa pressure class and higher systems.
- .3 Product Data: Provide data for duct materials.
- .4 Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.6 QUALITY ASSURANCE

- .1 Perform Work to SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.7 QUALIFICATIONS

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .2 Installer: Company specializing in performing the work of this section with minimum 3 years documented experience.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- .2 Maintain temperatures during and after installation of duct sealants.

2 Products

2.1 DUCT MATERIALS

- .1 Galvanized Steel Ducts: ASTM A653 galvanized steel sheet, lock-forming quality, having G60 zinc coating to ASTM A90 on both sides.
- .2 Fasteners: use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts.

2.2 SEALANT

- .1 Oil resistant, water based or solvent based, anti-microbial, anti-bacterial, ultra violet resistant, polymer type, flame resistant duct sealant.

- .2 VOC content to be less than VOC limits of the State of California's South Coast Air Quality District Rule #1168. VOC content less than 30 g/L (less water and less exempt compounds) for sealing metal to metal contact.
- .3 Sealant shall be cured for a minimum of 48 hours.
- .4 Flame Spread Rating: 0 (zero).
- .5 Smoke Spread Rating: 0 (zero).

2.3 TAPE

- .1 Polyvinyl treated, open weave fibre glass, 50 mm wide.

2.4 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
up to 500	B
Over 500	A
- .2 Seal classification:
 - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
 - .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.
 - .3 Class C: transverse joints and connections made air tight with gaskets. Longitudinal seams unsealed.
 - .4 Unsealed seams and joints.

2.5 DUCT WORK FABRICATION

- .1 Fabricate and support to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.
- .2 Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centreline. Where not possible and where rectangular elbows are used, provide air foil turning vanes.
- .3 Complete metal ducts within themselves with no single partition between ducts. Where width of duct exceeds 450 mm, cross break for rigidity. Open corners are not acceptable.
- .4 Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.
- .5 Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- .6 Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints: minimum 100 mm cemented slip joint, brazed or electric welded. Prime coat welded joints.

- .7 Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
- .8 Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breath, rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled.
- .9 Provide easements where low pressure ductwork conflicts with piping and structure where easements exceed 10% duct area, split into two ducts maintaining original duct area.
- .10 Exposed ductwork to be fabricated from Aluminum for aesthetics.

2.6 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows.
 - .1 Rectangular: standard radius with single thickness turning vanes. Centreline radius: 1.5 times width of duct.
 - .2 Round: smooth radius. Centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 400 mm: with single thickness Airfoil turning vanes.
 - .2 Over 400 mm: with double thickness Airfoil turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch: with radius on branch 1.5 times width of duct.
 - .2 Round main and branch: enter main duct at 45 degrees with conical connection.
 - .3 Provide volume control damper in branch duct near connection to main duct.
 - .4 Main duct branches: with splitter damper.
- .5 Transitions:
 - .1 Diverging: 15 degrees maximum included angle when increasing duct sizes.
 - .2 Converging: 45 degrees maximum included angle downstream of equipment.
 - .3 Diverging: 30 degrees maximum included angle upstream of equipment.
- .6 Offsets:
 - .1 Full radiused elbows, as indicated.
- .7 Obstruction deflectors: maintain full cross-sectional area.
 - .1 Maximum included angles: as for transitions.

2.7 MANUFACTURED DUCT WORK AND FITTINGS

- .1 Manufacture to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.
- .2 Flat Oval Ducts:
 - .1 Machine made from round spiral lockseam duct with light reinforcing corrugations; fittings manufactured of at least two gauges heavier metal than duct.

- .3 Double Wall Insulated Flat Oval Ducts:
 - .1 Machine made from round spiral lockseam duct with light reinforcing corrugations, galvanized steel outer wall, 25 mm thick fibreglass insulation, perforated galvanized steel inner wall; fittings manufactured with solid inner wall.
- .4 PVC Coated Steel Ducts:
 - .1 UL 181, Class 1, galvanized steel duct coated with polyvinyl chloride plastic, 0.1 mm thick on outside and 0.05 mm thick on inside.
- .5 Transverse Duct Connection System:
 - .1 SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

2.8 CASINGS

- .1 Fabricate casings to SMACNA HVAC Duct Construction Standards - Metal and Flexible and construct for operating pressures indicated.
- .2 Mount floor mounted casings on 100 mm high concrete curbs. At floor, rivet panels on 200 mm centres to angles. Where floors are acoustically insulated, provide liner of 1.20 mm galvanized expanded metal mesh supported at 300 mm centres, turned up 300 mm at sides with sheet metal shields.
- .3 Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection. Provide clear wire glass observation ports, minimum 150 X 150 mm size.
- .4 Fabricate acoustic casings with reinforcing turned inward. Provide 1.50 mm back facing and 0.80 mm perforated front facing with 2.4 mm diameter holes on 4 mm centres. Construct panels 75 mm thick packed with 72 kg/cu m minimum glass fibre media, on inverted channels of 1.50 mm.

2.9 FIRESTOPPING

- .1 Retaining angles around duct, on both sides of fire separation
- .2 Fire stopping material and installation must not distort duct.

3 Execution

3.1 GENERAL REQUIREMENTS

- .1 Do work in accordance with SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
 - .1 Ensure diffuser is fully seated.
- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.

- .5 Install proprietary manufactured flanged duct joints and manufactured equipment in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.
- .7 At each point where ducts pass through partitions, the joints around the duct shall be sealed with non-combustible material.

3.2 INSTALLATION

- .1 Install and seal ducts to SMACNA HVAC Duct Construction Standards - Metal and Flexible according to seal classification specified.
- .2 Provide openings in duct work where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated duct work, install insulation material inside a metal ring.
- .3 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- .4 Use double nuts and lock washers on threaded rod supports.
- .5 Provide access doors for inspection.
- .6 Tape joints of PVC coated metal duct work with PVC tape.
- .7 Connect terminal units to supply ducts directly or with 300 mm maximum length of flexible duct. Do not use flexible duct to change direction.
- .8 Connect diffusers to low pressure ducts directly. To decouple diffuser from duct system, use 1.5 m maximum length of flexible duct held in place with caulking compound and strap or clamp. Do not use flexible duct to change direction.
- .9 Connect flexible ducts to metal ducts with adhesive and strap or clamp.
- .10 Set plenum doors 150 to 300 mm above floor. Arrange door swings so that fan static pressure holds door in closed position.
- .11 During construction provide temporary closures of metal or taped polyethylene on open duct work to prevent construction dust from entering duct work system.
- .12 Provide floor drains in fresh air coil, and humidifier sections with deep seal traps.

3.3 CLEANING

- .1 Clean work to requirements of Division 1 and as detailed herein.
- .2 Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

- .3 Provide adequate access into duct work for cleaning purposes.
- .4 Prior to occupancy and during initial occupancy, building shall be flushed at maximum outdoor air volume. Supply a total of 4,300 cu.m of outdoor air per sq.m of floor area or approximately 30,564,400cu.m of outdoor air or approximately 54 days of flushing. Note that a minimum of 3 weeks of flushing will be required prior to occupancy.

3.4 LEAKAGE TESTS

- .1 Refer to Section 23 05 94.
- .2 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .3 Do leakage tests in sections.
- .4 Make trial leakage tests as instructed to demonstrate workmanship.
- .5 Do not install additional ductwork until trial test has been passed.
- .6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.
- .7 Complete tests before performance insulation or concealment Work.

3.5 SEALANT APPLICATION

- .1 Contractor shall apply sealant on exposed ductwork in a 50mm band centered on joint.
- .2 Sealant shall be applied evenly with a clean edge finish perpendicular to duct and plumb.
- .3 Tape shall be utilized to provide clean edge finish to sealant application.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Air turning devices/extractors.
- .2 Backdraft dampers.
- .3 Combination fire and smoke dampers.
- .4 Duct access doors.
- .5 Duct test holes.
- .6 Fire dampers.
- .7 Flexible duct connections.
- .8 Volume control dampers.

1.2 REFERENCES

- .1 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- .2 NFPA 92A - Smoke-Control Systems.
- .3 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- .4 UL 33 - Heat Responsive Links for Fire-Protection Service.
- .5 UL 555 - Fire Dampers.
- .6 UL 555S - Smoke Dampers.

1.3 SUBMITTALS

- .1 Section 01 33 00: Procedures for submittals.
- .2 Shop Drawings: Provide for shop fabricated assemblies including volume control dampers.
- .3 Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
- .4 Manufacturer's Installation Instructions: Indicate for dampers including fire and fireés smoke dampers.

1.4 PROJECT RECORD DOCUMENTS

- .1 Section 01 78 00: Submittals for project closeout.
- .2 Record actual locations of access doors.

1.5 QUALITY ASSURANCE

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .2 Accessories shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems.
- .3 Fabricate in accordance with ASHRAE handbooks and SMACNA duct manuals.

1.6 REGULATORY REQUIREMENTS

- .1 Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Protect dampers from damage to operating linkages and blades.

1.8 EXTRA MATERIALS

- .1 Section 01 78 00: Submittals for project closeout.
- .2 Provide two of each size and type of fusible link.

2 Products

2.1 TURNING VANES

- .1 Factory or shop fabricated single thickness or double thickness, to recommendations of SMACNA and as indicated.
- .2 Shall be airfoil type.
- .3 Where acoustical lining is provided, provide turning vanes of perforated metal type with fibre glass inside.

2.2 BACKDRAFT DAMPERS.

- .1 Gravity Backdraft Dampers, Size 450 x 450 mm or Smaller Provided with Air Moving Equipment: Air moving equipment manufacturers standard construction.
- .2 Extruded aluminum 6063T5 backdraft damper frame shall not be less than 1.52 mm in thickness. Frame shall be 63.5 mm deep.
- .3 Blades shall be extruded aluminum (6063T5) profiles and shall be less than 1.52 mm in thickness.
- .4 Blade and side seals shall be extruded silicone. Seals are to be secured in integral slots within the aluminum extrusions.
- .5 Bearing system shall be composed of Celcon bearings rotating on zinc-plated 12.7 mm steel pivot points.
- .6 Linkage system shall consist of hard alloy aluminum (6005T6) crank arms fastened to zinc-plated steel pivot rods and shall be doubly secured within channel running along top of blade. Large diameter 8.73 mm hard alloy aluminum (6065-T6C) linkage rod shall connect the crank arms by means of a zinc-plated steel trunnion.
- .7 Cup point trunnion set screw shall create a compression hard spot where it secures to the linkage rod for a slip-proof grip.
- .8 Trunnions shall be zinc-plated to provide a hard, smooth and long-lasting rotating surface.
 - .1 Performance:
 - .2 Temperature range: -40 deg.C to 100 deg.C.
 - .3 Leakage: 101.2 l/s per square meter at 0.25 kPa.
 - .4 Pressure Drop: less than 24.9 Pa.

- .9 Backdraft dampers shall be made to size required. Minimum section size shall be 152 mm wide x 152 mm high. Maximum section size shall be 914 mm wide by 3658 mm high. Mullion breaks shall be used when damper height exceeds 1220 mm.
- .10 Backdraft dampers with dimensions greater than maximum section size shall be manufactured in multiple sections. Multiple sections are not interlinked or connected. To install, each section must be individually fastened to a structural frame prepared on site.
- .11 Fully adjustable device to permit setting for varying differential static pressures less than 2.49 Pa.

2.3 DUCT ACCESS DOORS

- .1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- .2 Access doors to be ULC labelled.
- .3 Fabrication for un-insulated ducts: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices.
- .4 Fabrication for 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 with sealing gaskets and quick fastening locking devices.
- .5 Gaskets: neoprene.
- .6 Hardware:
 - .1 Less Than 300 mm Square: Secure with sash locks complete with safety chain.
 - .2 Up to 450 mm Square: Provide two hinges and two sash locks.
 - .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.
 - .5 300 x 300 mm glass viewing panels where indicated.
 - .6 Hold open devices.
- .7 Access doors with sheet metal screw fasteners are not acceptable.

2.4 DUCT TEST HOLES

- .1 Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- .2 Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.5 FLEXIBLE DUCT CONNECTIONS

- .1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

- .2 Connector:
 - .1 Fabric: cUL listed fire-retardant self extinguishing neoprene coated woven glass fibre fabric to NFPA 90A, minimum density 1.0 kg/sq m. Approximately 50mm of fabric clenched by means of double locked seams.
 - .2 Frame: 75 mm wide, 0.6 mm thick galvanized sheet metal.
 - .3 Attach edging strip to ducting and equipment by screws or bolts at 150 mm (6") intervals
- .3 Leaded Vinyl Sheet: Minimum 14 mm0.55 inch thick, 4.2 kg/sq m0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

3 Execution

3.1 INSTALLATION

- .1 Install accessories to manufacturer's written instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.
- .2 Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

3.2 ACCESS DOORS

- .1 Provide adequately sized duct access doors for inspection and cleaning.
- .2 Sizes:
 - .1 600 x 600 mm for person size entry.
 - .2 900 x 900 mm for servicing entry.
 - .3 300 x 300 mm for viewing.
 - .4 As indicated.
- .3 Locations (before and after):
 - .1 Fire and smoke dampers (install at fire dampers).
 - .2 Control dampers.
 - .3 Devices requiring maintenance.
 - .4 Required by code.
 - .5 Reheat coils.
 - .6 Filters.
 - .7 To facilitate cleaning of ductwork (minimum
 - .8 Elsewhere as indicated.
- .4 Provide 100 mm x 100 mm (4" x 4") quick opening access doors for inspection at balancing dampers, before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust duct work to NFPA 96. Provide minimum 200 x 200 mm size for hand access, 450 x 450 mm size for shoulder access, and as indicated. Provide 100 x 100 mm for balancing dampers only. Review locations prior to fabrication.

3.3 TEST PORTS

- .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

- .2 Provide duct test ports where indicated and required for testing and balancing purposes.
- .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.
 - .3 At inlet and outlet of coils.
 - .4 Downstream of junctions of two converging air streams of different temperatures.
 - .5 And as indicated.

3.4 FLEXIBLE CONNECTORS

- .1 Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment , and supported by vibration isolators, including but not limited to the following:
 - .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.
- .6 For fans developing static pressures of 1250 Pa and over, cover connections with leaded vinyl sheet, held in place with metal straps.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Balancing dampers for mechanical forced air ventilation and air conditioning systems.
 - .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

- .1 Sheet Metal and Air Conditioning National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-1985.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 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.

1.4 QUALITY ASSURANCE

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

Part 2 Products

2.1 GENERAL

- .1 Manufacture to SMACNA standards.

2.2 MANUAL VOLUME CONTROL DAMPERS.

- .1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

- .2 Splitter Dampers:
 - .1 Fabricate from same material as duct but one sheet metal thickness heavier (minimum 16 gauge), with appropriate stiffening to avoid vibration.
 - .2 Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous piano hinge.
 - .3 Operator: Minimum 6 mm diameter rod in self aligning, universal joint action, flanged bushing with set screw and position indicator.
 - .4 Rod configuration to prevent end from entering duct.
 - .5 Folded leading edge.
 - .6 Size on basis of straight air volume proportioning.

- .3 Single Blade Dampers:
 - .1 Fabricate for duct sizes up to 150 (in depth) x 760 mm.
 - .2 Fabricate from same material as duct, but one sheet metal thickness heavier (minimum 16 gauge). V-groove stiffened.
 - .3 Size and configuration to recommendations of SMACNA
 - .4 Locking quadrant with shaft extension to accommodate insulation thickness.
 - .5 Inside and outside nylon end bearings.
 - .6 Channel frame of same material as adjacent duct, complete with angle stop.

- .4 Multi-Blade Damper:
 - .1 Factory manufactured of material compatible with duct.
 - .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
 - .3 Maximum blade height: 100 mm
 - .4 Bearings: self-lubricating oil impregnated nylon.
 - .5 Linkage: shaft extension with locking quadrant.
 - .6 Channel frame of same material as adjacent duct, complete with angle stop.

- .5 End Bearings: Except in round duct work 300 mm and smaller, provide end bearings.

- .6 Quadrants:
 - .1 Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 - .2 On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 - .3 Where rod lengths exceed 750 mm provide regulator at both ends.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install where specified, where required for balancing and where indicated on drawings.

- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 Use splitter dampers only where indicated.
- .4 Provide commercial balancing dampers on all low velocity duct take-offs to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly unless specifically noted otherwise.
- .5 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts. Where indicated on the drawings, a balancing damper is not required for runouts in non-accessible ceiling spaces provided a damper is specified on the register and diffuser.
- .6 Dampers: shall be installed vibration free.
- .7 Ensure damper operators are observable and accessible. Provide access doors in ceilings/ walls where required.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation of flexible ductwork, joints and accessories.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .2 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .4 National Fire Protection Association (NFPA).
 - .1 NFPA 90A-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B-02, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.
- .5 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 95 (Addendum No.1, November 1997).
 - .2 SMACNA IAQ Guideline for Occupied Buildings under Construction, 1st Edition 1995.
- .6 Underwriters' Laboratories Inc. (UL).
 - .1 UL 181-96, Standard for Factory-Made Air Ducts and Air Connectors.
- .7 Underwriters' Laboratories of Canada (ULC).
 - .1 CAN/ULC-S110-1986(R2001), Fire Tests for Air Ducts.

1.3 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS in accordance with Section 02 81 01 - Hazardous Materials for the following:
 - .1 Thermal properties.
 - .2 Friction loss.
 - .3 Acoustical loss.
 - .4 Leakage.
 - .5 Fire rating.

- .3 Samples: submit samples with product data of different types of flexible duct being used in accordance with Section 01 33 00 - Submittal Procedures.

1.4 QUALITY ASSURANCE

- .1 Certification of Ratings:
 - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to Codes and Standards.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

Part 2 Products

2.1 GENERAL

- .1 Factory fabricated to CAN/ULC-S110.
- .2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
- .3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 FLEXIBLE DUCT MATERIALS

- .1 Two ply vinyl film supported by helically wound spring steel wire.
 - .1 Pressure Rating: 2.50 kPa positive and 250 Pa negative.
 - .2 Maximum Velocity: 20.3 m/sec.
 - .3 Temperature Range: -23 to 71 degrees C.
- .2 ULC Labeled, black polymer film supported by helically wound spring steel wire.
 - .1 Pressure Rating: 1000 Pa positive and 175 Pa negative.
 - .2 Maximum Velocity: 20.3 m/sec.
 - .3 Temperature Range: -28 to 79 degrees C.
- .3 ULC labeled, multiple layers of aluminum laminate supported by helically wound spring steel wire.
 - .1 Pressure Rating: 2.50 kPa positive and 250 Pa negative.
 - .2 Maximum Velocity: 20.3 m/sec.
 - .3 Temperature Range: -28 to 99 degrees C.

2.3 INSULATED FLEXIBLE DUCT MATERIALS

- .1 Two ply vinyl film supported by helically wound spring steel wire; fibreglass insulation; polyethylene vapour barrier film.
 - .1 Pressure Rating: 2.50 kPa positive and 250 Pa negative.
 - .2 Maximum Velocity: 20.3 m/sec.
 - .3 Temperature Range: -23 to 71 degrees C.

- .2 Black polymer film supported by helically wound spring steel wire; fibreglass insulation; polyethylene vapour barrier film.
 - .1 Pressure Rating: 1000 Pa positive and 175 Pa negative.
 - .2 Maximum Velocity: 20.3 m/sec.
 - .3 Temperature Range: -28 to 79 degrees C.

- .3 Multiple layers of aluminum laminate supported by helically wound spring steel wire; fibreglass insulation; polyethylene vapour barrier film.
 - .1 Pressure Rating: 2.50 kPa positive and 250 Pa negative.
 - .2 Maximum Velocity: 20.3 m/sec.
 - .3 Temperature Range: -28 to 99 degrees C.

Part 3 Execution

3.1 DUCT INSTALLATION

- .1 Install in accordance with: SMACNA.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This Section covers items common to Sections of Electrical Contractor. This section supplements requirements of Division 00 – Procurement and Contracting Requirements, Division 01 – General Requirements, Division 02 – Existing Conditions.
- .2 Provide complete and fully operational electrical systems with facilities and services to meet requirements described herein, as shown on the drawings, and in complete accord with applicable codes and ordinances.
- .3 Only those items that are specifically indicated as not in contract (N.I.C.) will be omitted.
- .4 Contract documents of Divisions 26, 27, and 28 are diagrammatic and approximately to scale, unless detailed otherwise. They establish scope, material and installation quality, and are not detailed installation instructions.
- .5 Follow manufacturers' recommended installation details and procedures for equipment supplemented by details given herein and on plans subject to approval of the Consultant.
- .6 Examine all drawings to ensure that work under this Division can be properly installed without interference.
- .7 Where discrepancies, ambiguities, obvious omissions or errors have been made in drawings and specifications, it shall be the responsibility of the contractor to clarify same prior to tender closing. No allowance will be made after contract award for any expense incurred by him for having to adjust his work to properly conform.

1.2 REFERENCES

- .1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
 - .2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
 - .3 National Electrical Manufacturers Association (NEMA).
 - .4 National Building Code 2010 (NBC 2010)
 - .5 National Fire Protection Association (NFPA)
 - .6 Institute of Electrical and Electronic Engineers (IEEE).
 - .7 Audio Engineering Society (AES).
 - .8 Other Applicable CSA and UL approvals.

1.3 CODES AND STANDARDS

- .1 The electrical installation shall comply with all SaskPower requirements and regulations.

- .2 In the event of any inspection authority requesting deviation from the design, notify the Consultant and obtain approval before proceeding with any change.
- .3 In no instance, shall the standard established by the drawings and specification be reduced by any code or ordinance. All references to codes and standards shall be to the latest edition.

1.4 CARE, OPERATION AND START-UP

- .1 Instruct operating personnel in the operation, care and maintenance of systems, system equipment and components.
- .2 Connect to equipment furnished in other Divisions and by Owner including start-up and test.
- .3 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .4 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.5 VOLTAGE RATINGS

- .1 Operating voltages: to CAN3-C235-83
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.6 PERMITS, FEES AND INSPECTION

- .1 Submit to SaskPower necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees.
- .3 Notify Consultant of changes required by Electrical Inspection Department prior to making changes.
- .4 Furnish Certificates of Acceptance from Electrical Inspection Department and authorities having jurisdiction on completion of work to Consultant.

1.7 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 All goods and materials shall be new and carry CSA approval seal. Equipment and material shall be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the Consultant and the Electrical Inspection Department.
- .3 All fire alarm equipment shall carry ULC approval seal.

- .4 No deviation from specified materials shall be allowed, except where alternative materials have been specifically accepted in writing.
- .5 Where materials are not directly specified by catalogue number and manufacturer's name, a high industry specification grade product shall be provided. The Consultant shall be the sole judge of whether this standard is being met.
- .6 All references to known standard specifications shall mean and intend the latest edition of such specifications.
- .7 Each major component of equipment shall have manufacturer's name, address, catalogue and serial number in a conspicuous place.
- .8 Upon request, provide a complete list of all materials and their manufacture. The contractor will be required to use the materials indicated. Changes in manufactures at a future date will not be acceptable.
- .9 Factory assemble panels and component assemblies.

1.8 WORKMANSHIP

- .1 All work under this Division shall be executed in a workmanlike and substantial manner, neat in its mechanical appearance and arrangement.
- .2 A competent representative shall constantly supervise the work of this Division from beginning to completion and final acceptance. So far as possible, the same supervisor and workmen shall be employed throughout the project's duration.
- .3 Material and workmanship not meeting the standard intended and required by this specification shall, upon instruction from the Consultant, be properly replaced without further charge or consideration.

1.9 ELECTRICAL DRAWINGS

- .1 They indicate the general location and route of conduit and cable to be installed. Conduit shall be installed in coordination with other services. These include both new and existing services. Prior to excavation anywhere on site, arrange to have all existing services marked. Where space is indicated for future equipment or plant use, leave space clear.
- .2 Install equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment to the satisfaction of the Consultant at no extra cost.
- .3 Ceiling and floor outlet symbols are scaled to centre line of symbol; symbol does not indicate the size or shape. Mounting height shall be measured to the lowest point on ceiling mounted equipments, and above finished surface for wall mounted equipment.
- .4 Wall outlets are scaled to the perpendicular centre line of the symbol. Mounting heights for all wall mounted outlets shall be measured to the horizontal centre line.
- .5 Where outlets are mounted in masonry walls, outlets should be mounted to the nearest coursing line.

1.10 WORK PROVIDED FOR OTHER DIVISIONS

- .1 Provide information as to exact size and location of all required concrete bases, housekeeping pads and curbs required for the installation of equipment of Divisions 26, 27, and 28.
- .2 Provide information as to the location and exact size of all openings through floors and walls.
- .3 Provide information as to the location and exact size of all equipment supports required within walls, and roof support structure.
- .4 Provide electrical connections, circuit protection and disconnect devices for all equipment supplied by other Divisions, including the Owners. Provide motor starters, disconnect switches, thermal switches, etc., for motors supplied by mechanical contractor. Special control equipment being supplied by mechanical contractor shall be installed and wired by that contractor.

1.11 WORK PROVIDED BY OTHER DIVISIONS

- .1 All concrete bases, housekeeping pads and curbs required for the installation of equipment of Divisions 26, 27, and 28.
- .2 Installation and framing of all openings in walls or floors larger than 150 mm diameter, or rectangular, with one dimension greater than 150 mm.
- .3 Openings in millwork for electrical outlets and conduits.
- .4 Painting of all panelboard and communication panel trims to match colour scheme where exposed in finished areas.
- .5 Firestopping shall be the responsibility of the General Contractor.

1.12 WORK NOT PROVIDED BY THIS DIVISION

- .1 Control wiring below 50V for Mechanical Contractor equipment beyond terminal section of each motor control centre, unless specifically indicated otherwise.

1.13 COORDINATION WITH OTHER DIVISIONS

- .1 Cooperate fully with the Consultant and other trades of electrically operated equipment to ensure proper arrangement of and provision for all electrical equipment.
- .2 Where outlets or equipment may affect architectural or site treatment desired, contact Consultant and for instructions or detailed drawings.
- .3 Refer to other Divisions including mechanical, millwork, kitchen equipment, owner supplied equipment, etc, for electrical work in connection with these drawings and specifications.
- .4 Location of lighting outlets and receptacles in mechanical or equipment rooms and similar areas shall be finalized during construction to give optimum arrangement. The Consultant shall approve final location before installation.

- .5 Supply and install all motor connections, including starters and overload protection and disconnecting devices at motors where required. All motor driven equipment shall be provided with a lockable disconnecting device within line of site of the motor to be disconnected.
- .6 Supply and install complete wiring requirements for full voltage in-line devices on single phase equipment such as thermostats, multi-speed switches for unit heaters, force flows, cabinet heaters, etc.
- .7 Cutting of openings for electrical outlets in millwork and other similar types of custom-made equipment shall be done by the supplier of this equipment.
- .8 Check other Divisions to ensure that suitable provisions have been provided for all motors. It is possible that some motors may vary in size, numbers and characteristics, depending on the equipment manufacturer's specific requirements. Any variations in this regard will not constitute cause for further consideration. The mechanical coordination schedule supplied on the drawings shall be updated with nameplate specifications.
- .9 Assume full responsibility for layout of this work and for any damage caused the Owner or other Divisions by improper location or carrying out of this work.
- .10 Before commencing work, examine the work of other Divisions, and report at once any defects or interference affecting the work under this Division, or the guarantee of same.
- .11 Location of lighting outlets and receptacles in mechanical or equipment rooms and similar areas shall be finalized during construction to give optimum arrangement. The Consultant shall approve final location before installation.
- .12 Allow for all hoisting and setting of material and equipment.

1.14 OWNER SUPPLIED EQUIPMENT

- .1 Connect all electrically operated equipment supplied by the Owner, as designated on the drawings.
- .2 Reconnect all existing electrical services from new and existing electrical sources modified by the work of this contract.

1.15 INSPECTION AND TESTING

- .1 During construction and up to final acceptance, make accessible any equipment or wiring for inspection purposes.
- .2 All electrically operating equipment shall be left as a complete installation in perfect operating condition, and receive final test in the presence of the Consultant.
- .3 Ensure that all power circuitry is properly tested and meets the CSA Ground Resistance Requirements. For any 600 volt systems, a 600 volt megger or hi-pot procedures shall be used for all such tests. Provide documentation for each test within maintenance/commissioning manuals.
- .4 On the request of the Consultant, a staff supervisor shall be made available to assist in this inspection work.

- .5 At the completion of the installation, voltage tests shall be conducted in the presence of the Consultant. Transformer taps shall be adjusted, and any other corrective measures implemented to assure the proper operation of all electrical equipment. Provide documentation for each test within maintenance/commissioning manuals.
- .6 Acceptance tests and commissioning shall be conducted for systems and/or equipment where indicated in the specifications and other standards referenced herein.
- .7 Acceptance tests shall meet requirements as required by manufacturer, as outlined in ANSI – NETA 2007 and additional requirements described on drawings and specified herein. All tests shall be documented as per ANSI – NETA 2007 standards and shall include testing results, testing date, testing technician and representative present.
- .8 Acceptance tests shall be made up of the following:
 - .1 Shop Drawing Information Sheets
 - .2 Static Review Check Sheets
 - .3 Performance Verifications Sheets
 - .4 Manufacturer Commissioning and Report
 - .5 Manufacturer Test Reports, Factory and On Site where required
 - .6 Test Results not forming part of the Static Review Checks Sheets
 - .7 Owner / Consultant Demonstration Sheets
 - .8 Training
- .9 Certification of all acceptance tests and commissioning shall be submitted to the Consultant for approval. Tests not conducted to the satisfaction of the Consultant shall be repeated, and no further costs will be considered. Written documentation bearing name and signature of Contractor, Consultant and Owner's personnel present during acceptance tests shall be included in certification reports. Provide for a minimum of twelve (12) hours across three (3) separate meetings with Consultant and Owner for review of acceptance test sheets.

1.16 SHOP DRAWINGS

- .1 Submit shop drawings, where specifically called for, or as requested. Shop drawings shall show detailed dimensional and technical information, and shall properly describe each piece of equipment. Where applicable, shop drawings shall include complete schematics and wiring diagrams. These shop drawings shall be sufficiently detailed to permit the Owner's technicians to trouble-shoot and repair the equipment. Equipment shall not be ordered and/or fabricated until shop drawings have been reviewed by the Consultant. Shop Drawings shall include, but not be limited to the following Sections on systems and equipment:
 - .1 26 05 36 - Cable Trays
 - .2 26 27 26 - Wiring Devices
 - .3 26 28 21 - Moulded Case Circuit Breakers
 - .4 26 50 00 – Lighting
- .2 Review of shop drawings shall be for general design, arrangement and appearance only. This Division shall check and correct, if necessary, all manufacturers' drawings before submitting, and shall so indicate on each copy, along with a dated approval stamp. All shop drawings must bear an approval stamp and be signed by the Contractor. This review does not relieve this

Division from the responsibility for the final installation being correct in all detail, and fully acceptable to the Consultant. Refer to each section for further shop drawing information.

- .3 Refer to General Conditions of the Contract.
- .4 Provide nine (9) printed copies and one PDF copy for each Section. Each shop drawing shall be complete with a cover page with the following information:
 - .1 Specification Section and name
 - .2 Project name, Owner's name and address
 - .3 Number of pages in submittal
 - .4 Contractor and Supplier's name and contact information
 - .5 Approval stamps with room for Consultant's stamp
- .5 Shop drawings for complementary systems and/or equipment shall be submitted at the same time. Partial submittals of related equipment will be rejected or held until all other related shop drawing information has been submitted (i.e. submit all shop drawings for power equipment at the same time). Submittals of shop drawings that are incomplete will be rejected.

1.17 CHANGES

- .1 Refer to General and Supplemental Conditions.
- .2 Submit complete itemized breakdowns of all extras, deletions, and changes to the Consultant. Breakdown shall include quantities, unit costs and extensions. If requested, support claim by certified copies of supplier's invoices.
- .3 The right is reserved to move equipment 3000 mm from location shown without further charge or consideration, provided that such re-location is requested prior to finish being applied.

1.18 CONSULTANT PRICES

- .1 Electrical progress claims shall be made on Contractor Progress Report #ES110 provided by the Consultant. A copy of this Progress Report is attached for reference. The Electrical contract price shall be broken down into thirteen (13) parts to facilitate assessment of work done and material supplied. This progress claim shall be submitted simultaneously to the General Contractor and the Consultant, the latter case in duplicate. Refer to General Conditions.
- .2 The breakdown shall indicate labour and material to the nearest dollar. Overhead, profit and job expense shall be apportioned to all parts. The breakdown shall be as follows:
 - .1 Main services
 - .2 Distribution/Panels
 - .3 Conduit and boxes
 - .4 Wire and cable
 - .5 Motor control
 - .6 Wiring devices
 - .7 Lighting fixtures and lamps
 - .8 Communications systems
 - .9 Security Systems
 - .10 Fire Alarm System

- .11 Specials
- .12 Miscellaneous - 8% maximum
- .13 Extras and credits. (Extras in excess of \$1,000 shall be broken down into the above points on a separate ES110 sheet)

1.19 OPERATING INSTRUCTIONS AND SERVICE MANUALS

- .1 Upon completion of the installation, provide complete and comprehensive identical sets of operating and maintenance manuals.
- .2 The Consultant shall review the operating and maintenance manuals and approve same prior to the manuals being sent to the Owner.
- .3 The operating and maintenance manuals shall include but not be limited to the following information when applicable in the project:
 - .1 Certification reports.
 - .2 Documentation indicating Owner's receipt of operating instructions.
 - .3 Complete list of all materials turned over to the Owner c/w receipts for same.
 - .4 Shop drawings properly indexed and contained in suitably sized binders.
 - .5 Schematic drawings for all systems indexed and contained in suitably sized envelopes or attached efficiently in the above binders.
 - .6 Catalogue brochures for light fixtures, panelboards, switches, receptacles, fuses, etc.
 - .7 All final settings of equipment that has user adjustable settings.
 - .8 Certificate of Owner's training.
 - .9 Acceptance Testing and Commissioning reports.

The above information shall be bound in binders as noted in specifications. Incomplete or poorly reproduced manuals will be rejected.

- .4 Maintain, on a daily basis, a complete set of marked-up prints as as-built drawings that show in complete detail the final arrangement and location of all electrical components and the interconnecting wiring.
- .5 All riser conduits (size and routing), panel feeds (size and routing), conduit runs (size and routing) and main communications (size and routing) shall be marked on plans. These are to be maintained in a neat and substantial manner, so as to properly and fully illustrate the way in which the installation has been completed.
- .6 All equipment locations such as fire alarm signal boosters, cable termination boxes, signal amplifiers, network switches, door controllers, etc shall be identified on the drawings as to their location and quantity (if more than one exists at that particular location).
- .7 The Owner's personnel shall be instructed in the operation and maintenance of the following equipment to the satisfaction of the Owner as per the standards referenced herein.

<u>Section No.</u>	<u>Description</u>	<u>Hours</u>
26 50 00	Lighting	1

- .8 The above instructions shall be given by personnel experienced in the operation of the particular system or equipment. Each item or type of equipment, and all controls, shall be operated in the presence of the Owner's personnel to ensure their understanding of equipment function and individual working parts. The Owner reserves the right to set the period or periods during which the instruction shall be given. The contractor shall submit a program of instruction for approval by the Owner.
- .9 Operating and maintenance manuals shall include written documentation bearing name and signature of Owner's personnel who received the above instructions. Contractor shall allow for all training to be completed in a minimum of two sessions. One session at substantial completion, and one session within three months of turning over the system.
- .10 Operating and maintenance manuals, as well as all Owner instructions, shall be complete before substantial completion (as outlined by the Builders' Lien Act) will be considered. Also, preliminary maintenance manuals must be submitted prior to 70% completion. No further progress payments will be permitted until these preliminary maintenance manuals have been submitted and approved.

1.20 STORAGE AND PROTECTION

- .1 Maintain and protect all work provided under this Division. Store all materials within a protected enclosure to prevent exposure to weather or construction dirt.
- .2 Protect all finished and unfinished work of this and other divisions from damage during the course of construction. Cover floors and other surfaces, if necessary. Any damaged work or finishes shall be repaired or replaced without further charge to the Owner.

1.21 WARRANTY

- .1 All materials and workmanship shall be guaranteed for a period of one year from date of substantial completion.
- .2 Properly repair and replace all defective work and other work which becomes defective during the term of warranty.
- .3 Service on equipment or systems critical to the Owner's operation shall be provided on an emergency basis which may necessitate overtime and service outside of normal working hours. The contractor shall ensure that all suppliers comply with this requirement.

1.22 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
- .2 Control wiring and conduit is provided by the Electrical Contractor except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 15 and shown on mechanical drawings.

1.23 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 indoor switchboards and distribution enclosures light grey ASA 61.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.24 ABBREVIATIONS

- .1 Abbreviations used in this specification are common to and in general use within the related trades.

1.25 EQUIPMENT IDENTIFICATION

- .1 Nameplates shall be provided on each new piece of electrical equipment, including, receptacle coverplates, power panels, distribution panels, lighting panels, transformers, disconnect switches, contactors, telephone panels, miscellaneous systems and panels.
- .2 Nameplates for each new electrical panel shall indicate panel designation, mains voltage and panel and circuit number from which this panel is fed.
- .3 Nameplates for new disconnects and contactors shall indicate equipment being controlled, and voltage.
- .4 Nameplates for new terminal cabinets shall indicate system and voltage and load of area served.
- .5 Nameplates for Normal Power Equipment shall be made from black-white-black Lamecoid with bevelled edges and white engraved letters. Nameplates shall be fastened with self tapping metal screws to equipment in a conspicuous location. Flush mounted panels shall have nameplate located on front of panel behind hinged door.
- .6 Typical identification standards shall be used for new equipment throughout the project as follows:
 - .1 Receptacle coverplates shall be identified with an engraved Lamecoid plate secured to the coverplate as follows:
 - .1 Circuit number in 4 mm high letters
 - .2 White Lamecoid label for circuits fed from normal power, red Lamecoid label for circuits fed from emergency power, and blue Lamecoid label for circuits fed from UPS power.
 - .2 Lighting, receptacle and power panels shall each be identified with an engraved Lamecoid plate secured to top interior trim as:

Panel 202	10 mm high lettering
120/208 volts	6 mm high lettering
Fed from	6 mm high lettering
 - .3 Each panel shall be supplied with a directory card holder welded to inside of door, complete with a neatly typewritten list showing information as follows:

Panelboard name	202
Panel voltage	120/208 volts

<u>Circuit Number</u>	<u>Description</u>	<u>Load</u>
1	Lighting Room 200 (Main Area)	1200W
2	Receptacles Room 200 (Main Area)	6-15A
3	Room 220	1/3 H.P. Fan

Spaces and spares shall be left blank so as to facilitate future description. Also, existing panels where adjustments have been made in the circuitry shall be field checked in their entirety and new updated directory cards shall be provided.

- .4 List shall be covered with a 1 mm thick clear plastic sheet to protect it.
- .5 Other cabinets and plywood back boards for low voltage systems, such as signals and communications, shall be identified as panelboards with a directory showing circuit numbers and room locations, plus a blank for "Remarks", as well as a Lamecoid plate designation panel name.
EXAMPLE: if cabinet is for telephone
.....TP - 2nd floor
- .6 Equipment not listed above, such as incoming service cables, communicating cables, switchgear, transformers, disconnects, motors, instruments, fire alarm and control panels, shall be identified in a similar manner, showing name and number of the equipment, voltage and load information.
- .7 Feeder pull boxes and junction boxes shall be identified with waterproof ink, showing feeder or system concerned. Conduit entering junction boxes for communications systems shall be identified with the room number that each conduit serves.
- .8 A small dab of paint shall be applied to inside of each outlet box, pull box and panel as it is installed, using colour code as follows:

Red	- Fire Alarm System
Yellow	- Security, Alarm Systems, Card Access
Green	- Telephone/IT Computer Systems

The outside of the box shall also be identified in this way so as to readily determine the system within the conduit system. The cover of each junction box for branch circuits shall describe the voltage being used by means of a waterproof ink.
- .9 No colour code is required for regular lighting and power circuits, but voltage class shall be displayed on all pull boxes and panels.
- .10 Junction boxes in furred ceilings shall be colour identified on both inside and outside.
- .11 Connections in equipment shall be made Phase 'A', 'B', 'C', from left to right when viewing wiring from front or accessible direction.
- .12 Colour coding shall be carried through from incoming utility supply down to and including panels, and shall be as follows:

- .1 Incoming utility service lines shall be identified by Red - Phase 'A'; Black - Phase 'B'; Blue - Phase 'C'; with colour coded PVC tape.
- .2 Switchgear buswork in each switchboard and unit substation cubicle shall be banded with 3M tape identified in accordance with service lines colour coding. In addition, where neutral bus is introduced, it shall be banded white. Ground bus shall be banded green.
- .3 Feeder and sub-feeder bus or conductors shall be banded as above.
- .4 Lighting and power panels shall conform to the Canadian Electrical Code, and shall have main bus banded with tape as follows:

Red	-	Phase 'A'
Black	-	Phase 'B'
Blue	-	Phase 'C'
White	-	Neutral
Green	-	Ground

- .13 The circuits controlled by all light switches shall be neatly printed with waterproof ink on the side of the switch outlet box so that the panel and circuit number are clearly legible when the coverplate is removed. It shall not be necessary to remove the switch from the outlet box in order to read the panel or circuit number.

1.26 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or 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 code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

1.27 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.

1.28 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.29 MANUFACTURERS AND CSA LABELS

- .1 Visible and legible, after equipment is installed.

1.30 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Inspection Department and Owner.
- .2 Decal signs, minimum size 175 x 250 mm.

1.31 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with drawings and specifications.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and electrical on latch side of door.

1.32 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 or as noted on drawings.
 - .1 Local switches: 1200 mm.
 - .2 Wall receptacles:
 - .1 General: 450 mm.
 - .2 Above top of counters or counter splash backs: 150 mm.
 - .3 In mechanical rooms: 1400 mm.
 - .3 Fire alarm stations: 1200 mm.
 - .4 Fire alarm horn/strobe: 2100 mm.

1.33 LOAD BALANCE

- .1 All lighting panels, distribution centres, motor control centres and main switchboards shall be load balanced such that the maximum variation between the two worst phases does not exceed 5%.
- .2 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.
- .3 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .4 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.34 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.
- .4 All conduit and tray sealing shall be the responsibility of the Electrical Contractor.

1.35 TEMPORARY AND TRIAL USAGE

- .1 Temporary and trial usage by the Owner, or the Contractor, of any of the electrical apparatus or equipment, or any work or materials supplied under this Division before final completion and written acceptance, is not to be construed as evidence of acceptance of same by the Owner.
- .2 Temporary and trial usage may be made as soon as this Division deems the work sufficiently advanced for making a complete and thorough test of same, and that no claim may be made for the injury to or the breaking of any part of such work which may be so used, whether caused by weakness or inaccuracy of structural parts, or by defective material or workmanship of any kind.
- .3 Lighting shall not be used for temporary or trial usage without prior approval of the owner and consultant sign off. If temporary lighting is required for the duration of the project, only construction lamps marked with a permanent ink on the lamp may be used. Evidence of marking will be requested by the consultant. Any fixtures used for temporary or trail usage shall be relamped and cleaned. Evidence of cleaning and relamping will be required by the consultant.

1.36 TEMPORARY LIGHT AND POWER

- .1 The General Contractor shall be responsible for all temporary light and power provisions. Refer to General Conditions.

1.37 MATERIAL TO BE TURNED OVER TO THE OWNER

- .1 All equipment that is being removed or replaced shall be stockpiled as per Owner's request. The owner may deem that the equipment shall be disposed. All disposal and removal is the responsibility of the contractor.
- .2 Materials as indicated in various sections of this specification shall be turned over to the Owner. These materials shall include, but not be limited to the following:
 - .1 Obtain a signed receipt for each item turned over to the Owner. Include receipts in the operating and maintenance manuals.

1.38 SITE EXAMINATION

- .1 The contractor shall visit the existing site during the tendering period to familiarize himself with the construction conditions and electrical work provided to date. The contractor shall thoroughly satisfy himself that the work contained in these drawings and specifications can be carried out and that all costs have been included in the tender submitted.

1.39 CUTTING AND PATCHING

- .1 Should any cutting or repairing of either unfinished or finished work be required, the contractor shall employ the particular trade whose work is involved, to do such cutting and patching, and shall pay for any resulting costs.
- .2 All holes within buildings shall be fire stopped when penetrating a fire rated structure.

1.40 PAINTING

- .1 All iron or steel structures fabricated and installed by Divisions 26, 27, and 28 for supporting panels, starters, conduit or other equipment, shall be wire brushed and given one coat of lead chromate paint primer before being set into place. After all equipment is installed and piping complete, this iron work shall be given two coats of ASA #61 enamel to match the panel or structure being supported or in the colour specified for the product.
- .2 All pull boxes, wireways, gutters, etc., fabricated for Divisions 26, 27, and 28, shall be given a coat of lead chromate primer and two coats of ASA #61 enamel before installation to match equipment finish.
- .3 All panels and pull boxes that are set in finished walls or ceilings shall have approved flush covers that shall be prime coated with lead chromate paint, and left for the painting division to paint in with the surrounding wall or ceiling finishes. Panel trims and pull box covers to be painted with the cover removed from the wall so that it can be easily installed or removed without damaging the surrounding paint finish.
- .4 All electrical equipment shall be finished with an ASA #61 enamel, the colour of which shall be grey, unless otherwise specified.
- .5 When installation is complete, all scratches and defects to the paint finishes shall be properly touched up, and where necessary, entire paint surfaces shall be re-done.

1.41 MATERIAL SAFETY DATA AND HAZARDOUS MATERIALS

- .1 The Contractor shall provide material safety data sheets on all materials prior to shipping materials to site. These data sheets shall be submitted in triplicate to the Owner.
- .2 The Contractor shall coordinate and provide necessary information for the Owner's "WorkPlace Hazardous Material Information System".

1.42 SCHEDULING OF WORK AND DEMOLITION

- .1 Refer to Division 1 specifications.
- .2 Refer to the overall project schedule for further scheduling requirements.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

CONTRACTOR PROGRESS REPORT ES110



Ritenburg & Associates Ltd.
Consulting Electrical Engineers

#200-2222 ALBERT STREET - REGINA, SASK. S4P 2V2
Phone: (306) 569-1303 Fax: (306) 569-1307

ELECTRICAL PROGRESS CLAIM No. _____

DATE _____ 20____

PROJECT _____

ELECTRICAL CONTRACTOR _____

GENERAL CONTRACTOR _____

PRIME CONSULTANT _____

SUBMITTED BY _____

REVIEWED BY: _____

DATE: _____ 20____

RECOMMENDED PAYMENT AS SHOWN

AS CORRECTED

REJECTED

* Cross out if not applicable	TOTAL CONTRACT		COMPLETE TO DATE		THIS PROGRESS	
	MATERIAL	LABOR	MATERIAL	LABOR	MATERIAL	LABOR
A. MAIN SERVICE *HV, Duct Bank, Trans- formers, Switchboards						
B. DISTRIBUTION / PANELS *Distribution Centres, Dry Type Transformers, Fuses						
C. CONDUIT AND BOXES *Tray						
D. WIRE AND CABLE *Bus Duct						
E. MOTOR CONTROL						
F. WIRING DEVICES *Dimmers, Pac Poles, Low Voltage Switching, Cover- plates						
G. LIGHTING FIXTURES & LAMPS						
H. ALARM SYSTEMS *Fire, Security, Signal, Medical						
I. COMMUNICATIONS SYSTEMS *Intercom, Nurses' Call, Data/Telephones						
J. SPECIALS *Emergency Generator, Lightning Protection CCTV, UPS, Trench Duct						
K. MISCELLANEOUS - 8% Maximum						
L. EXTRAS & CREDITS (List price changes separately, use separate sheet if necessary)						
TOTAL						

SUMMARY TOTAL

Contract \$	To Date \$	This Progress
Contract GST \$	To Date GST \$	This Prog GST \$
Total Amount	Less Holdback	Less Holdback
XXXXXXXXXX	Net Amount	Net Amount

% COMPLETE _____

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

- .1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
 - .2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
 - .3 National Electrical Manufacturers Association (NEMA).
 - .4 National Building Code 2010 (NBC 2010)
 - .5 National Fire Protection Association (NFPA)
 - .6 Institute of Electrical and Electronic Engineers (IEEE).
 - .7 Audio Engineering Society (AES).
 - .8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 26 05 01 – Common Work Results
- .2 Shop drawings shall include but not be limited to device types, cable types, and special mounting details.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.
- .2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 MATERIALS

- .1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.

- .2 Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors #10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for round copper conductors.
 - .2 Clamp for round copper conductors.
 - .3 Stud clamp bolts.
 - .4 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required.

Part 3 Execution

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
 - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.
 - .3 Install fixture type connectors and tighten. Replace insulating cap.
 - .4 Install bushing stud connectors in accordance with NEMA.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

- .1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
 - .2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
 - .3 National Electrical Manufacturers Association (NEMA).
 - .4 National Building Code 2010 (NBC 2010)
 - .5 National Fire Protection Association (NFPA)
 - .6 Institute of Electrical and Electronic Engineers (IEEE).
 - .7 Audio Engineering Society (AES).
 - .8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 26 05 01 – Common Work Results
- .2 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.4 PRODUCT APPROVALS

- .1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.
- .2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.
- .3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.
- .2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 BUILDING WIRES

- .1 All conductors shall be copper, minimum No. 12 gauge, unless specifically noted otherwise.
- .2 All conductors # 12 AWG to # 8 AWG shall be rated for minimum 600V RW-90 XLPE. Conductors # 6 AWG and larger shall be rated for minimum 600V RW-90 XLPE. All conductor for motor feeds from variable frequency drives, shall be rated for minimum 1000V RW-90 XLPE or RWU-90 XLPE. Wiring in channel back of fluorescent fixtures shall be 600 volt Type GTF or TEW. Size, grade of insulation, voltage and manufacturer's name shall be marked at regular intervals.
- .3 Wiring for major feeders may be NUAL aluminum and shall be installed only where specifically noted on the drawings.
- .4 Conductor utilized in conduit run under slab on grade or in conduit underground shall be Type 'RWU-90'.
- .5 Wire shall be as manufactured by Nexans, Alcan, Pirelli, BICC General Wire or Superior Essex.

2.2 TECK CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600V to 1000V as noted above.
- .4 Fastenings:
 - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables.
 - .3 Threaded rods: 6 mm dia. to support suspended channels.
- .5 Connectors:
 - .1 Watertight approved for TECK cable.

Part 3 Execution

3.1 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance information for the Intercom system for incorporation into manual specified in:
 - .1 Section 01 78 00 - Closeout Submittals
- .2 Include:
 - .1 Manufacture description sheet on each cable type

3.2 INSTALLATION OF BUILDING WIRES

- .1 Termination for #8 AWG and larger shall be by means of approved solderless connector lug. For parallel conductors, a common lug with separate termination for each conductor shall be employed.
- .2 Conductor splices shall be made in accordance with specifications. Provide sufficient length for joint remake, and no less than 200 mm spare length. On through wiring, leave 300 mm loop.
- .3 Wiring in cabinets, pull boxes, panels and junction boxes shall be neatly trained and held with nylon cable ties.
- .4 Conductors shall be tag identified where passing through junction boxes.

3.3 INSTALLATION OF TECK CABLE 0 -1000 V

- .1 Install cables.
 - .1 Group cables wherever possible on channels.
- .2 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - 0-1000V.
- .3 All cables shall be terminated and spliced with suitable compression type connectors, as recommended by the cable manufacturer. The connectors shall satisfy the bonding and grounding requirements at the supply end.
- .4 All cables shall be single conductor and copper, unless otherwise specified.
- .5 All cable shall be rated for 600 volts, insulated with cross-linked polyethylene and rated for operation at 90 degrees C. Cable shall have a FT4 rated outer jacket.
- .6 All cable shall meet the CSA requirements for cold bend and impact testing at minus 40 degrees C.
- .7 All cable shall be protected by a corrugated aluminum sheath or by interlocked aluminum armour. PVC jackets shall be required on all metallic sheathed cables.
- .8 The jackets shall meet the FT4 flame spread requirements and be identified on the P.V.C. jacket.
- .9 All cables shall be installed in accordance with the manufacturers recommendations, in suitable cable tray as specified within the specifications.

- .10 The cables shall be terminated at the supply end on a non-ferrous metallic plate and at the load end on a non-metallic rigid fibre board plate. The cable sheaths shall be bonded at the supply end only.
- .11 All cable installed in cable tray shall be installed at one diameter spacing.
- .12 When single conductor cables are direct earth buried they shall be spaced 150 mm apart.
- .13 Cables shall be manufactured by Nexans, Alcan, Superior Essex, General Wire or Pirelli.

3.4 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors 0-1000 V.
- .3 Conductors: insulated, copper, size as indicated.
- .4 Type: AC90 - Armour: interlocking type fabricated from aluminum strip.
- .5 Type: ACWU90 - jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.
- .6 Connectors: as required.
- .7 Multi conductor cables shall be color coded during manufacture. Single conductor cables shall be color coded with adhesive colour coding tape. The tape shall be applied for a minimum of 75 mm at all terminations. Cables shall not be painted under any condition. Color coding shall be as follows:

Phase 'A' - Red

Neutral - White

Phase 'B' - Black

Ground - Green or Bare

Phase 'C' - Blue

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

- .1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
 - .2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
 - .3 National Electrical Manufacturers Association (NEMA).
 - .4 National Building Code 2010 (NBC 2010)
 - .5 National Fire Protection Association (NFPA)
 - .6 Institute of Electrical and Electronic Engineers (IEEE).
 - .7 Audio Engineering Society (AES).
 - .8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 Section 26 05 01 – Common Work Results
- .2 Shop drawings shall include but not be limited to connectors used, specialty ground bars, etc.

1.4 PRODUCT APPROVALS

- .1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.
- .2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.
- .3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

- .2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 All ground rods shall be 20 mm diameter by 3000 mm long, copper clad.
- .3 Grounding conductors: bare stranded copper.
- .4 Insulated grounding conductors: green
- .5 Ground bus: copper, complete with insulated supports, fastenings, connectors.
- .6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.
- .7 All ground conductors shall be bare or insulated, stranded, medium hard drawn copper wire. All insulated ground wires shall be green.
- .8 Exposed copper shall be cleaned to a bright surface, and shall be finished with two coats of clean, insulating varnish.
- .9 Connect ground conductor to copper water pipe at least twice (minimum 40 mm diameter), utilizing a Burndy Type GAR pipe clamp. Provide jumper across water meter.
- .10 All connections to the ground bus or risers shall be thermowelded, or shall utilize the Burndy Hy-Ground compression connections. Clamp type connections shall only be allowed to individual pieces of equipment.
- .11 Where bonds are covered with soil, the conductors are to be coated with anti-corrosion compound "Kopr-Shield" (Thomas & Betts Co.) before compression connector is applied. All bonding shall be done with 'C' tap and lug compression connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Electrical equipment and wiring shall be grounded in accordance with the Canadian Electrical Code, and local inspection authority's rules and regulations.

- .2 All metallic raceways and conduits for communications, cable and conductors shall be grounded.
- .3 All motors with flexible connections shall have separate ground wire run bridging the flexible connections. This ground wire shall be run from the motor back to the nearest junction box or motor control centre where the termination can be readily inspected. Insulation for this wire shall be green.
- .4 Lay-in trays and feeder conduits shall be connected to the ground bus.
- .5 All panel feeds at 208 volt shall include a building network ground conductor.
- .6 All grounding conductors outside the electrical rooms and closets shall be insulated and installed in conduits, unless otherwise noted.
- .7 Install connectors in accordance with manufacturer's instructions.
- .8 Protect exposed grounding conductors from mechanical injury.
- .9 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .10 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.
- .11 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .12 Structural steel and metal siding to ground by welding copper to steel.
- .13 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections unless indicated otherwise.
- .14 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .15 Soldered joints not permitted.
- .16 Install separate ground conductor to outdoor lighting standards.
- .17 Make grounding connections in radial configuration only. Avoid loop connections.
- .18 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

3.2 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of secondary systems.

3.3 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, duct systems, frames of motors, starters, control panels, structure steel work, and distribution panels.

3.4 COMMUNICATION SYSTEMS

- .1 Install grounding connections for all communication and security systems as per manufacturer's recommendations

3.5 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Perform tests before energizing electrical system.
- .3 Disconnect ground fault indicator during tests.
- .4 All grounding conductors outside the electrical rooms and closets shall be insulated and installed in conduits, unless otherwise noted.
- .5 Connections to equipment shall be made with, bronze or copper bolts and connectors.
- .6 Equipment grounds shall be connected to the building grounding network. All non-current carrying metallic parts of equipment shall be connected to the ground network.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

- .1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
 - .2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
 - .3 National Electrical Manufacturers Association (NEMA).
 - .4 National Building Code 2010 (NBC 2010)
 - .5 National Fire Protection Association (NFPA)
 - .6 Institute of Electrical and Electronic Engineers (IEEE).
 - .7 Audio Engineering Society (AES).
 - .8 Other Applicable CSA and UL approvals.
- .2 Submit shop drawings in accordance with:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 Section 26 05 01 – Common Work Results

1.3 PRODUCT APPROVALS

- .1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.
- .2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.
- .3 The Bidder must provide a complete list of primary system products offered with their bid.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.
- .2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended or set in poured concrete walls and ceilings.

Part 3 Execution

3.1 INSTALLATION

- .1 Secure equipment to poured concrete with expandable inserts.
- .2 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .3 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .6 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .7 For surface mounting of two or more conduits, use channels spaced as required by C22.1.
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.2 WARRANTY

- .1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the

Owner on 24 hours' notice.

- .2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.
- .3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:
 - .1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

- .1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
 - .2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
 - .3 National Electrical Manufacturers Association (NEMA).
 - .4 National Building Code 2010 (NBC 2010)
 - .5 National Fire Protection Association (NFPA)
 - .6 Institute of Electrical and Electronic Engineers (IEEE).
 - .7 Audio Engineering Society (AES).
 - .8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

- .1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.
- .2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.
- .2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 At least three spare terminals on each set of lugs in splitters.

2.2 JUNCTION AND PULL BOXES

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

- .1 Sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

Part 3 Execution

3.1 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance information for incorporation into manual specified in:
 - .1 Section 01 78 00 - Closeout Submittals
- .2 Include:
 - .1 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.
 - .2 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.2 SPLITTER INSTALLATION

- .1 Install splitters and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.3 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install terminal / bix block where indicated in cabinets.
- .4 Only main junction and pull boxes are indicated. Provide others as required by code. Install pull boxes so as not to exceed 30m of conduit run between pull boxes.

3.4 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Install size 2 identification labels indicating system name, voltage and phase, Emergency, or Normal power.

3.5 WARRANTY

- .1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.
- .2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.
- .3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:
 - .1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

- .1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
 - .2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
 - .3 National Electrical Manufacturers Association (NEMA).
 - .4 National Building Code 2010 (NBC 2010)
 - .5 National Fire Protection Association (NFPA)
 - .6 Institute of Electrical and Electronic Engineers (IEEE).
 - .7 Audio Engineering Society (AES).
 - .8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 Section 26 05 01 – Common Work Results
- .2 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.4 PRODUCT APPROVALS

- .1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.
- .2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.
- .3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.
- .2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 OULET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Provide blank cover plates for boxes without wiring devices.
- .5 Provide combination boxes with barriers where outlets for more than one system are grouped.
- .6 Each outlet box installed in steel stud and gyproc walls shall be mounted on Caddy #BHA, series SGB or TSGB screw gun brackets. Wood strapping with steel studs shall not be utilized for supporting outlet boxes
- .7 Use condulets where 90° turn required on wall mounted conduit. They shall be of the type where cover screws do not enter the wire chamber and covers are left accessible.
- .8 Each outlet box installed in acoustic tile ceilings shall be mounted on double Caddy "Tee Bar Hanger" #512 in such a manner that the outlet box will not twist in any direction.
- .9 Where boxes are surface mounted in unfinished areas, such as furnace or boiler rooms, stamped galvanized steel 100 mm square box to accept #8300 series raised covers shall be used.
- .10 Where surface wiring methods are allowed and approved in finished areas, use Hubbell or Wiremold boxes as per drawings c/w suitable adapter for wireway entrance.
- .11 Outdoors or damp locations, boxes shall be cast Feraloy or aluminum type 'FS', with threaded hubs and vapourproof covers.
- .12 Indoors, stamped zinc cadmium plated steel boxes shall be provided and set for each fixture, switch, wall receptacle or other types of outlets, adapted to suit its respective location and designed to accept its particular components.
- .13 Standard octagon boxes shall be 100 mm diameter, 53 mm deep minimum. Increase depth where area fill requires. Equip each box used for fixture hanging with a fixture stud.
- .14 Two gang or larger shall be solid type with raised cover for tile, block or gyproc finish.
- .15 Wood strapping with steel studs shall not be utilized for supporting outlet boxes.
- .16 Set boxes plumb and level within 6 mm of finished surface. Mats not permitted.
- .17 Where required, provide voltage separation barriers.

2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 Standard octagon boxes shall be 100 mm diameter, 53 mm deep minimum. Increase depth where area fill requires. Equip each box used for fixture hanging with a fixture stud.
- .3 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.
- .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .5 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 MASONRY BOXES

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

2.4 CONCRETE BOXES

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

- .1 Outdoors or damp locations, boxes shall be cast Feraloy or aluminum type 'FS', with threaded hubs and vapourproof covers.
- .2 Indoors, stamped zinc cadmium plated steel boxes shall be provided and set for each fixture, switch, wall receptacle or other types of outlets, adapted to suit its respective location and designed to accept its particular components.
- .3 Standard octagon boxes shall be 100 mm diameter, 53 mm deep minimum. Increase depth where area fill requires. Equip each box used for fixture hanging with a fixture stud.
- .4 Two gang or larger shall be solid type with raised cover for tile, block or gyproc finish.
- .5 Wood strapping with steel studs shall not be utilized for supporting outlet boxes.
- .6 Set boxes plumb and level within 6 mm of finished surface. Mats not permitted.
- .7 Where required, provide voltage separation barriers.

2.6 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

- .4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- .5 Outlet boxes shall be supported independently of conduit capable of supporting weight of fixture or other device. Conduit entering the back of a box shall not enter the centre knockout.
- .6 For recessed fixtures in suspended ceilings, outlet box shall be accessible when fixture is removed.
- .7 Flexible conduit to fixture shall be minimum 12 mm diameter, and shall not emanate from outlet box cover. Maximum length of flexible conduit from outlet box to fixture shall be 3000 mm. Outlet box for fixture shall not be located above ducts, pipes, etc. Outlet box shall be within 750 mm (vertically) of the fixture.
- .8 Provide and set all special communications type back boxes associated with systems specified under Electrical Divisions.
- .9 In placing outlets, allow for overhead pipes, ducts, etc., and for variation in wall and ceiling finishes, door and window trim, panelling, etc.
- .10 Location of receptacle outlets in equipment rooms shall be finalized during construction to give optimum arrangement. Consultant to approve locations before installation.
- .11 Multigang boxes shall have each gang fully barriered from the next, or multiple single gang boxes may be used, provided they are installed in a neat, orderly fashion. Barriers shall be steel and shall be firmly held in place.

Attention is directed to special outlet box locations for switches requiring wider mount spacing rejection feature.

3.2 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance information for incorporation into manual specified in:
 - .1 Section 01 78 00 - Closeout Submittals
- .2 Include:
 - .1 Operation instructions
 - .2 Description of system operation

- .3 Description of each subsystem operation
- .4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.
- .5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WARRANTY

- .1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.
- .2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.
- .3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:
 - .1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

- .1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
 - .2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
 - .3 National Electrical Manufacturers Association (NEMA).
 - .4 National Building Code 2010 (NBC 2010)
 - .5 National Fire Protection Association (NFPA)
 - .6 Institute of Electrical and Electronic Engineers (IEEE).
 - .7 Audio Engineering Society (AES).
 - .8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

- .1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.
- .2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.
- .3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.
- .2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2

Products

2.1 CONDUITS

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .2 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.
- .4 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3
- .5 Conduit for use in corrosive atmospheres shall be rigid PVC or rigid steel with extruded PVC jacketed. Refer to drawings for areas requiring PVC.
- .6 Condulets shall be of a type wherein cover screws do not enter the wire chamber.
- .7 Flexible conduit connections to all mechanical equipment shall be of 'Sealtite' manufacture.
- .8 Flexible conduit connectors shall be of the insulated throat type.
- .9 Condulets with suitable covers shall be used where condulets are exposed. Each conduit fitting shall be of a type suitable to its particular use, and of a type which will allow installation of future conduits without blocking covers of existing condulets.
- .10 Expansion joints shall be installed with ground jumper.
- .11 All conduits shall be terminated with a suitable bushing.
- .12 Flexible conduit and Rigid conduit entering boxes or enclosures shall be terminated with nylon insulated steel threaded bushings, grounded type.

2.2 CONDUIT FASTENINGS

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

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit / raceway specified. Coating: same as conduit / raceway.
- .2 Factory "ells" where 90° bends are required for 25 mm and larger conduits / raceways.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conduits and cables shall be supported, at regular intervals, with corrosion resisting clamps. Lead anchors or expansion bolts shall be used to attach clamps to masonry walls.
- .3 Conduit and cables shall be installed to avoid proximity to water and heating pipes. They shall not run within 150 mm of such pipes, except where crossings are unavoidable, in which case they shall be kept at least 25 mm from covering of pipe crossed.
- .4 Cap ends of all conduits to prevent entrance of foreign matter during construction. Manufactured caps shall be employed.
- .5 Conduit shall be installed as close to building structure as possible so that where concealed, necessary furring can be kept to a minimum.
- .6 Empty conduits, installed under this Division but in which wiring will be installed by others, shall be swabbed out with "Jet Line" foam packs, and be c/w Polypropylene pull wire or polytwine.
- .7 Conduits shall be installed at right angles or parallel to building lines, accurate in line and level.
- .8 Conduit shall not be bent over sharp objects. Improperly formed bends and running threads will not be accepted. Bends and fittings shall not be used together. Proper supports of manufactured channels shall be provided where exposed conduits and cable runs are grouped.
- .9 Under no condition will EMT be allowed exposed within 1200 mm of floor, outdoors, or in areas where explosive, corrosive or moist atmosphere exists.
- .10 Not more than four (4) 90 degree bends or equivalent offsets will be permitted between pull boxes. When maximum number of bends are used, the total run between pull boxes shall not exceed 18000 mm.
- .11 PVC conduit shall not pass through a fire partition or floor separation. Where it is necessary for PVC conduits to pass through a fire barrier, a transition to rigid steel conduit shall be provided for 2000 mm on either side of the fire barrier.
- .12 Surface mount conduits except where noted otherwise.
- .13 Use rigid PVC conduit in corrosive areas or as indicated on plans.
- .14 Use flexible metal conduit or Teck90 for connection to motors.

- .15 Use liquid tight flexible metal conduit or Teck90 for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .16 Use explosion proof flexible connection for connection to explosion proof motors.
- .17 Minimum conduit size for lighting and power circuits: 19 mm.
- .18 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter. Mechanically bend steel conduit over 19 mm dia.
- .19 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .20 Install pulltwine in all empty conduits / raceways and conduits / raceways that are less than 40% filled.
- .21 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .22 Dry conduits out before installing wire.
- .23 Conduits/Cabling/raceways are not to be run within concrete floors/ceilings. Any conduits/cabling/raceways required to be run along the concrete slabs shall be surface run and not recessed into the concrete. Any instances where cabling is required to be run vertically within concrete poured walls, coreline may be used as the raceway but it shall be transitioned to EMT or Rigid Steel (where required) with interfacing connectors or junction boxes being provided as required. This specification contains references to cast in place conduits. This is only applicable where specifically called for in certain locations within the documents.

3.2 SURFACE CONDUITS

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

3.3 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.

- .2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.5 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance information for incorporation into manual specified in:

- .1 Section 01 78 00 - Closeout Submittals

- .2 Include:

- .1 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

- .2 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.6 WARRANTY

- .1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.
- .2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.
- .3 Section 01 33 00 - Submittal Procedures.
- .4 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2No.126-M91(R1997), Cable Tray Systems.
- .2 National Electrical Manufacturers Association (NEMA) standards
 - .1 NEMA FG 1-1993, Fibreglass and Cable Tray Systems.
 - .2 NEMA VE 1-1998, Metal Cable Tray Systems.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with section 01 33 00 - Submittal Procedures.
- .2 Identify types of cabletroughs used.
- .3 Show actual cabletrough installation details and suspension system.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.
- .2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 CABLETROUGH

- .1 Cable trays shall be complete with necessary factory elbows, fittings, joiner plates, radius turns, supports, etc., as necessary for the total installation.
- .2 Cable tray shall be provided for communications conductors where shown on the drawings. The cable tray shall be used for the running of data/voice communications cables, coax cable.
- .3 The cable tray shall not be used for the running of low-voltage Class 2 control wiring.

- .4 Cable tray indicated on the drawings for the purpose of running base building Data / communications conductors shall be a basket tray cable support system, electroplated welded wire-mesh, minimum of 50 x 100mm mesh size, 105mm deep, in standard 3048mm lengths. Tray width shall be 305mm or 610mm as noted on the drawings.
- .5 Where required, provide framed cable or conduit drops.
- .6 Provide cable clamps or ties at 1000 mm intervals to maintain alignment of cable in tray.
- .7 All hanger rods and supports shall be galvanized.
- .8 Cable tray shall be manufactured by Cooper B-Line Systems, Cablofil, Canstrut, Code Manufacturing Ltd., or Thomas and Betts 'Express' Tray.

2.2 WATERFALL KITS FOR DATA CABLES

- .1 Provide data cable waterfall kits mounted to cable tray within LAN room to support owner-supplied data cables and maintain cable radius as they transition from cable tray to data racks.
- .2 Two (2) waterfall kits shall be provided for each owner-supplied data rack. Coordinate locations on site.
- .3 Waterfall kits shall be steel or glass reinforced nylon construction, and be of the same manufacturer as cable tray

2.3 SUPPORTS

- .1 Provide supports as required.

Part 3 Execution

3.1 INSTALLATION

- .1 Install complete cabletrough system.
- .2 The cable tray within LAN room shall be suspended 2700mm above the floor ceiling in the layout noted
- .3 The cable trays run within existing ceiling spaces shall be installed above t-bar ceilings where existing, to maximize headroom.
- .4 Do not run tray within 300 mm of steam or hot water lines. Cable tray shall not be in contact of any sprinkler piping or laboratory gas lines.
- .5 Cuts shall be filed smooth and treated with a galvanizing compound where cutting of certain sections is required.
- .6 Cable tray shall be supported on 1500 mm centres, and shall be adequately braced to withstand loads due to pulling in of cables.
- .7 Check routing and field dimensions to ensure there is absolutely no interference with work and equipment of other divisions. Cable tray routing may be altered to address existing ductwork and building elements upon approval by owner.

- .8 Cable tray shall be bonded with manufactured grounding lugs every 15 meters with AWG #6 insulated copper unless otherwise noted.
- .9 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.
- .10 Install waterfall kits onto cable tray over data rack locations.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

- .1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
 - .2 CSAC22.2No.26, Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.
 - .3 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
 - .4 National Electrical Manufacturers Association (NEMA).
 - .5 National Building Code 2010 (NBC 2010)
 - .6 National Fire Protection Association (NFPA)
 - .7 Institute of Electrical and Electronic Engineers (IEEE).
 - .8 Audio Engineering Society (AES).
 - .9 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

- .1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.
- .2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.
- .3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

- .2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 WIREWAYS

- .1 Wireways and fittings: to CSA C22No.26.
- .2 Sheet steel with hinged cover to give uninterrupted access.
- .3 Finish: baked grey enamel.
- .4 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

Part 3 Execution

3.1 INSTALLATION

- .1 Install wireways and auxiliary gutters.
- .2 Keep number of elbows, offsets, connections to minimum.
- .3 Install supports, elbows, tees, connectors, fittings.
- .4 Install barriers where required.
- .5 Install gutter to full length of equipment.

3.2 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance information for incorporation into manual specified in:
 - .1 Section 01 78 00 - Closeout Submittals
- .2 Include:
 - .1 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.
 - .2 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WARRANTY

- .1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.
- .2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.
- .3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal

operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

- .1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
 - .2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
 - .3 National Electrical Manufacturers Association (NEMA).
 - .4 National Building Code 2010 (NBC 2010)
 - .5 National Fire Protection Association (NFPA)
 - .6 Institute of Electrical and Electronic Engineers (IEEE).
 - .7 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .8 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .9 CSA-C22.2 No.55, Special Use Switches.
 - .10 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

- .1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.
- .2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.
- .3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.
- .2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 SWITCHES

- .1 15 A, 120 Volt and 347 Volt, single pole, three-way switches where required on drawings.
- .2 Manually-operated general purpose ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine molding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 Ivory toggle.
- .3 Toggle operated fully rated for tungsten filament and fluorescent lamps.
- .4 All wiring devices specified shall be of the same manufacture throughout the project.
- .5 Switches controlling motors shall be K.W. (H.P.) rated and approved for motor control service.
- .6 Set switches flush in all finished areas, or in surface box where conduit or wireway is exposed.
- .7 Refer to drawing symbol schedule for further requirements.
- .8 Switches and receptacles shall comply with requirements of CSA and NEMA Standards.
- .9 Switches shall be specification grade from one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

2.2 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:
 - .1 Ivory high impact chemical resistant molded nylon or polycarbonate face.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
 - .6 Specification grade from one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.
- .2 Single locking receptacles CSA type L5-15 R, 125 V, 15 A, U ground with following features:
 - .1 High impact chemical resistant molded nylon or polycarbonate face.
 - .2 Suitable for No. 10 AWG for back and side wiring.

- .3 Four back wired entrances, 2 side wiring screws.
- .4 Specification grade from one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.
- .3 All UPS powered receptacles specified above shall be blue
- .4 All emergency powered receptacles specified above shall be red.
- .5 Other receptacles with ampacity and voltage as indicated.
- .6 Receptacles shall be of one manufacturer throughout project.
- .7 Set receptacles flush in all finished areas, or in surface box where conduit or wireway is exposed.
- .8 Receptacles located in LAN room for data rack equipment shall be mounted within a surface box secured to cable tray above rack location using uni-strut supports. Provide lamecoid label riveted to outlet box cover indicating circuit number – blue labels for UPS circuit, and red labels for Emergency power circuit.

2.3

COVER PLATES

- .1 Cover plates for wiring devices.
- .2 Cover plates from one manufacturer throughout project.
- .3 Wall plates shall be designed and manufactured in accordance with performance and dimensional requirements of the following industry standards:
 - CSA Standard C22-2 No. 42
 - U.S. Federal Specification WP455
 - NEMA Standard WD-1
- .4 Wall plates shall be manufactured by one of the following:
Cooper, Arrow Hart, Eagle, Hubbell, Leviton or Pass & Seymour.
- .5 Blank cover plates in finished ceiling areas shall be Columbia Electric #9002 baked white enamel for white ceilings, or painted to match colored finishes.
- .6 Unbreakable Nylon wall plates shall be provided for all switches, receptacles, blanks, telephone and special purpose outlets. The wall plates shall be of suitable configuration for the device for which it is to cover with color matched mounting screws. Use ganged plate where more than one device occur at one location. Any specific locations calling for Metal wall plates shall be stainless steel.
- .7 Where surface wiring methods need to be employed in a high finish area because of renovations to existing structure, wall plates shall be used in conjunction with Wiremold surface box to suit the device.
- .8 Where outlets occur in an unfinished area such as boiler or furnace room and surface conduit and boxes are specified, stamped galvanized steel wall plates shall be used to suit configuration.

- .9 Exterior outlets shall be fitted with weatherproof die cast aluminum cover plates to suit wiring device, c/w rubber gasket to provide positive seal. Duplex cover plates shall have two independent flaps. Weatherproof covers shall provide protection in wet and damp locations.

Part 3 Execution

3.1 INSTALLATION

- .1 Switches:
- .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Switches shall be as located on the drawings, mounted up 1200 mm, and ganged where more than one occurs in the same location.
- .2 Receptacles:
- .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Convenience outlets shall be as located on the drawings, and mounted up 450 mm, unless otherwise noted.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
 - .4 Outlets over counter tops shall be mounted 150 mm above counter, or immediately above backsplash. Co-ordinate with architectural drawings for location of all counter tops, millwork and feature walls, to ensure proper location and mounting height.
 - .5 Coordinate with the location of all mechanical convectors and mount convenience outlets up 100 mm above heating convectors.
 - .6 All convenience outlets shall meet tension tests as per CSA requirements, and will be subjected to 'on site' tests during final inspection.
- .3 All plug-in type receptacles shall be identified by means of a Lamecoid label fixed with self tapping screws on the cover plate. Each cover plate shall contain the panel and circuit number. Those receptacles fed from ground fault interrupters shall have 'GFI' labeled adjacent to the panel and circuit number. Those receptacles designated for housekeeping purposes shall have 'HOUSEKEEPING' labeled adjacent to the panel and circuit number.
- .4 The circuits controlled by all switches on all levels, shall be neatly printed with waterproof ink on the side of the switch outlet box so that the panel and circuit number are clearly legible when the cover plate is removed. It shall not be necessary to remove the switch from the outlet box in order to read the panel or circuit number.
- .5 Cover plates:
- .1 Protect 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 meant for flush outlet boxes on surface-mounted boxes.

3.2 WARRANTY

- .1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.
- .2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.
- .3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:
 - .1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

- .1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
 - .2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
 - .3 National Electrical Manufacturers Association (NEMA).
 - .4 National Building Code 2010 (NBC 2010)
 - .5 National Fire Protection Association (NFPA)
 - .6 Institute of Electrical and Electronic Engineers (IEEE).
 - .7 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).
 - .8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 Section 26 05 01 – Common Work Results
- .2 Include time-current characteristic curves for breakers with ampacity of 50 A and over or with interrupting capacity of 18,000 A symmetrical (rms) and over at system voltage.

1.4 PRODUCT APPROVALS

- .1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.
- .2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.
- .3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.
- .2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg C ambient.
- .2 Common-trip breakers: with single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips.
- .4 Circuit breakers with interchangeable trips as indicated.
- .5 Circuit breakers to have minimum of 10,000 A symmetrical rms interrupting capacity rating in breaker panelboards.
- .6 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers to have adjustable trips.

2.2 THERMAL MAGNETIC BREAKERS

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 SOLID STATE TRIP BREAKERS

- .1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous, tripping for ground fault short circuit protection.

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

3.2 WARRANTY

- .1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

- .2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.
- .3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:
 - .1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

- .1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
 - .2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
 - .3 National Electrical Manufacturers Association (NEMA).
 - .4 National Building Code 2010 (NBC 2010)
 - .5 National Fire Protection Association (NFPA)
 - .6 Institute of Electrical and Electronic Engineers (IEEE).
- .2 American National Standards Institute (ANSI)
 - .1 ANSI C82.1, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.
 - .2 ANSI C82.4, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.
 - .3 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .4 ANSI/IEEE C62.41, Surge Voltages in Low-Voltage AC Power Circuits.
 - .5 American Society for Testing and Materials (ASTM)
 - .6 ASTM F1137, Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
 - .7 United States of America, Federal Communications Commission (FCC)
 - .8 FCC (CFR47) EM and RF Interference Suppression.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 Section 26 05 01 – Common Work Results
- .2 Shop drawings for each fixture shall include but not be limited to, lamps, ballasts, fixture cuts, custom colors, and special mounting details. All pertinent information for each fixture shall be stapled separately from other fixtures.

1.4 PRODUCT APPROVALS

- .1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.
- .2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 10 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.
- .3 The Bidder must provide detailed lighting calculation drawings for fixtures that are submitted for approval for offices, open office areas, or as requested by the consultant. These shall be submitted no later than 10 working days before tender close.
- .4 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 LAMPS

- .1 Provide in wattages and types to properly suit the specified fixtures.
- .2 T5 Linear Fluorescent Lamps:
 - .1 Miniature Bi-pin, slim 5/8" diameter for operating with high frequency electronic programmed start ballasts
 - .2 Colour Rendering Index (CRI) of 85
 - .3 Colour Temperature: 3500°K
 - .4 Nominal Life Rating: 20,000 hours
- .3 Lamps shall be manufactured by Osram-Sylvania or Philips.

2.2 BALLASTS

- .1 Ballasts for fluorescent fixtures shall be supplied with the fixtures, pre-wired for operation with the compatible lamps and quantity of lamps specified for the fixture. Provide ballasts in the voltage noted with the fixture specification.
- .2 Fluorescent ballast systems shall include:
 - .1 Operate lamps for maximum efficacy, high lumen output operation and operate for full lamp life
 - .2 Eliminate lamp flicker
 - .3 UL Listed Class P, Type 1 Outdoor
 - .4 CSA Certified
 - .5 70°C Maximum Case Temperature
 - .6 FCC 47CFR Part 18 Non-Consumer for EMI and RFI filtering
 - .7 Class A Sound Rating
 - .8 ANSI C62.41 Category A Transient Protection

- .9 CFCI Compatible
- .3 Ballasts for Linear T5 Lamps
 - .1 Starting Method: Programmed Rapid Start
 - .2 Stepped Switching Ballast System where indicated bi-level 100% and 50% stepped output
 - .3 Ballast Factor (BF): 1.00
 - .4 Circuit Type: Series
 - .5 Lamp Frequency: >40kHz to reduce potential interference with infrared control systems
 - .6 Lamp Current Crest Factor (CCF): less than 1.6
 - .7 Total Harmonic Distortion: <10% THD
 - .8 Power Factor: >98%
 - .9 End of Lamp Life Sensing
 - .10 Manufacturer:
 - Sylvania 'Quicktronic PROStart T5 Professional Series
 - Advance 'Optanium Step Dim EL' series, available in 120-volt only
- .4 Dimming Fluorescent Ballasts for T5, T5HO and Compact Fluorescent Lamps
 - .1 Starting Method: Programmed Rapid Start System
 - .2 Ballast Factor (BF): 1.00 – Normal Ballast Factor
 - .3 Circuit Type: Series
 - .4 Lamp Frequency: >40kHz to reduce potential interference with infrared control systems
 - .5 Lamp Current Crest Factor (CCF): less than 1.7
 - .6 Total Harmonic Distortion: <10% THD
 - .7 Power Factor: >98%
 - .8 Dimming Range: 100 to 10%
 - .9 1 – 10 Volt Control
 - .10 Anti-Flash Circuitry turns on in dimmed mode
 - .11 End of Lamp Life Sensing for T4 and T5 lamps
 - .12 Compatible with 4-pin compact fluorescent lamp types
 - .13 Manufacturers (unless noted otherwise):
 - Lutron 'Hi-Lume' series
 - Sylvania 'Quicktronic – Powersense' series
 - Advance Mark 10
- .5 Fluorescent ballasts shall have inrush current limiting capability to assure compatibility with all lighting systems controls.
- .6 Ballast Warranty: All fluorescent ballasts shall include a written manufacturer's warranty against defects in materials and workmanship for 60 months from date of substantial completion and include a nominal replacement labour allowance.

2.3 LUMINAIRES

- .1 Contractor is responsible for all required mounting details for all lighting fixtures. If mounting of fixture is uncertain, contractor shall confirm prior to finalising pricing.
- .2 Lighting fixtures shall be of the makes indicated. Similar types of fixtures shall be by one manufacturer.
- .3 Only clean luminaires and lamps will be accepted at time of final inspection.
- .4 Recessed fixtures shall generally be supplied complete with trim, plaster frame or ring and mounting brackets where installed in plaster, or without plaster frame in acoustic ceilings.
- .5 Fixtures shall bear appropriate CSA labels.
- .6 Cooperate with all other trades for the proper installation of all lighting fixtures.
- .7 Verify the quantity of fixtures before placing orders.
- .8 Verify all ceiling types with architectural drawings and the General Contractor before ordering fixtures.
- .9 Fluorescent lighting fixtures shall be so designed that the temperature on the ballast case shall not exceed a maximum of 70°C in an ambient temperature of 25°C.
- .10 Co-ordinate with drawings to ensure that all fluorescent fixtures are equipped with ballasts of a suitable voltage to match branch circuitry.
- .11 All fluorescent fixtures such as troffers, specified as being equipped with flat acrylic lens, shall be provided with lens not less than 3.175 mm thick, regardless of catalogue numbers specified.
- .12 All fluorescent troffers specified as being installed in inverted T-bar ceilings shall be painted on bottom face of fixture to match the T-bar splines unless otherwise noted.
- .13 A self adhesive small circular label coloured blue shall be placed on a T-bar spline adjacent to each fixture housing the ballast to facilitate its location.
- .14 All fluorescent luminaires installed on branch circuits with voltages exceeding 150 volts-to-ground shall be provided with a disconnecting means integral with the luminaire that simultaneously opens all circuit conductors between the branch circuit conductors and the conductors supplying the ballast(s), and shall be marked in a conspicuous and permanent manner adjacent to the disconnecting means so as to identify the disconnect.
- .15 The new light fixture lamps shall not be used during construction. The contractor may use their own temporary lamps during construction at their own expense with the Owner's approval. The contractor shall replace temporary lamps with new lamps upon completion of work. All fixtures shall be cleaned inside and outside prior to substantial completion.
- .16 Provide lighting fixtures of type and quality as specified in the following schedule. Fixtures shall be complete with necessary accessories, lamps and ballasts. The contractor shall advise of any restrictions on providing luminaire, lamp and ballast as specified during tender period.

- .17 The lighting fixtures shall be as specified in the following schedule, and the manufacturer's numbers shown shall not reduce or amend the requirements as outlined under the description of each fixture type.

2.4 LUMINAIRE SCHEDULE

- .1 Fixture type 'AA'
- .1 Luminaire: Surface mounted fluorescent strip light, 1219mm length c/w wire guard. Suspend to 2700mm, provide chain hanger. Coordinate final mounting height and locations with cable tray and data rack layout.
 - .2 Lamps: 2 x F28 watt T5 lamp
 - .3 Ballast: Program Rapid start electronic ballast, **120-volt**
 - .4 Manufacturer:
Philips #SV series, Cooper Metalux #SM series, Lithonia #UN Series
Or approved equal.

Part 3 Execution

3.1 INSTALLATION

- .1 The contractor under this Division shall be responsible for expediting the delivery and installation of the fixtures to suite the construction schedule and the work of other trades.
- .2 Remove packing material and debris from the job site immediately after installation of fixtures and lamps. Debris shall not be allowed to accumulate more than a reasonable amount.
- .3 Industrial fixtures where suspended shall have 12 mm conduit hangers and ball aligners, the length and location shall clear equipment ducts and pipes.
- .4 Lighting fixture diffusers are not to be installed until the area is completely finished in order to minimize the amount of dirt collection on these units.
- .5 Exit signs shall be wired in a separate conduit system.
- .6 Conduit installation shall conform to the specifications.
- .7 Emergency battery lighting units shall be connected to the room's 120-volt lighting circuit, non-switched leg.

3.2 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance information
 - .1 Section 01 78 00 - Closeout Submittals
- .2 Include:
 - .1 Operation instructions
 - .2 Description of system operation
 - .3 Description of each subsystem operation

- .4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.
- .5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WIRING

- .1 Each fixture shall be fed with a separate flex or AC-90 drop. Looping between fixtures or wiring rows through ballast channel will not be accepted.

3.4 LUMINAIRE SUPPORTS

- .1 Lighting fixtures shall be supported independent of plasterboard or acoustic tile. Support from structural members of the building or ceiling.
- .2 Fixtures installed in exposed ceilings may require plywood backing behind the acoustical panels. Confirm support requirements with manufacturer.

3.5 LUMINAIRE ALIGNMENT

- .1 Luminaires shown in continuous lines or rows shall be carefully aligned so that all rows appear as straight lines.
- .2 Fixtures shall be installed accurately in line and level. Any fixtures which are not installed properly shall be taken down and re-installed at no change to the contract sum. Plaster frames and rings required for recessed fixtures shall be supplied under this section, and installed under the lathing and plaster or acoustic ceiling divisions. The work of the electrical division shall include the necessary co-ordination with the above divisions in regard to the correct location and installation of the plaster frame and rings.

3.6 WARRANTY

- .1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.
- .2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.
- .3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:
 - .1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

3.7 VERIFICATION

- .1 Perform tests in accordance with:
 - .1 Section 26 05 01 - Common Works Results - Electrical

- .2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:
 - .1 That the system is complete in accordance with this specification
 - .2 That the system is installed in accordance with the manufacturer's best recommendations
- .3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.8 TRAINING

- .1 Perform training in accordance with:
 - .1 Section 26 05 01 - Common Works Results – Electrical
- .2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

- .1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
 - .2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
 - .3 National Electrical Manufacturers Association (NEMA).
 - .4 National Building Code 2010 (NBC 2010)
 - .5 National Fire Protection Association (NFPA)
 - .6 Institute of Electrical and Electronic Engineers (IEEE).
- .2 Canadian Standards Association, (CSA International)
 - .1 CSA-T529, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/EIA TIA 568A with modifications).
 - .2 CSA-C22.2 No. 214, Communications Cables (Bi-national Standard, with UL 444).
 - .3 CAN/CSA-C22.2 No. 182.4, Plugs, Receptacles, and Connectors for Communication Systems.
- .3 Telecommunications Industry Association (TIA)
 - .1 TIA/EIA/ANSI – 568B.1/2/3 latest revision Commercial Building Standards for Telecommunications Pathways and Spaces;
 - .2 TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises;
 - .3 TIA-568-C Series Commercial Building Telecommunications Cabling Standard;
 - .4 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces;
 - .5 TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building;
 - .6 TIA/EIA-607 Commercial Building Ground (Earthing) and Bonding Requirements for Telecommunications;
 - .7 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision
 - .8 TIA/EIA T568-A UTP wiring/pinout

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

- .1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.
- .2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.
- .3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 SYSTEM DESCRIPTION

- .1 The data and voice cable installation shall include all cable, patch cords, connectors, terminations, and coverplates. New cables shall be terminated on existing patch panels within existing racks, and on existing bix blocks within the existing LAN closet noted on drawings.
- .2 The cabling system shall meet or exceed the minimum characteristics as outlined TIA Standards Category 6A. In addition, the testing method and parameters shall be as per the TIA recommendations.
- .3 The cabling installer shall be a Belden Certified System Vender installing Belden components. Once completed, the installation must be a Belden Certified System. The data system and components shall be guaranteed for a period of twenty (20) years from the date of installation against defects in materials and workmanship.

1.6 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures and 26 05 01 – Common Work Results, Electrical.
- .2 Submit shop drawings for review prior to ordering equipment. Shop drawings shall include but not be limited to, photocopies of accredited installers, cabling, hardware and components, patch cords, tester information, and labeling.
- .3 Submit manufacturer's certification documentation that guarantees installation techniques, cable and cabling components and carry a minimum 20 year certification from the manufacturer for the capability to support gigabit applications such as 1000 Base-T, 622MB/s and 2.4 Gb/s ATM and work case channel performance based on the values indicated. The term channel performance incorporates manufacturer certified patch cords.
- .4 Upon request and at no cost, the contractor shall provide a manufacturer's technical representative to conduct an onsite visit to ensure complete technical compliance.

- .5 The manufacturer's certification must guarantee that design or installation negligence on the part of the certified contractor will not negate or void any portion of the certified system. The manufacturer must guarantee that all material, components and labour are covered for the full certification period. It must also guarantee that in the event a contractor is no longer in business, the full certification remains valid.

1.7 CONTRACTOR QUALIFICATIONS

- .1 The Installer (Firm and Employees) conducting the installation shall have full working knowledge of cabling low voltage applications such as, but not limited to data/voice communications cabling systems. The Installer shall have at least five years of continuous recent experience on similar projects. The Installer shall hold recent, up-to-date licenses, certifications and training certificates in the area the project is located and for the equipment to be installed. The Installer shall:
 - .1 Provide references of the type of installation provided for this specification;
 - .2 Be a Belden Certified System Vendor.
 - .3 Have a knowledge of all applicable Telecommunication standards such as but not limited to CSA, TIA/EIA, IEEE and ANSI;
 - .4 Have a experience in the installation of pathways and support for horizontal and backbone cabling;
 - .5 Be experienced in the installation and testing of telecommunication network cabling system, including the use of light meter and OTDR.
 - .6 Provide proof of being a manufacturer certified installer for all cable network components being installed such as but not limited to cables, connectors and end termination equipment. The use of non-manufacture certified installer is not permitted.

1.8 PROJECT CLOSEOUT

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures and 26 05 01 – Common Work Results, Electrical.
- .2 Operating and Maintenance Manuals at project closeout shall include
 - .1 List of cables, hardware and components;
 - .2 Copies of approved shop drawings;
 - .3 Record drawings.
 - .4 Warranty certification from the Manufacturer
 - .5 Receipts that include the listing of spare parts, materials and supplies, including patch cables and equipment cords.
 - .6 Test and verification reports (may be submitted on CD Disk inserted in an appropriate envelope page in the manual).

Part 2 Products

2.1 COMMUNICATION CABLES, PATHWAYS AND TERMINATION BLOCKS

- .1 Refer to Section 27 05 14 - Communication Cables Inside Buildings
- .2 Refer to Section 27 05 28 – Pathways for Communications Systems
- .3 Refer to Section 27 11 19 – Communications Termination Blocks

Part 3 Execution

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 The communications cabling system and testing shall comply with the following standards. All standards shall be as per the latest revision at the time of tendering this project.
 - .1 TIA/EIA/ANSI – 568B.1/2/3 latest revision
 - .2 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision
 - .3 TIA/EIA T568-A UTP wiring/pinout
 - .4 BICSI, TDMM Telecommunications Distribution Methods Manual (latest edition)
 - .5 CAN/CSA-T529-M91
 - .6 CAN/CSA-T530-M90
 - .7 CAN/CSA-T527-94, EIA/TIA-607
 - .8 CAN/CSA-T528-93, EIA/TIA-606
 - .9 EIA/TIA-TSB 40-A
 - .10 EIA/TIA-TSB 67
 - .11 EIA/TIA-569
 - .12 EIA/TIA-606
- .3 The total installation shall be completed by the cable Installer who is certified by the manufacturer for Category 6A cable installations. The Installer shall submit photocopies of accreditation certificates with the shop drawings. Submit testing method and tester with shop drawings.
- .4 The contractor shall submit the verified test result on each cable, connector, and connection for the total installation, including back-bone and horizontal cabling. The model number and manufacturer of the Category 6A cable shall be documented. The type of tester used for testing the Category 6A cabling must also be documented.
- .5 Test results shall be evaluated by the test equipment using the most up-to-date criteria from the TIA/EIA Standard. This information shall be supplied in electronic format.
 - .1 Room number of installation
 - .2 Wall plate ID
 - .3 Test Results with an identification of type of test used and whether the result was PASS or FAIL
- .6 Category 6A cable tests shall provide results for the following tests:
 - .1 Near End Crosstalk (NEXT)
 - .2 Attenuation
 - .3 Ambient Noise
 - .4 Attenuation to Crosstalk Ration (ACR)
 - .5 Far End Crosstalk (FEXT)
- .7 Provide with maintenance manuals, a marked set of prints illustrating the network drop name for each drop location. No other as-built information shall be provided on these prints unless it relates to the data or voice network.

- .8 The consultant will spot test this testing following test completion. Contractor shall provide the testing technician for (2) hours, and the completed test charts, for spot check verifications.

3.2 WARRANTY

- .1 Testing and certification of the building network distribution cable installation shall be by the Installer and shall include the provision of a full Manufacturer's and Vendor's Warranty covering performance, products and installation. The Warranties shall cover the full repair and/or replacement of any component failing or failure to meet the design requirements within one (1) year. Warranties shall be delivered to the Project Manager with the Testing and Certification documentation.
- .2 Within ten (10) days after testing, the Installer shall submit the cable test results, and a marked up record drawing(s) of the as-built cable network. The record drawing(s) shall include the cable/jack identification at the outlet locations.
- .3 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.
- .4 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts

3.3 VERIFICATION

- .1 Perform tests in accordance with:
- .1 Section 26 05 01 - Common Works Results - Electrical
- .2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:
- .1 That the system is complete in accordance with this specification
 - .2 That the system is installed in accordance with the manufacturer's best recommendations
- .3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.4 TRAINING

- .1 Perform training in accordance with:
- .1 Section 26 05 01 - Common Works Results - Electrical
- .2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

- .1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
 - .2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
 - .3 National Electrical Manufacturers Association (NEMA).
 - .4 National Building Code 2010 (NBC 2010)
 - .5 National Fire Protection Association (NFPA)
 - .6 Institute of Electrical and Electronic Engineers (IEEE).
 - .7 Audio Engineering Society (AES).
 - .8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

- .1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.
- .2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.
- .2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

1.6 SYSTEM DESCRIPTION

- .1 The data and voice cable installation, shall include all cable, connectors as specified and shown on drawings.
- .2 The cabling system shall meet or exceed the minimum characteristics as outlined TIA Standards Category 6A. In addition, the testing method and parameters shall be as per the TIA recommendations and meet requirements for testing Category 6 installations.
- .3 The cabling system shall use matched components from a single manufacturer certified to deliver system performance over the lifetime of the applications which the cabling system was originally designed to support. The data system and components to be certified by the manufacturer and shall be guaranteed for a period of twenty (20) years from the date of installation against defects in materials and workmanship. The manufacturer shall be Belden.
- .4 Each cable shall be equipped with connectors on each end and connected to wall jacks or cable connectors. All field communications cabling to be terminated on patch panels located on the drawings.
- .5 The data cabling channel shall not exceed four (4) connections and shall not exceed 90m.

Part 2 Products

2.1 HORIZONTAL COMMUNICATIONS BUILDING CABLE (CBC)

- .1 All communication cable (data and voice) shall be unshielded twisted pair, Category 6A. four (4) pair #23 AWG, CMP (FT6) rated and meet TIA/EIA/ANSI – 568-C.2, latest revision unless noted otherwise. Cable colour shall match existing on site – confirm on site prior to ordering: Data cable shall be white, Voice cable shall be blue.
- .2 Each cable shall be equipped with connectors on each end at the wall jacks and patch panels at the data equipment racks.
- .3 The data cabling channel shall not exceed four (4) connections and overall length shall not exceed 90m. The maximum distance shall include an allowance of 3 meters from the outlet to the workstation and 6 meters for patch cords.
- .4 Data and voice may be installed in a common box.
- .5 A minimum of two Category 6A UTP cables shall be installed at each workstation unless otherwise noted on the drawings.

2.2 IMS NETWORK PATCH CORDS

- .1 Pre-terminated, factory tested patch cords shall be of the same manufacturer as the installed system and shall be part of the certified system. Patch cables shall be labeled at both ends.
- .2 Patch cords for data and voice cables shall have stranded conductors and meets the requirements of TIA/EIA 568B (latest revision). Patch cords shall meet Category 6A criteria when tested with the components of the system. Patch cords at workstations shall be Category 6A cable terminated with 8 pin modular male jacks, TIA T568B pinout.

- .3 Provide 2.1m length patch cords for PC connections at each new and existing cable drop located within the office, boardroom and open office renovation shown on the plans.
- .4 Provide patch cords at the data racks with lengths to match existing.

Part 3 Execution

3.1 INSTALLATION OF COMMUNICATION CABLES

- .1 All cable shall be pulled using proper wire grips. Pulling force and bend radius shall not exceed manufacturer's specifications.
- .2 Velcro straps shall be used in all locations, cable ties are unacceptable.

3.2 WARRANTY

- .1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.
- .2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.
- .3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:
 - .1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.
- .4 During the warranty period, provide three (3) separate site visits of four (4) hours each on site for owner revisions and additional training.

3.3 VERIFICATION

- .1 Perform tests in accordance with:
 - .1 Section 26 05 01 - Common Works Results - Electrical
- .2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:
 - .1 That the system is complete in accordance with this specification
 - .2 That the system is installed in accordance with the manufacturer's best recommendations
- .3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.4 TRAINING

- .1 Perform training in accordance with:
 - .1 Section 26 05 01 - Common Works Results - Electrical
- .2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

- .1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
 - .2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
 - .3 National Electrical Manufacturers Association (NEMA).
 - .4 National Building Code 2010 (NBC 2010)
 - .5 National Fire Protection Association (NFPA)
 - .6 Institute of Electrical and Electronic Engineers (IEEE).
 - .7 Audio Engineering Society (AES).
 - .8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 Section 26 05 01 – Common Work Results
- .2 Submit shop drawings for review prior to ordering equipment. Shop drawings shall include but not be limited to, photocopies of accredited installers, outlets, and coverplates.

1.4 PRODUCT APPROVALS

- .1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.
- .2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

- .2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

1.6 SYSTEM DESCRIPTION

- .1 Telecommunications raceways system consists of outlet boxes, cover plates, cabinets, conduits, cable troughs, pull boxes, sleeves and caps, fish wires, service poles, service fittings, concrete encased ducts.

Part 2 Products

2.1 MATERIAL

- .1 Conduits: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings
- .2 Cable troughs: type, in accordance with Section 26 05 36 - Cable Trays for Electrical Systems
- .3 Junction boxes, in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets

2.2 OUTLET BOXES

- .1 Outlet boxes shall be 100mm square boxes. Multiple boxes shall not be ganged unless noted otherwise.
- .2 Wall plates for communication cable systems shall have integral self labeling. The wall plates must support up to four (4) network drops and be run in a minimum of **27mm** conduit to the nearest equipment rack or stub at the basket tray in the accessible ceiling. Provide blank filler plates for unused drops.
- .3 Wall plates shall be modular and in 'Keystone' format opening to allow the possibility of changing connector types in the future without replacing the wall plate. Faceplates shall be equipped with small form factor terminating connectors to fit the individual outlet's requirements (RJ45 and or Dual LC and or CATV bulkheads).
- .4 Wall plates shall be equipped with a minimum of four (4) angled keystone openings. The installer shall equip the wall plate with the required amount of blank inserts as required. The minimum standard of acceptance for wallplates are Corning WLL-PL-AP or Panduit NK4VSFWH.

2.3 CABLE MANAGEMENT

- .1 Velcro ties shall be used. Each cable type shall be bundled separately; that is data bundle, voice bundle, and fibre bundle. Cable ties wraps are unacceptable.

Part 3 Execution

3.1 SECURITY

- .1 All cabling shall be installed in conduit in areas deemed unsecured. Unsecured areas, unless otherwise noted include the following:

- .1 Any area accessible by more than one tenant or the public.
- .2 Any area where cabling crosses from one tenant space to another tenant space.
- .2 No communication (data, voice or fibre) cabling shall share same raceway or junction boxes with any other pathway system.

3.2 **INSTALLATION**

- .1 All horizontal cables shall be run in existing cable tray.
- .2 Use of LL, LR and LL conduit fittings is not permitted.
- .3 In all wall outlet boxes, the contractor shall leave 400mm length of cable in each box.
- .4 In all wall workstation drops, leave 300mm of cable slack before entering wall or workstation in suspended ceiling.

3.3 **WARRANTY**

- .1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.
- .2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.
- .3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:
 - .1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.
- .4 During the warranty period, provide three (3) separate site visits of four (4) hours each on site for owner revisions and additional training.

3.4 **VERIFICATION**

- .1 Perform tests in accordance with:
 - .1 Section 26 05 01 - Common Works Results - Electrical
- .2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:
 - .1 That the system is complete in accordance with this specification
 - .2 That the system is installed in accordance with the manufacturer's best recommendations
- .3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required

equipment such as ladders, scaffolding, etc.

3.5 TRAINING

- .1 Perform training in accordance with:
 - .1 Section 26 05 01 - Common Works Results - Electrical
- .2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

- .1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
 - .2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
 - .3 National Electrical Manufacturers Association (NEMA).
 - .4 National Building Code 2010 (NBC 2010)
 - .5 Institute of Electrical and Electronic Engineers (IEEE).
- .2 Canadian Standards Association (CSA) International
 - .1 CAN/CSA-C22.2 No.182.4, Plugs, Receptacles and Connectors for Communication Systems.
 - .2 CSA T529, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/EIA TIA 568a with modifications).
- .3 Electronic Industries Alliance (EIA) / Telecommunications Industries Association (TIA)
 - .1 TIA/EIA/ANSI – 568B.1/2/3 latest revision
 - .2 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision
 - .3 TIA/EIA T568-A UTP wiring/pinout
- .4 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 Section 26 05 01 – Common Work Results
- .2 Submit shop drawings for review prior to ordering equipment. Shop drawings shall include but not be limited to, photocopies of accredited installers, copper termination jacks, and sample labeling.

1.4 PRODUCT APPROVALS

- .1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as

alternates must result in a control system that meets or exceeds all technical performance criteria as described.

- .2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.
- .3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.
- .2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

1.7 SYSTEM DESCRIPTION

- .1 Termination, patch cords, and cross-connection equipment installed inside building for voice and data for telecommunications systems employing unshielded-twisted-pair (UTP) cables. Refer to drawings for details.

Part 2 Products

2.1 PATCH PANELS, CONNECTORS AND ADAPTORS

- .1 New data and voice cable shall be terminated on owner supplied patch panels within the new LAN Room 200.33 on Second Floor.
- .2 Connectors shall be modular 8 PIN jacks, rated Category 6A –TIA/EIA T568-A UTP wiring/pinout. All data jacks shall be white and all voice jacks shall be blue – confirm colour prior to ordering. Colours shall match existing cable installation.

Part 3 Execution

3.1 LABELLING

- .1 Cable labels shall be self laminating labels as manufactured by Burndy or Panduit.
- .2 Wall plates shall have integral labeling; self-adhesive labels will not be acceptable. Wall plates shall have self-adhesive icons adjacent to each jack of either a telephone or workstation to illustrate type of jack.
- .3 Cable labels shall be self laminating labels as manufactured by Burndy or Panduit.
- .4 Labeling shall be neatly typewritten and be in accordance with TIA 660. Cabling shall be labeled with the drop ID number at both termination points. Cable labeling shall be a logical numbering system. Confirm if owner has special labeling system prior to installation. If owner has no set labeling system, confirm contractor suggested labeling with owner or consultant prior to any installation. The owner or consultant must sign off on labeling prior to installation; this sign-off shall be included in the maintenance manuals.

3.2 WARRANTY

- .1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.
- .2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.
- .3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:
 - .1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.
- .4 During the warranty period, provide three (3) separate site visits of four (4) hours each on site for owner revisions and additional training.

3.3 VERIFICATION

- .1 Perform tests in accordance with:
 - .1 Section 26 05 01 - Common Works Results - Electrical
- .2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:
 - .1 That the system is complete in accordance with this specification
 - .2 That the system is installed in accordance with the manufacturer's best recommendations
- .3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.4 TRAINING

- .1 Perform training in accordance with:
 - .1 Section 26 05 01 - Common Works Results - Electrical
- .2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 Wherever practical and reasonable, all cabinets and electrical boxes shall be installed in the locations shown on the attached floor plans.
- .2 Drawings show conduit connection requirements. Actual conduit runs shall run parallel to building lines.
- .3 Unless specified otherwise, all conduits shall be sized according to the number of cables in the run. Maximum conduit fill is 50%.
- .4 Unless specified otherwise, all junction boxes (J1, J2, J3, etc.) shall be steel and sized according to the number of conduits they must accommodate.
- .5 Unless noted otherwise, all cables pulled to a 'T' Type cabinet (T1, T2, T3, etc.) shall have no less than 2400mm of cable slack in the 'T' cabinet.
- .6 Unless noted otherwise, all cables terminating in a device or outlet box shall have no less than 600mm of cable slack at the device/outlet box.
- .7 All cables terminating in a cabinet, a splitter trough, a device box, a utility box or an outlet box shall be labelled.
- .8 The contractor shall test all cables installed as part of this contract for opens, grounds and shorts. The contractor shall replace any cables found to be defective by the owner.

Part 2 Materials & Products

- .1 Conduit
 - .1 Unless specified otherwise, all conduits shall be EMT.
- .2 Junction, Outlet and Pull Boxes
 - .1 Unless specified otherwise, all outlet, device and pull boxes shall be steel.
- .3 Cable
 - .1 All telephone type (Cat3) cables shall be NORDXD-INSIDE CABLE, 24 AWG, CMR, Category 3 solid copper with a grey jacket (or equivalent).
- .4 Pull Cord/Tape
 - .1 Polypropylene type, 200 lb tensile strength minimum.

Part 3 Execution

- .1 J1 Junction Box
 - .1 Supply and install one junction box above the suspended ceiling. If the ceiling is finished the junction box should be recessed on a wall 100mm below finished ceiling but no higher than 2400mm A.F.F.. Junction box shall be sized according to the number of conduits that must be accommodated.
 - .2 Supply and install conduit, sized to fit cables, from this junction box the T1 cabinet in Room 211.03.
- .2 T1 "T" Cabinet (300H X 300W X 100D)
 - .1 Supply and install one 300H X 300W X 100Dmm Type 1 Telephone cabinet with wood back (BEL Products TCFKO12124WB or equivalent) mounted 150mm above the suspended ceiling.
 - .2 Supply and install one structured wiring/data outlet in the top right corner inside this cabinet. Provide Category 6A cabling from the wiring/data outlet and terminate on a patch panel in LAN Room 200.33.
 - .3 Provide patch cords and cross connected from patch panel to an available port on a data switch.
- .3 01 Device Box
 - .1 Supply and install one recessed 76H X 100W X 63Dmm double gang device box c/w blank cover plate 150mm below finished ceiling but no higher than 2400mm A.F.F..
 - .2 Supply and install conduit from this device box to a junction box in the area (as per floor plans).
 - .3 Supply, install and label two 4 pair telephone (Cat3) cables in the conduit from this outlet box to the T1 cabinet in Room 211.03.
- .4 11 Square Outlet Box
 - .1 Supply and have door-frame fabricator spot weld one 100H X 100W X 40Dmm square outlet box on top of the frame as per attached detail drawing "PROTECTED DOOR - ELEVATION OF SINGLE DOOR WITH DOOR CONTACT".
 - .2 Drill a 19mm hole 75mm (center point) from the edge of the door casing to allow for door switch installation and access to frame mounted outlet box.
 - .3 Supply and install conduit from the outlet box in the door frame to a 76H X 50W X 63Dmm single gang pull box mounted above the door on the protected side of the wall. This pull box shall have a blank cover plate installed and shall be mounted above the suspended ceiling OR 100mm below the ceiling if the ceiling is finished.
 - .4 Supply and install conduit from the pull box to a junction box in the area (as per floor plans).
 - .5 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from the outlet box in the door frame to the T1 cabinet in Room 211.03.
 - .6 The cable slack at the outlet box in the door frame shall be tucked into the outlet box to protect the cable from damage.

- .5 21 Device Box
 - .1 Supply and install one recessed 76H X 150W X 63Dmm three gang device box c/w blank cover plate centered 1500mm A.F.F..
 - .2 Supply and install conduit from this device box to a junction box in the area (as per floor plans).
 - .3 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from this device box to the T1 cabinet in Room 211.03.

- .6 41 Octagon Outlet Box
 - .1 Supply and install one 4" ceiling mounted octagon outlet box.
 - .2 Supply and install conduit from this outlet box to a junction box in the area (as per floor plans).
 - .3 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from this outlet box to the T1 cabinet in Room 211.03.
 - .4 Note: Supply no less than 3600mm of cable slack at the outlet box.

- .7 Refer to Drawing E3.1 for PTSS Partial Second Floor Plan.

- .8 Refer to Drawing E3.1 for Detail Drawing - Protected Door - Elevation Of Single Door With Door Contact.

END OF SECTION