

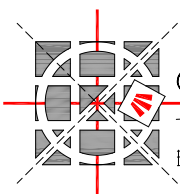
DOCUMENTS & SPECIFICATIONS

Issued for Tender & Construction

COLLINS BAY DOG AREA

for
Correctional Service Canada

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Project N° 18062



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END OF SECTION

PART 1 - GENERAL

1.1 SECTION
INCLUDES

- .1 Connecting to existing services.
- .2 Special scheduling requirements.

1.2 EXISTING
SERVICES

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

1.3 SCHEDULING

- .1 Coordinate with the Departmental Representative to minimize user interference and to ensure continuity of security throughout construction.
 - .2 Site will be occupied continuously throughout construction, including nights and weekends.
 - .3 Execute work on man doors one door at a time, such that each door is fully secure and operational before work is started on the next door. Painting and finishing work may be completed subsequently, but still only one door at a time so that only one door is out of service at any given time.
-

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Inspecting and testing by inspecting firms or testing laboratories designated by Departmental Representative.
- 1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE .1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by Departmental Representative are specified under various sections.
- 1.3 APPOINTMENT AND PAYMENT .1 Departmental Representative will appoint and pay for services of testing laboratory except follows:
.1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
.2 Inspection and testing performed exclusively for Contractor's convenience.
.3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
.4 Mill tests and certificates of compliance.
.5 Tests specified to be carried out by Contractor under the supervision of Departmental Representative.
.6 Additional tests specified in the following paragraph.
- .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.
- 1.4 CONTRACTOR'S RESPONSIBILITIES .1 Provide labour, equipment and facilities to:
.1 Provide access to Work to be inspected and tested.
.2 Facilitate inspections and tests.
-

- 1.4 CONTRACTOR'S RESPONSIBILITIES (Cont'd)
- .1 (Cont'd)
 - .3 Make good Work disturbed by inspection and test.
 - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
 - .2 Notify Departmental Representative sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
 - .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
 - .4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

1.1 ADMINISTRATIVE

- .1 Contractor will schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting 5 days in advance of meeting date to Departmental Representative.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7 Reproduce and distribute copies of minutes within 5 days after meetings and transmit to meeting participants and, affected parties not in attendance.
- .8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Within 15 days after award of Contract, in coordination with CSC, the Contractor will request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
 - .2 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
 - .3 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
 - .4 Agenda to include:
-

1.2 PRECONSTRUCTION .4
MEETING
(Cont'd)

- (Cont'd)
- .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work:
 - .3 Schedule of submission of shop drawings, samples, colour chips.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities.
 - .5 Delivery schedule of specified equipment.
 - .6 Site security.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .8 Owner provided products.
 - .9 Record drawings.
 - .10 Maintenance manuals.
 - .11 Take-over procedures, acceptance, warranties.
 - .12 Monthly progress claims, administrative procedures, hold backs.
 - .13 Insurances, transcript of policies.

1.3 PROGRESS
MEETINGS

- .1 During course of Work and weeks prior to project completion, Contractor will schedule progress meetings monthly.
 - .2 Contractor and major Subcontractors involved in Work are to be in attendance.
 - .3 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 5 days after meeting.
 - .4 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Revision to construction schedule.
 - .6 Other business.
-

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

1.1 SECTION
INCLUDES

- .1 Shop drawings and product data.
- .2 Samples.
- .3 Certificates and transcripts.
- .4 Fees and permits.

1.2 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
 - .2 Work affected by submittal shall not proceed until review is complete.
 - .3 Present shop drawings, product data, Commissioning documentation, 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 shall be considered rejected.
 - .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
-

1.2 ADMINISTRATIVE
(Cont'd)

- .7 Verify field measurements and affected adjacent Work are coordinated.
- .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.

1.3 SHOP DRAWINGS
AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
 - .2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
 - .3 Where technical sections specify that shop drawings bear the stamp of a Registered Professional Engineer, registered in the Province of Ontario.
 - .4 Allow 10 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.
-

1.3 SHOP DRAWINGS
AND PRODUCT DATA
(Cont'd)

- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of any revisions other than those requested.
- .7 Accompany submissions with transmittal letter, in duplicate, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .8 Submissions shall 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.
 - .11 Equipment identification.
- .9 After Departmental Representative's review, distribute copies.

1.3 SHOP DRAWINGS
AND PRODUCT DATA
(Cont'd)

- .10 Submit 6 prints of shop drawings, product data, test reports, certificates, and manufacturers instructions for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .11 Delete information not applicable to project.
- .12 Supplement standard information to provide details applicable to project.
- .13 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.
- .14 The review of shop drawings by Correctional Services Canada is for sole purpose of ascertaining conformance with general concept. This review shall not mean that CSC 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 all requirements of construction and Contract Documents. Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of all sub-trades.

1.4 SAMPLES

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

- 1.4 SAMPLES
(Cont'd)
- .2 Where colour, pattern or texture is criterion, submit full range of samples.
 - .3 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

- 1.5 FEES, PERMITS
AND CERTIFICATES
- .1 Provide authorities having jurisdiction with information requested.
 - .2 Pay fees and obtain certificates and permits required.
 - .3 Furnish certificates and permits.
 - .4 Submit acceptable certificate stating that suspended ceiling systems provide adequate support for electrical fixtures, as required by current bulletin of Electrical Inspection Department of Ontario Hydro.

PART 2 - PRODUCTS

- 2.1 NOT USED
- .1 Not Used.

PART 3 - EXECUTION

- 3.1 NOT USED
- .1 Not Used.

PART 1 - GENERAL

- 1.1 Purpose .1 To ensure that both the construction project and the institutional operations may proceed without undue disruption or hindrance and that the security of the Institution is maintained at all times.
- 1.2 Definitions .1 "Contraband" means:
- .1 An intoxicant, including alcoholic beverages, drugs and narcotics.
 - .2 Tobacco or associated tobacco products.
 - .3 An igniting device, lighter or matches.
 - .4 A weapon or a component thereof, ammunition for a weapon, and anything that is designed to kill, injure or disable a person or that is altered so as to be capable of killing, injuring or disabling a person, when possessed without prior authorization.
 - .5 An explosive or a bomb or a component thereof.
 - .6 Currency over any applicable prescribed limit, \$25 when possessed by an inmate, visitor or contractor without prior authorization.
 - .7 Any item not described in paragraphs 1.2.1.1 to 1.2.1.6 that could jeopardize the security of a Penitentiary or the safety of persons, when that item is possessed without prior authorization.
- .2 "Unauthorized Smoking and related Items" means all smoking items including, but not limited to, cigarettes, cigars, tobacco, chewing tobacco, cigarette making machines, matches and lighters.
- .3 "Commercial Vehicle" means any motor vehicle used for the shipment of material, equipment and tools required for the construction project.
- .4 "CSC" means Correctional Service Canada.
-

1.2 Definitions
(Cont'd)

- .5 "Project Authority" means, Director, Warden or Superintendent of the Institution as applicable.
- .6 "Construction Employees" means persons working for the General Contractor, the sub-contractors, equipment operators, material suppliers, testing and inspection companies and regulatory agencies.
- .7 "Departmental Representative" means the project manager from Correctional Services Canada.
- .8 "Perimeter" means the fenced or walled area of the Institution that restrains the movement of the inmates.
- .9 "Construction Limits" means the area as shown on the contract drawings that the Contractor will be allowed to work. This area may or may not be isolated from the security area of the Institution.

1.3 Preliminary
Proceedings

- .1 Prior to the commencement of work, the Contractor shall meet with the Project Authority or his/her representative to:
 - .1 Discuss the nature and extent of all activities involved in the Project.
 - .2 Establish mutually acceptable security procedures in accordance with this instruction and the institution's particular requirements.
- .2 Contractor shall:
 - .1 Ensure that all Construction Employees are aware of the security requirements.
 - .2 Ensure that a copy of the security requirements is always prominently on display at the job site.
 - .3 Co-operate with institutional personnel in ensuring that security requirements are observed by all Construction Employees.

1.4 Construction
Employees

- .1 Submit to the Project Authority a list of the names with date of birth of all Construction Employees to be employed on the construction site and a security clearance form for each employee.
 - .2 Submit a copy of photo ID with CPIC clearance form for each employee. Contractor responsible to pay for and provide their own CPICs. Employees will not be admitted to the Institution without a valid security clearance in place and a recent picture identification such as a provincial driver's license. Security clearances obtained from other CSC Institutions are not valid at this Institution.
 - .3 The Project Authority may require that facial photographs may be taken of Construction Employees and these photographs may be displayed at appropriate locations in the Institution or in an electronic database for identification purposes. The Project Authority may require that Photo ID cards be provided for all Construction Employees. ID cards will then be left at the designated entrance to be picked upon arrival at the institution and shall be displayed prominently on the Construction Employees' clothing at all time while Construction Employees are in the institution.
 - .4 Construction Employees are to report to the Principal Entrance building anytime they enter or leave the institution.
 - .5 Entry to Institutional Property will be refused to any person there may be reason to believe may be a security risk.
 - .6 Any person employed on the construction site will be subject to immediate removal from Institutional Property if they:
 - .1 Appear to be under the influence of alcohol, drugs or narcotics.
 - .2 Behave in an unusual or disorderly manner.
 - .3 Are in possession of contraband.
-

1.4 Construction
Employees
(Cont'd)

.7 Smoking is prohibited anywhere on CSC property.

1.5 Vehicles

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

.2 Gas caps on all vehicles and motorized equipment shall be lockable.

.3 The Project Authority may limit at any time the number and type of vehicles allowed within the institution.

.4 Drivers of delivery vehicles for material required by the project will not require security clearances but must remain with their vehicle the entire time that the vehicle is in the Institution. The Project Authority will require that these vehicles be escorted by Institutional Staff or Commissionaires while in the Institution.

.5 If the Project Authority permits trailers to be left inside the secure perimeter of the Institution, these trailer doors will be locked at all times. All windows will be securely locked when left unoccupied. All trailer windows shall be covered with expanded metal mesh. All storage trailers inside and outside the perimeter shall be locked when not in use.

1.6 Parking

.1 Parking area(s) to be used by Construction Employees will be designated by the Project Authority. Parking in other location will be prohibited and vehicles may be subject to removal.

1.7 Shipments .1 All shipments of project material, equipment and tools shall be addressed in the Contractor's name to avoid confusion with the Institution's own shipments. The Contractor must have his/her own employees on site to receive any deliveries or shipments. CSC staff will NOT accept receipt of deliveries or shipments of any material, equipment or tools.

1.8 Telephones .1 There will be no installation of telephones, Facsimile machines and computers with Internet connections permitted within the perimeter of the Institution unless prior approval of the Project Authority is received.

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

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

.4 The use of two way radios are not permitted.

1.9 Work Hours .1 Work hours within the Institution are:
Monday to Friday, 07:30 hrs to 16:00 hrs.

1.9 Work Hours (Cont'd) .2 Work will not be permitted during weekends and statutory holidays without the permission of the Project Authority. A minimum of seven (7) days advance notice will be required to obtain the required permission. In case of emergencies or other special circumstances, this advance notice may be waived by the Project Authority.

1.10 Overtime Work .1 No overtime work will be allowed without permission of the Project Authority. Give a minimum forty-eight (48) hours advance notice when overtime work on the construction project is necessary and approved. If overtime work is required because of an emergency such as work to make the construction safe and secure, the Contractor shall advise the Project Authority as soon as this condition is known and follow the directions given by the Project Authority. Costs to the Crown for such events may be attributed to the Contractor.

.2 When overtime work, weekend, or statutory holiday work is required and approved by the Project Authority staff members may be posted by the Project Authority or his/her designate, to maintain the security surveillance. The Departmental Representative may post extra staff for inspection of construction activities. The actual cost of this extra staff may be subject to reclamation by the Crown.

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

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

1.11 Tools and
Equipment
(Cont'd)

- .3 Keep all tools and equipment under constant supervision, particularly power-driven and cartridge-driven tools, cartridges, files, saw blades, rod saws, wire, rope, ladders and any sort of jacking device.
 - .4 Store all tools and equipment in approved secure locations.
 - .5 Lock all tool boxes when not in use. Keys to remain in the possession of the employees of the Contractor. Scaffolding shall be secured and locked when not erected and when erected, will be secured in a manner agreed upon with the Institutional designate.
 - .6 All missing or lost tools or equipment shall be reported immediately to the Project Authority.
 - .7 The Project Authority will ensure that the security staff members carry out checks of the Contractor's tools and equipment against the list provided by the Contractor. These checks may be carried out at the following intervals:
 - .1 At the beginning and conclusion of every construction project.
 - .2 Weekly, when the construction project extends longer than a one week period.
 - .3 The Contractor may be subject to random checks by security staff to ensure proper storage and security of tools throughout the project.
 - .8 Certain tools/equipment such as cartridges and hacksaw blades are highly controlled items. The Contractor will be given at the beginning of the day, a quantity that will permit on day's work. Used blades/cartridges will be returned to the Project Authority's representative at the end of each day.
 - .9 If propane or natural gas is used for heating the construction, the Institution will require that an employee of the Contractor supervise the construction site during non-working hours.
-

1.11 Tools and Equipment (Cont'd) .10 If torches or grinders are required tools to perform Work, Contractor must complete a Hot Work Permit as supplied by CSC. Completed original form(s) are copied and posted on the work site in a conspicuous location. Original documents are to remain with the Institutional Fire Chief.

1.12 Keys .1 Keys:
.1 The Contractor will use standard construction cylinders for locks for his use during the construction period.
.2 The Contractor will issue instructions to his employees and sub-trades, as necessary to ensure safe custody, of the construction set of keys.
.3 Upon completion of each phase of the construction, the CSC representative will, in conjunction with the lock manufacturer:
.1 Prepare an operational keying schedule.
.2 Accept the operational keys and cylinders directly from the lock manufacturer.
.3 Arrange for removal and return of the construction cores and install the operational core in all locks.
.2 Upon putting operational security keys into use, the CSC construction escort shall obtain these keys as they are required from the Security Maintenance Officer (SMO) and open doors as required by the Contractor. The Contractor shall issue instructions to his employees advising them that all security keys shall always remain with the CSC construction escort.

1.13 Prescription Drugs .1 Employees of the Contractor who are required to take prescription drugs during the workday shall obtain approval of the Project Authority to bring a one day supply only into the Institution.

- 1.14 Smoking Restrictions
- .1 Contractors and construction employees are not permitted to smoke inside correctional facilities or outdoors within the perimeter of a correctional facility and must not possess unauthorized smoking items within the perimeter of a correctional facility.
 - .2 Contractors and construction employees who are in violation of this policy will be requested to immediately cease smoking or dispose of any unauthorized smoking items and, if they persist, will be directed to leave the institution.
 - .3 Smoking is only permitted outside the perimeter of a correctional facility in an area to be designated by the Project Authority.

- 1.15 Contraband
- .1 Weapons, ammunition, explosives, alcoholic beverages, drugs and narcotics are prohibited on Institutional Property.
 - .2 Discovery of Contraband on the construction site and the identification of the person(s) responsible for the Contraband shall be reported immediately to the Project Authority.
 - .3 Contractors shall be vigilant with both their staff and the staff of their sub-contractors and suppliers that the discovery of Contraband may result in cancellation of the security clearance of the affected employee. Serious infractions may result in the removal of the company from the Institution for the duration of the construction.
 - .4 Presence of arms and ammunition in vehicles of Contractors, sub-contractors and suppliers or employees of these will result in the immediate cancellation of security clearances for the driver of the vehicle.
-

- 1.16 Searches
- .1 All vehicles and persons entering Institutional property may be subject to search.
 - .2 When the Project Authority suspects, on reasonable grounds, that an employee of the Contractor is in possession of Contraband or unauthorized items, he/she may order that person to be searched.
 - .3 All employees entering the Institution may be subject to screening of personal effects for traces of Contraband drug residue.

- 1.17 Access to and Removal from Institution Property
- .1 Construction personnel and commercial vehicles will not be admitted to the Institution after normal working hours, unless approved by the Project Authority.

- 1.18 Movement of Vehicles
- .1 Escorted commercial vehicles will not be allowed to enter or leave the Institution after normal working hours, unless approved by the Project Authority.
 - .2 Construction vehicles shall not leave the Institution until an inmate count is completed.
 - .3 The Contractor shall advise the Project Authority twenty four (24) hours in advance to the arrival on the site of heavy equipment such as concrete trucks, cranes, etc.
 - .4 Vehicles being loaded with soil or other debris, or any vehicle considered impossible to search, must be under continuous supervision by CSC Staff or Commissionaires working under the authority of the Project Authority.
 - .5 Commercial Vehicles will only be allowed access to Institutional property when their contents are certified by the Contractor or his/her representative as being strictly necessary to the execution of the construction project.
-

- 1.18 Movement of Vehicles
(Cont'd)
- .6 Vehicles shall be refused access to Institutional property if, in the opinion of the Project Authority, they contain any article which may jeopardize the security of the Institution.
 - .7 Private vehicles of Construction Employees will not be allowed within the security wall or fence of medium or maximum security Institutions without the permission of the Project authority.
 - .8 With prior approval of the Project authority, a vehicle may be used in the morning and evening to transport a group of employees to the work site. This vehicle will not remain within the institution the remainder of the day.
 - .9 With the approval of the Project authority, certain equipment may be permitted to remain on the construction site overnight or over the weekend. This equipment must be securely locked, with the battery removed. The project authority may require that the equipment be secured with a chain and padlock to another solid object.
- 1.19 Movement of Construction Employees on Institutional Property
Property
- .1 Subject to the requirements of good security, the Project authority will permit the contractor and his/her employees as much freedom of action and movement as is possible.
 - .2 However, notwithstanding paragraph above, the Project authority may:
 - .1 Prohibit or restrict access to any part of the Institution.
 - .2 Require that in certain areas of the Institution, either during the entire construction project or at certain intervals, Construction Employees only be allowed access when accompanied by a member of the CSC security staff.
-

1.19 Movement of
Construction
Employees on
Institutional
Property
(Cont'd) .3 During the lunch and coffee/health breaks,
all employees will remain within the
construction site. Employees are not
permitted to eat in the officer's lounge
and dining room.

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

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

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

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

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

1.23 Completion of Construction Project .1 Upon completion of the construction project, or when applicable, the takeover of facility, the Contractor shall remove all remaining construction material, tools and equipment that are not specified to remain in the Institution as part of the construction contract.

PART 2 - PRODUCTS

2.1 Not Used .1 Not used.

PART 3 - EXECUTION

3.1 Not Used .1 Not used.

PART 1 - GENERAL

1.1 REFERENCES

- .1 National Fire Code 2005 (NFC):
 - .1 NFC 2005, Division B, Part 2 Emergency Planning, subsection 2.8.2 Fire Safety Plan.
- .2 Province of Ontario:
 - .1 Occupational Health and Safety Act Revised Statutes of Ontario 1990, Chapter O.1 as amended, and Regulations for Construction Projects, O. Reg. 213/91 as amended.
 - .2 Workplace Safety and Insurance Act, 1997.
 - .3 Municipal statutes and authorities.
- .3 Fire Commissioner of Canada (FCC):
 - .1 FC-301 Standard for Construction Operations.
 - .2 FC-302 Standard for Welding and Cutting, June 1982.

Labour Program
Fire Protection Engineering Services
4900 Yonge Street 8th Floor
Willowdale, Ontario M2N 6A8

and copies may be obtained from:

Human Resources and Social Development Canada
Labour Program
Fire Protection Engineering Services
Ottawa, Ontario K1A 0J2

1.2 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00.
- .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 operations found in work plan.

1.2 SUBMITTALS
(Cont'd)

- .2 (Cont'd)
- .3 Provide a Fire Safety Plan, specific to the work location, in accordance with NBC, prior to commencement of work. The plan shall be coordinated with, and integrated into, the existing Building, Facility, Emergency Procedures and Evacuation Plan in place at the site. Departmental representative will provide Building, Facility, Emergency Procedures and Evacuation Plan. Deliver two copies of the Fire Safety Plan to the Departmental representative not later than 14 days before commencing work.
- .4 Contractor's and Sub-contractors' Safety Communication Plan.
- .5 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with existing Building, Facility, Emergency Response requirements and procedures provided by Departmental representative.
- .3 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 days after receipt of comments from Departmental Representative.
- .4 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.
- .5 Submit records of Contractor's Health and Safety meetings when requested.
- .6 Submit 2 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative weekly.
-

- 1.2 SUBMITTALS
(Cont'd)
- .7 Submit copies of orders, directions or reports issued by health and safety inspectors of the authorities having jurisdiction.
 - .8 Submit copies of incident and accident reports.
 - .9 Submit Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00.
- 1.3 FILING OF
NOTICE
- .1 File Notice of Project with Provincial authorities prior to commencement of Work.
- 1.4 WORK PERMIT
- .1 Obtain building permit related to project prior to commencement of Work.
 - .2 Obtain Hot Work Permit from Chief Plant Maintenance.
- 1.5 SAFETY
ASSESSMENT
- .1 Perform site specific safety hazard assessment related to project.
- 1.6 MEETINGS
- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.
- 1.7 REGULATORY
REQUIREMENTS
- .1 Comply with the Acts and regulations of the Province of Ontario.
 - .2 Comply with specified standards and regulations to ensure safe operations at site.
 - .3 Obtain ESA approval of the work.
-

- 1.9 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 either accepting or requesting improvements.
 - .3 Relief from or substitution for any portion or provision of minimum Health and Safety standards specified herein or reviewed site-specific Health and Safety Plan shall be submitted to Departmental Representative in writing.

- 1.10 COMPLIANCE REQUIREMENTS
- .1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990 Chapter 0.1, as amended.

- 1.11 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.
 - .3 Where applicable the Contractor shall be designated "Constructor", as defined by Occupational Health and Safety Act for the Province of Ontario.
-

- 1.12 UNFORESEEN HAZARDS
- .1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, immediately stop work and advise Departmental Representative verbally and in writing.
 - .2 Follow procedures in place for Employees Right to Refuse Work as specified in the Act for the Province of Ontario.
- 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 of Ontario, and in consultation with Departmental Representative.
 - .1 Contractor's Safety Policy.
 - .2 Constructor's Name.
 - .3 Notice of Project.
 - .4 Name, trade, and employer of Health and Safety Representative or Joint Health and Safety Committee members (if applicable).
 - .5 Ministry of Labour Orders and reports.
 - .6 Occupational Health and Safety Act and Regulations for Construction Projects for Province of Ontario.
 - .7 Address and phone number of nearest Ministry of Labour office.
 - .8 Material Safety Data Sheets.
 - .9 Written emergency Response Plan.
 - .10 Site Specific Safety Plan.
 - .11 Valid certificate of first aider on
 - .12 WSIB "In Case of Injury At Work" poster.
 - .13 Location of toilet and cleanup facilities.
- 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.
-

1.14 CORRECTION OF NON-COMPLIANCE (Cont'd) .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.15 WORK STOPPAGE .1 Give precedence to safety and health of public and site personnel, protection of environment, and the security of the Institution over cost and schedule considerations for Work.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

PART 1 - GENERAL

- 1.1 FIRES .1 Fires and burning of rubbish on site not permitted.
- 1.2 DISPOSAL OF WASTES .1 Do not bury rubbish and waste materials on site.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.
- .3 Dispose of waste in accordance with Section 01 74 20.
- 1.3 POLLUTION CONTROL .1 Maintain pollution control features installed under this contract.
- .2 Control emissions from equipment and plant to local authorities emission requirements.
- .3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.
- .4 Spills of deleterious substances:
.1 Immediately contain, limit spread and clean up in accordance with provincial regulatory requirements.
.2 Report immediately to Ontario Spills Action Centre: 1-800-268-6060.
.3 Further information on dangerous goods emergency cleanup and precautions including a list of companies performing this work can be obtained from the Transport Canada 24-hour number (613) 996-6666 collect.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.
-

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 COMPLIANCE .1 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender closing date and all 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 DESIGNATED SUBSTANCES .1 Designated substances have been identified as being present in this building. Refer to Designated Substance Report for Collins Bay Institution, Kingston, Ontario. The contractor is required to comply with applicable legislation for any work causing disturbance to designated materials.

- 1.3 BUILDING SMOKING ENVIRONMENT .1 Comply with smoking restrictions and municipal by-laws.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

1.1 SECTION
INCLUDES

- .1 Inspection and testing, administrative and enforcement requirements.
- .2 Tests and mix designs.
- .3 Mill tests.
- .4 Equipment and system adjust and balance.

1.2 RELATED
SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.

1.3 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
 - .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
 - .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
 - .4 Departmental Representative may order any 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.
-

1.4 INDEPENDENT
INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.

1.5 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.

1.6 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.
-

- 1.7 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.

- 1.8 EQUIPMENT AND SYSTEMS .1 Submit testing, adjusting and balancing reports for mechanical, electrical and building equipment systems.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Temporary utilities.
- 1.2 RELATED SECTIONS .1 Section 01 52 00 - Construction Facilities.
.2 Section 01 56 00 - Temporary Barriers and Enclosures.
- 1.3 INSTALLATION AND REMOVAL .1 Provide temporary utilities controls in order to execute work expeditiously.
.2 Remove from site all such work after use.
- 1.4 WATER SUPPLY .1 Departmental Representative will provide continuous supply of potable water for construction use.
.2 Departmental Representative will pay for utility charges at prevailing rates.
- 1.5 TEMPORARY HEATING AND VENTILATION .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
.2 Provide temporary heat and ventilation in enclosed areas as required to:
.1 Facilitate progress of Work.
.2 Protect Work and products against dampness and cold.
.3 Prevent moisture condensation on surfaces.
.4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
.5 Provide adequate ventilation to meet health regulations for safe working environment.
.3 Ventilating:
-

1.6 TEMPORARY POWER AND LIGHT
(Cont'd)

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

1.7 FIRE PROTECTION

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

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

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- .1 Construction aids.
 - .2 Temporary fencing and hording.
 - .3 Parking.
 - .4 Project identification.
- 1.2 SUBMITTALS
- .1 Provide submittals in accordance with Section 01 33 00.
- 1.3 SITE STORAGE/LOADING
- .1 Confine work and operations of employees to areas defined by Contract Documents. Do not unreasonably encumber premises with products.
 - .2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.
- 1.4 TEMPORARY FENCING AND HORDING
- .1 Where specified or approved, temporary fencing and hording must be in good condition, with all welds and joints intact, and securely assembled and installed, to the satisfaction of the Departmental Representative.
- 1.5 CONSTRUCTION PARKING
- .1 Parking will be permitted on site only as indicated on drawings.
 - .2 Provide and maintain adequate access to project site.
 - .3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.
-

1.6 EQUIPMENT,
TOOL AND MATERIALS
STORAGE

- .1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.

1.7 SANITARY
FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.8 PROTECTION AND
MAINTENANCE OF
TRAFFIC

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

1.9 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- .1 Barriers.
 - .2 Environmental Controls.
 - .3 Fire Routes.
- 1.2 RELATED SECTIONS
- .1 Section 01 51 00 - Temporary Utilities.
 - .2 Section 01 52 00 - Construction Facilities.
- 1.3 REFERENCES
- .1 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.189-2000, Exterior Alkyd Primer for Wood.
 - .2 CAN/CGSB-1.59-97, Alkyd Exterior Gloss Enamel.
- 1.4 INSTALLATION AND REMOVAL
- .1 Provide temporary controls in order to execute Work expeditiously.
 - .2 Provide temporary barriers, fences, and gates as specified in drawings, to quality specified. Use institutional grade locking hardware as directed in drawings.
 - .3 Remove from site all such work after use.
- 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 FIRE ROUTES
- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.
-

1.7 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY .1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.8 PROTECTION OF BUILDING FINISHES .1 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.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- .1 Product quality, availability, storage, handling, protection, and transportation.
 - .2 Manufacturer's instructions.
 - .3 Quality of Work, coordination and fastenings.
 - .4 Existing facilities.
- 1.2 RELATED SECTIONS
- .1 Section 01 45 00 - Quality Control.
- 1.3 REFERENCES
- .1 Within text of specifications, reference may be made to reference standards.
 - .2 Conform to these standards, in whole or in part as specifically requested in specifications.
 - .3 If there is question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
 - .4 The cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.
 - .5 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.
-

- 1.4 QUALITY
- .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.
 - .2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
 - .3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
 - .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
 - .5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

- 1.5 AVAILABILITY
- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
-

1.5 AVAILABILITY
(Cont'd)

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

1.6 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 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.
- .7 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .8 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.
-

- 1.7 TRANSPORTATION
- .1 Pay costs of transportation of products required in performance of Work.
 - .2 Transportation cost of products supplied by Owner will be paid for by Departmental Representative. Unload, handle and store such products.
- 1.8 MANUFACTURER'S INSTRUCTIONS
- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
 - .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative may establish course of action.
 - .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.
- 1.9 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.
-

- 1.10 CO-ORDINATION .1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.
- 1.11 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.
- 1.12 REMEDIAL WORK .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate 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.
- 1.13 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.
- 1.14 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.
-

- 1.14 FASTENINGS
(Cont'd)
- .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.

- 1.15 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.

- 1.16 PROTECTION OF
WORK IN PROGRESS
- .1 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Departmental Representative.
-

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

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 SUBMITTALS
- .1 Submittals: in accordance with Section 01 33 00.
 - .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Owner or separate contractor.
 - .3 Include in request:
 - .1 Identification of project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Owner or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.
- 1.2 MATERIALS
- .1 Required for original installation.
 - .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00.
- 1.3 PREPARATION
- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
 - .2 After uncovering, inspect conditions affecting performance of Work.
-

1.3 PREPARATION
(Cont'd)

- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.4 EXECUTION

- .1 Execute cutting, fitting, and patching 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 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

1.4 EXECUTION
(Cont'd) .11 Conceal pipes, ducts and wiring in floor,
wall and ceiling construction of finished
areas except where indicated otherwise.

1.5 WASTE
MANAGEMENT AND
DISPOSAL .1 Separate waste materials for reuse and
recycling in accordance with Section
01 74 20.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- .1 Progressive cleaning.
 - .2 Final cleaning.
- 1.2 PROJECT CLEANLINESS
- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris.
 - .2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
 - .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
 - .4 Provide on-site containers for collection of waste materials and debris.
 - .5 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 20.
 - .6 Remove waste material and debris from site and deposit in waste container at end of each working day.
 - .7 Dispose of waste materials and debris off site.
 - .8 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
 - .9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
 - .10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
-

1.2 PROJECT
CLEANLINESS
(Cont'd)

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

1.3 FINAL CLEANING

- .1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review, remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by Owner.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.
- .8 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.
-

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

1.1 REGULATORY AGENCIES

- .1 The Ontario Ministry of Environment (OME) in accordance with Section 7 of Ontario Regulation 103/94 requires a source separation program for the waste that will be generated in the construction or demolition of a structure.
- .2 The source separation program required shall:
 - .1 Deal separately with each of the categories of waste set out in Part III of the Schedule that have been source separated from other kinds of waste and also from each other category of waste in Part III; or
 - .2 Provide for removal from the building site of any commingled categories of waste set out in Part III of the Schedule and for the immediate separation of such waste from all other kinds of waste and also from each category of waste in Part III, at
 - .1 permanent premises of the person undertaking the construction project
 - .2 permanent premises of the person on whose behalf the construction project is undertaken or
 - .3 a waste disposal site operating under the authority of a certificate of approval
- .3 The source separation program shall be implemented before construction work begins on site.

1.2 SUBMITTAL

- .1 Prepare and submit a waste reduction work plan. Describe management of construction wastes. Identify materials which can be recycled, reused and indicate methods proposed for reducing, reusing and recycling wastes.
-

1.3 WASTE
COLLECTION AND
DISPOSAL

- .1 Separate and salvage materials suitable for reuse and/or recycling from general waste stream.
- .2 Provide on site facilities for collection, handling and storage of anticipated quantities of reusable and/or recyclable materials.
- .3 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .4 Collect, handle, store on site and transport off site, salvaged materials, salvaged for reuse and/or recycling in separate condition. Transport to authorized reuse/recycling location.
- .5 Separate non salvageable materials from salvaged items. Transport and deliver non salvageable items to licensed disposal facility.
- .6 Burying, burning, selling waste materials on site is prohibited.
- .7 Disposals of liquid wastes into waterways, sewers is prohibited.
- .8 Unless specified otherwise, materials for removal become Contractor's property.
- .9 Clean up work, storage and waste collection areas as work progresses.

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- .1 Administrative procedures preceding preliminary and final inspections of Work.
- 1.2 RELATED SECTIONS
- .1 Section 01 78 00 - Closeout Submittals.
 - .2 Section 01 91 00 - Commissioning - General Requirements.
- 1.3 INSPECTION AND DECLARATION
- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an 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's Inspection.
 - .2 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
 - .3 Completion: submit written certificate that the 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 and the performance of the equipment and system has been verified.
 - .4 Work is complete and ready for Final Inspection.
-

1.3 INSPECTION AND
DECLARATION
(Cont'd) .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative, and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request reinspection.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

1.1 SECTION
INCLUDES

- .1 As-built, samples, and specifications.
- .2 Equipment and systems.
- .3 Product data, materials and finishes, and related information.
- .4 Operation and maintenance data.
- .5 Spare parts, special tools and maintenance materials.
- .6 Warranties and bonds.
- .7 Approvals from Authorities Having Jurisdiction.

1.2 RELATED
SECTIONS

- .1 Section 01 91 00 - Commissioning - General Requirements.

1.3 SUBMISSION

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
 - .2 Copy will be returned with Departmental Representative's comments.
 - .3 Revise content of documents as required prior to final submittal.
 - .4 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of maintenance manuals and commissioning documentation in English.
 - .5 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.
-

1.3 SUBMISSION
(Cont'd)

- .6 If requested, furnish evidence as to type, source and quality of products provided.
- .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .8 Pay costs of transportation.

1.4 FORMAT

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

1.5 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.

- 1.5 CONTENTS - EACH .2 For each product or system:
VOLUME .1 list names, addresses and telephone
(Cont'd) numbers of subcontractors and suppliers,
including local source of supplies and
replacement parts.
- .3 Product Data: mark each sheet to clearly
identify specific products and component
parts, and data applicable to installation;
delete inapplicable information.
- .4 Drawings: supplement product data to
illustrate relations of component parts of
equipment and systems, to show control and
flow diagrams.
- .5 Typewritten Text: as required to supplement
product data. Provide logical sequence of
instructions for each procedure,
incorporating manufacturer's instructions
specified in Section 01 45 00.
- .6 Training: Refer to Section 01 91 00.
- 1.6 AS-BUILTS AND .1 In addition to requirements in General
SAMPLES Conditions, maintain at the site for
Departmental Representative one record copy
of:
- .1 Contract Drawings.
.2 Specifications.
.3 Amendments.
.4 Change Orders and other modifications
to the 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.
-

-
- 1.7 RECORDING .4 (Cont'd)
ACTUAL SITE .7 References to related shop drawings and
CONDITIONS modifications.
(Cont'd)
-
- .5 Specifications: legibly 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 Amendments and change
orders.
- .6 Other Documents: maintain manufacturer's
certifications, inspection certifications,
field test records, required by individual
specifications sections.
- 1.8 EQUIPMENT AND .1 Each Item of Equipment and Each System:
SYSTEMS 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.
-

1.8 EQUIPMENT AND
SYSTEMS

(Cont'd)

- .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 coordination 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 and 01 91 00.
- .15 Additional requirements: As specified in individual specification sections.

1.9 MATERIALS AND
FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

1.9 MATERIALS AND FINISHES
(Cont'd)

- .4 Additional Requirements: as specified in individual specifications sections.

1.10 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 all 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.

1.11 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 all 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.

1.12 SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
-

1.12 SPECIAL TOOLS
(Cont'd)

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

1.13 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.

1.14 WARRANTIES AND
BONDS

- .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 the applicable item of work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Certificate of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.

1.14 WARRANTIES AND BONDS .7 Retain warranties and bonds until time specified for submittal.
(Cont'd)

1.15 APPROVALS .1 Submit verification of approvals from Authorities Having Jurisdiction including ESA, Fire Alarm, sprinkler system.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Includes general requirements for commissioning facilities and facility systems.
- 1.2 RELATED SECTIONS .1 Section 01 33 00 - Submittal Procedures.
.2 Section 01 45 00 - Quality Control.
.3 Section 01 78 00 - Closeout Submittals.
- 1.3 QUALITY ASSURANCE .1 Co-operate with testing organization services under provisions specified in Section 01 45 00.
.2 Testing organization certified to perform specified services.
.3 Comply with applicable procedures and standards of the certification sponsoring association.
.4 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.
- 1.4 SUBMITTALS .1 Within 15 working days of Award of Contract, submit name of Testing organization proposed to perform services who has managerial responsibilities for coordination of all commissioning activities.
.2 Submit documentation to confirm compliance with quality assurance provision.
.3 Submit 3 preliminary specimen copies of each report forms proposed for use.
.4 Submit completed report forms within 3 days after completion of each testing to Consultant for review and verification.
-

1.4 SUBMITTALS
(Cont'd)

- .5 Fifteen days prior to Substantial Performance, submit 3 copies of final reports on applicable forms for functional performance verification.

1.5 CONTRACTOR'S
RESPONSIBILITIES

- .1 Prepare each system for testing and balancing.
- .2 Cooperate with testing organization and provide access to equipment and systems.
- .3 Provide personnel and operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.
- .4 Notify testing organization and Departmental Representative 7 days prior to time project will be ready for testing, adjusting, and balancing.
- .5 Accurately record data for each step.
- .6 Report to Departmental Representative any deficiencies or defects noted during performance of services.
- .7 Correct deficiencies identified in accordance with Departmental Representative's written instructions.

1.6 PREPARATION

- .1 Provide instruments required for testing, adjusting, and balancing operations.
 - .2 Make instruments available to Departmental Representative to facilitate spot checks during testing and functional performance verification.
 - .3 Retain possession of instruments and remove at completion of services.
 - .4 Verify systems installation is complete and in continuous operation.
-

1.7 EXECUTION .1 Test equipment.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 REFERENCES .1 Canadian Standards Association (CSA International)
.1 CSA S350-M1980(R1998), Code of Practice for Safety in Demolition of Structures.
- 1.2 WASTE MANAGEMENT AND DISPOSAL .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.
- 1.3 SITE CONDITIONS .1 Should material resembling spray or trowel-applied asbestos or other designated substance be encountered, stop work, take preventative measures, and notify Departmental Representative immediately.
.1 Do not proceed until written instructions have been received from Departmental Representative.
- .2 Notify Departmental Representative before disrupting building access or services.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

- 3.1 PREPARATION .1 Inspect areas of work with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
-

- 3.1 PREPARATION
(Cont'd)
- .3 Notify and obtain approval of utility companies before starting demolition.
- 3.2 PROTECTION
- .1 Keep noise, dust, and inconvenience to occupants to minimum.
- .2 Protect building systems, services and equipment.
- .3 Provide temporary dust screens, covers, railings, supports and other protection as required.
- .4 Do Work in accordance with Section 01 35 29.
- 3.3 DEMOLITION
- .1 Remove parts of existing building and items to permit new construction.
- .2 Trim edges of partially demolished buildings or items elements to tolerances as defined by Departmental Representative to suit future use.
- .3 When removing or demolishing any installed item, remove all attachments, anchors, connections, and accessories unless directed otherwise.
- 3.4 DISPOSAL
- .1 Dispose of removed materials, to appropriate recycling facilities except where specified otherwise, in accordance with authority having jurisdiction.

PART 1 - GENERAL

- 1.1 REFERENCES .1 Canadian Standards Association (CSA International)
- .1 CAN/CSA-A165 SERIES-04 (R2009), CSA Standards on Concrete Masonry Units.
 - .2 CSA A179-04, Mortar and Grout for Unit Masonry.
 - .3 CSA-A370-04, Connectors for Masonry.
 - .4 CSA-A371-04, Masonry Construction for Buildings.
 - .5 CSA G30.14-M1983 (R1998), Deformed Steel Wire For Concrete Reinforcement.
 - .6 CAN/CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
 - .7 CSA-S304.1-04, Masonry Design for Buildings.
- 1.2 SUBMITTALS .1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Sections 01 33 00.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00
- .2 Shop Drawings:
- .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Shop drawings consist of bar bending details, lists and placing drawings.
 - .3 On placing drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.
- 1.3 STORAGE AND HANDLING .1 Protect on site stored or installed material from moisture damage in accordance with manufacturer's printed instructions.
-

PART 2 - PRODUCTS

- 2.1 MASONRY UNITS .1 Standard concrete block units: to CAN/CSA-A165 Series (CAN/CSA-A165.1).
.1 Classification: H/15/A/M.
.2 Size: modular, CCMPA size code 15.
.3 Special shapes: provide bull-nosed units for exposed corners.
- 2.2 REINFORCEMENT AND CONNECTORS .1 Wire reinforcement: to CSA-A371 and CSA G30.14, truss type.
.2 Connectors shall be corrosion resistant: to CSA-A370 and CSA-S304.
- 2.3 MORTAR AND GROUT .1 Mortar: to CSA A179.
.1 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.
.2 Colour: ground coloured natural aggregates or metallic oxide pigments.
.2 Mortar Type: S
.3 Grout: to CSA A179, Table 3.

PART 3 - EXECUTION

- 3.1 INSTALLATION .1 Do masonry work in accordance with CSA-A371 except where specified otherwise.
.1 Bond: running stretcher bond with vertical joints in perpendicular alignment and centred on adjacent stretchers above and below.
.2 Coursing height: 200 mm for one block and one joint.
.3 Jointing: tool where exposed or where paint or other finish coating is specified to provide smooth compressed concave surface.
.2 Build masonry plumb, level, and true to line, with vertical joints in alignment.
-

- 3.5 ANCHORS .1 Supply and install metal anchors as indicated.
- 3.6 LATERAL SUPPORT AND ANCHORAGE .1 Supply and install lateral support and anchorage in accordance with CSA-S304.1 and as indicated.
- 3.7 SITE TOLERANCES .1 Tolerances in notes to Clause 5.3 of CSA-A371 apply.
- 3.8 CLEANING .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- 3.9 PROTECTION .1 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 08 71 00 Door Hardware.
- 1.2 REFERENCES
- .1 American Society for Testing and Materials International (ASTM)
- .1 ASTM A 653/A 653M-06a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM B 29-03, Standard Specification for Refined Lead.
 - .3 ASTM B 749-03, Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
- .2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
 - .2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.
- .3 Canadian Standards Association (CSA International)
- .1 CSA-G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59-03, Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door Manufacturers' Association (CSDMA)
- .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2000.
 - .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 1990.
- .5 National Fire Protection Association (NFPA)
- .1 NFPA 80-99, Standard for Fire Doors and Fire Windows.
 - .2 NFPA 252-03, Standard Methods of Fire Tests of Door Assemblies.
- .6 South Coast Air Quality Management District (SCAQMD), California State
-

- 1.2 REFERENCES (Cont'd)
- .6 (Cont'd)
 - .1 SCAQMD Rule 1113-04, Architectural Coatings.
 - .2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
 - .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701-01, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .2 CAN/ULC-S702-97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
 - .3 CAN/ULC-S704-03, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
 - .4 CAN4-S104-M80, Standard Method for Fire Tests of Door Assemblies.
 - .5 CAN4-S105-M85, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.
- 1.3 SYSTEM DESCRIPTION
- .1 Design Requirements:
 - .1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 NFPA 252 for ratings specified or indicated.
 - .2 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104, ASTM E 152 or NFPA 252 and listed by nationally recognized agency having factory inspection services.
- 1.4 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.
 - .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
-

1.4 ACTION AND
INFORMATIONAL
SUBMITTALS
(Cont'd)

- .3 (Cont'd)
 - .2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, 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 fire rating, finishes.
 - .4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.5 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 20 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

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

2.2 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 Stiffened: face sheets welded, uninsulated core.

2.3 ADHESIVES

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
- .2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.
- .3 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 PRIMER

- .1 Touch-up prime CAN/CGSB-1.181.

2.5 PAINT

- .1 Field paint steel doors and frames in accordance with Section 09 91 23 - Interior Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.
 - .1 Maximum VOC emission level 50 g/L to GS-11 to SCAQMD Rule 1113.

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 Glazing:
 - .1 Doors D1: 6mm heat tempered and laminated float glass.
 - .6 Make provisions for glazing as indicated and provide necessary glazing stops.
-

2.6 ACCESSORIES
(Cont'd)

- .6 (Cont'd)
- .1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screws.
 - .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 Interior frames: 1.6 mm welded type construction.
- .4 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .5 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .6 Manufacturer's nameplates on frames and screens are not permitted.
- .7 Conceal fastenings except where exposed fastenings are indicated.
- .8 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

2.8 FRAME ANCHORAGE

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

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 Interior doors: hollow steel construction.
 - .3 Fabricate doors with longitudinal edges locked seam.
 - .4 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware in accordance with ASTM E 330.
 - .5 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.
 - .6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
 - .7 Reinforce doors where required, for surface mounted hardware. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
-

2.10 DOOR
FABRICATION GENERAL
(Cont'd)

- .8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .9 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN4-S104 ASTM E 152 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.
- .10 Manufacturer's nameplates on doors are not permitted.

2.11 HOLLOW STEEL
CONSTRUCTION

- .1 Form face sheets for exterior doors from 1.2 mm sheet steel.
- .2 Form face sheets for interior doors from 1.2 sheet steel.
- .3 Reinforce doors with vertical stiffeners, securely welded to face sheets at 150 mm on centre maximum.
- .4 Fill voids between stiffeners of interior doors with honeycombcore.

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.
-

3.2 INSTALLATION
GENERAL
(Cont'd)

- .2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME
INSTALLATION

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

3.4 DOOR
INSTALLATION

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

3.5 FINISH REPAIRS

- .1 Touch up with primer finishes damaged during installation.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS .1 08 11 00 Metal Door Frames.

1.2 REFERENCES .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)

- .1 ANSI/BHMA A156.1-2000, American National Standard for Butts and Hinges.
- .2 ANSI/BHMA A156.2-2003, Bored and Preassembled Locks and Latches.
- .3 ANSI/BHMA A156.3-2001, Exit Devices.
- .4 ANSI/BHMA A156.4-2000, Door Controls - Closers.
- .5 ANSI/BHMA A156.5-2001, Auxiliary Locks and Associated Products.
- .6 ANSI/BHMA A156.6-2005, Architectural Door Trim.
- .7 ANSI/BHMA A156.8-2005, Door Controls - Overhead Stops and Holders.
- .8 ANSI/BHMA A156.12-2005, Interconnected Locks and Latches.
- .9 ANSI/BHMA A156.13-2002, Mortise Locks and Latches Series 1000.
- .10 ANSI/BHMA A156.14-2002, Sliding and Folding Door Hardware.
- .11 ANSI/BHMA A156.15-2006, Release Devices - Closer Holder, Electromagnetic and Electromechanical.
- .12 ANSI/BHMA A156.16-2002, Auxiliary Hardware.
- .13 ANSI/BHMA A156.17-2004, Self-closing Hinges and Pivots.
- .14 ANSI/BHMA A156.18-2006, Materials and Finishes.
- .15 ANSI/BHMA A156.19-2002, Power Assist and Low Energy Power - Operated Doors.
- .16 ANSI/BHMA A156.20-2006, Strap and Tee Hinges and Hasps.

.2 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)

- .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
 - .4 After approval samples will be returned for incorporation in Work.
 - .4 Hardware List:
 - .1 Submit contract hardware list.
 - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
 - .5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
 - .6 Manufacturer's Instructions: submit manufacturer's installation instructions.
- 1.4 CLOSEOUT SUBMITTALS
- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.
- 1.5 MAINTENANCE MATERIALS SUBMITTALS
- .1 Extra Stock Materials:
 - .1 Supply maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
-

1.6 QUALITY
ASSURANCE

- .1 Regulatory Requirements:
 - .1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.
 - .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.7 DELIVERY,
STORAGE AND
HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .4 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect door hardware from nicks, scratches, and blemishes.
 - .3 Protect prefinished surfaces.
 - .4 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 HARDWARE ITEMS

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

2.2 DOOR HARDWARE

- .1 Locks and latches:

2.2 DOOR HARDWARE
(Cont'd)

- .1 (Cont'd)
 - .1 Mortise locks and latches: to ANSI/BHMA A156.13, series 1000 mortise lock, grade 1, designed for function and keyed as stated in Hardware Schedule.
 - .2 Normal strikes: box type, lip projection not beyond jamb.
 - .3 Electric Strikes: as per hardware schedule.
 - .4 Cylinders: key into keying system as directed.
- .2 Butts and hinges:
 - .1 Butts and hinges: to ANSI/BHMA A156.1, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.
- .3 Door Closers and Accessories:
 - .1 Closers): to ANSI/BHMA A156.4, designated by letter C and numeral identifiers listed in Hardware Schedule, in accordance with ANSI/BHMA A156.4, table A1.
- .4 Door Operators:
 - .1 Power-operated pedestrian doors: to ANSI/BHMA A156.10.
 - .2 Power assist and low energy power operated doors: to ANSI/BHMA A156.19.
- .5 Architectural door trim: to ANSI/BHMA A156.6, designated by letter J and numeral identifiers listed in Hardware Schedule.
 - .1 Door protection plates: 1.27 mm thick stainless steel 3.2 mm thick.
- .6 Door bottom seal: door seal of extruded aluminum frame and solid closed cell neoprene seal, surface mounted, closed ends, adjustable clear anodized finish.
- .7 Card reader: to match existing in building, to be compatible with existing access control system and to be a complete, fully operational installation.

2.3 MISCELLANEOUS
HARDWARE

- .1 Indexed key control system: to ANSI/BHMA A156.5, designated by letter E and numeral identifiers, wall mounted.

2.4 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.

2.5 KEYING

- .1 Doors, to be keyed as noted in Hardware Schedule. Prepare detailed keying schedule in conjunction with Departmental Representative.
- .2 Supply keys in duplicate for every lock in this Contract.
- .3 Stamp keying code numbers on keys and cylinders.
- .4 Supply construction cores.
- .5 Hand over permanent cores and keys to Departmental Representative.

PART 3 - EXECUTION

3.1 INSTALLATION

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

3.1 INSTALLATION
(Cont'd)

- .2 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Supply manufacturers' instructions for proper installation of each hardware component.
- .4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).
- .5 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .6 Use only manufacturer's supplied fasteners.
 - .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .7 Remove construction cores when directed by Departmental Representative.
- .8 Coordinate with electrical trades to ensure all necessary conduit, boxes, and wiring is installed.

3.2 ADJUSTING

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to ensure tight fit at contact points with frames.

3.3 CLEANING

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

3.3 CLEANING
(Cont'd)

- .1 (Cont'd)
 - .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
 - .3 Remove protective material from hardware items where present.
 - .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 DEMONSTRATION

- .1 Keying System Setup and Cabinet:
 - .1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.
 - .2 Place file keys and duplicate keys in key cabinet on their respective hooks.
 - .3 Lock key cabinet and turn over key to Departmental Representative.
- .2 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.
- .3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.5 PROTECTION

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

3.5 PROTECTION .2 Repair damage to adjacent materials caused
(Cont'd) by door hardware installation.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C 36/C 36M, Specification for Gypsum Wallboard.
 - .2 ASTM C 475, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .3 ASTM C 645, Specification for Nonstructural Steel Framing Members.
 - .4 ASTM C 754, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - .5 ASTM C 840, Specification for Application and Finishing of Gypsum Board.
 - .6 ASTM C 1002, Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

- 1.2 STORAGE AND HANDLING
- .1 Store materials inside, level, under cover. Protect from weather, damage from construction operations and other causes, in accordance with manufacturer's printed instructions.
 - .2 Handle materials to prevent damage to edges or surfaces. Protect metal accessories and trim from being bent or damaged.

PART 2 - PRODUCTS

- 2.1 NON-STRUCTURAL METAL FRAMING
- .1 Non-load bearing channel stud framing: to ASTM C 645, 140 mm stud size, roll formed from 0.91 mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres.
-

2.1 NON-STRUCTURAL METAL FRAMING
(Cont'd)

- .2 Floor and ceiling tracks: to ASTM C 645, in widths to suit stud sizes, 32 mm flange height.
- .3 Metal channel stiffener: 19 x 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.

2.2 GYPSUM BOARD

- .1 Abuse-resistant board: to ASTM C 36/C 36M, 16 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges tapered.
- .2 Metal furring runners, hangers, tie wires, inserts, anchors.
- .3 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.
- .4 Steel drill screws: to ASTM C 1002.
- .5 Casing beads, corner beads, and edge trim: metal, zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one piece length per location.
- .6 Joint compound: to ASTM C 475, asbestos-free.

2.3 PLYWOOD SUBSTRATE

- .1 15.9 mm plywood substrate, 1200 mm wide to maximum practical length, screwed to studs.
- .2 Vertical edges aligned with studs.

PART 3 - EXECUTION

3.1 ERECTION OF FRAMING

- .1 Install steel framing members to receive screw-attached plywood and gypsum board in accordance with ASTM C 754 except where specified otherwise.
 - .2 Align partition tracks at floor and ceiling and secure at 400 mm on centre maximum.
-

3.1 ERECTION OF
FRAMING

(Cont'd)

- .3 Erect metal studding to tolerance of 1:1000.
- .4 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .5 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use double track slip joint.

3.2 ERECTION OF
GYPSUM BOARD AND
ACCESSORIES

- .1 Do application and finishing of gypsum board in accordance with ASTM C 840 except where specified otherwise.
- .2 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C 840 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 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles, .
- .5 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.
- .6 Install gypsum boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

3.3 APPLICATION

- .1 Do not apply plywood or gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical work are approved.
- .2 Apply single layer gypsum board to plywood substrate using screw fasteners. Maximum spacing of screws 300 mm on centre.

3.4 INSTALLATION

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure 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 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .5 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .6 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .7 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

PART 1 - GENERAL

- 1.1 Related Sections .1 Section 09 51 13 - Acoustical Panel Ceilings: Acoustical units.
- 1.2 References .1 American Society for Testing and Materials (ASTM International)
.1 ASTM C 635-07, Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
.2 ASTM C 636-08, Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- 1.3 Design Requirements .1 Maximum deflection: 1/360th of span to ASTM C 635 deflection test.
- 1.4 Shop Drawings .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- 1.5 Waste Management and Disposal .1 Separate and recycle waste materials in accordance with Section 01 74 20 - Construction/Demolition Waste Management and Disposal.
.2 Divert unused metal materials from landfill to metal recycling facility.
.3 Remove from site and dispose of packaging materials at appropriate recycling facilities.

PART 2 - PRODUCTS

- 2.1 Materials .1 Intermediate duty system to ASTM C 635.
-

2.1 Materials
(Cont'd)

- .2 Basic materials for suspension system: commercial quality cold rolled steel mill finished.
- .3 Suspension system: non fire rated, intermediate two directional exposed tee bar grid system.
- .4 Exposed tee bar grid components: shop painted satin sheen white. Components die cut. 38 mm Main tee with double web, rectangular bulb and 25 mm rolled cap on exposed face. 25 mm Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection.
- .5 Hanger wire: galvanized soft annealed steel wire.
 - .1 3.6 mm diameter for access tile ceilings.
- .6 Wall moulding: exposed 22 x 22 mm shop painted satin white.
- .7 Accessories: splices, clips, wire ties, retainers and wall moulding flush, to complement suspension system components, as recommended by system manufacturer.
- .8 Minimum of 25% recycled content.

PART 3 - EXECUTION

3.1 Installation

- .1 Installation: in accordance with ASTM C 636 except where specified otherwise.
 - .2 Install suspension system to manufacturer's instructions.
 - .3 Do not erect ceiling suspension system until work above ceiling has been inspected by CSC Representative.
 - .4 Secure hangers as recommended by the manufacturer.
-

- 3.1 Installation
(Cont'd)
- .5 Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.
 - .6 Lay out centre line of ceiling both ways, to provide balanced borders at room perimeter with border units not less than 50% of standard unit width, also refer to reflected ceiling plan.
 - .7 Ensure suspension system is co-ordinated with location of related components.
 - .8 Install wall moulding to provide correct ceiling height.
 - .9 Completed suspension system to support super-imposed loads, such as lighting fixtures diffusers grilles and speakers.
 - .10 Support at light fixtures diffusers with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
 - .11 Interlock Attach cross member to main runner to provide rigid assembly.
 - .12 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.
 - .13 Finished ceiling system to be square with adjoining walls and level within 1:1000.
- 3.2 Cleaning
- .1 Touch up scratches, abrasions, voids and other defects in painted surfaces.

PART 1 - GENERAL

- 1.1 SUMMARY .1 Related Sections:
.1 Section 09 22 27 - Acoustical
Suspension: Suspension system.
- 1.2 REFERENCES .1 American Society for Testing and Materials
International (ASTM)
.1 ASTM C 423-09a, Standard Test Method
for Sound Absorption and Sound Absorption
Coefficients by the Reverberation Room
Method
.2 ASTM E 1264-08e1, Standard
Classification for Acoustical Ceiling
Products.
.2 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-S102-2003, Surface Burning
Characteristics of Building Materials and
Assemblies.
- 1.3 SUBMITTALS .1 Submit samples in accordance with Section
01 33 00 - Submittal Procedures.
.2 Submit duplicate 100mm x 100mm samples of
each type acoustical units.
- 1.4 QUALITY
ASSURANCE .1 Mock-up:
.1 Construct mock-ups in accordance with
Section 01 33 00 -Submittals.
.2 Construct mock-up 10 m² minimum of each
type acoustical tile ceiling including one
inside corner and one outside corner.
.3 Construct mock-up where directed.
.4 Allow 48 hours for inspection of
mock-up by CSC Representative before
proceeding with ceiling work.
.5 When accepted, mock-up will demonstrate
minimum standard for this work. Mock-up may
remain as part of the finished work.
-

- 1.5 DELIVERY,
STORAGE AND
HANDLING
- .1 Protect on site stored or installed absorptive material from moisture damage.
 - .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20 - Construction /Demolition Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Fold up metal and plastic banding, flatten and place in designated area for recycling.
- 1.6 EXTRA MATERIALS
- .1 Provide extra acoustical units amounting to 2 % of gross ceiling area for each pattern and type required for project.
 - .2 Ensure extra materials are from same production run as installed materials.
 - .3 Clearly identify each type of acoustic unit, including colour and texture.
 - .4 Deliver to CSC Representative, upon completion of the work of this section.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Acoustic units for suspended ceiling system: to ASTM E 1264.
 - .1 Type III
 - .2 Class A
 - .3 Cellulose fibre with minimum 40% recycled content with no added urea formaldehyde.
 - .4 Pattern C, Class A.
 - .5 Textures: fine fissured.
 - .6 Flame spread rating of 25 or less in accordance with CAN/ULC-S102.
 - .7 Smoke developed 50 or less in accordance with CAN/ULC-S102.
 - .8 Noise Reduction Coefficient (NRC) designation of .7.
-

- 2.1 MATERIALS
(Cont'd)
- .1 (Cont'd)
 - .9 Ceiling Attenuation Class (CAC) rating 40, in accordance with ASTM E 1264.
 - .10 Edge type square.
 - .11 Colour white.
 - .12 Size 610 x 1220 x 19 mm thick.
 - .13 Surface coverings: low VOC paint.
 - .14 Acceptable products:
 - .1 Radar Climaplust, high NRC #22311, by CGC/USG.
 - .2 Fine Fissured, high NRC #HHF-497 HNRC, by CertainTeed.
 - .3 Fine Fissured, #1714 by Armstrong.
 - .2 Adhesive: low VOC type recommended by acoustic unit manufacturer.
 - .3 Staples, nails and screws: to CSA B111 non-corrosive finish as recommended by acoustic unit manufacturer.

PART 3 - EXECUTION

- 3.1 EXAMINATION
- .1 Do not install acoustical panels and tiles until work above ceiling has been inspected by CSC Representative.
- 3.2 INSTALLATION
- .1 Install acoustical panels and tiles in ceiling suspension system.
- 3.3 APPLICATION
- .1 Install acoustical units as indicated on reflected ceiling plan.
 - .2 Scribe acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.
- 3.4 INTERFACE WITH OTHER WORK
- .1 Co-ordinate with Section 09 22 27 - Acoustical Suspension.
-

3.4 INTERFACE WITH .2 Co-ordinate ceiling work to accommodate
OTHER WORK components of other sections, such as light
(Cont'd) fixtures, diffusers, speakers, sprinkler
heads, radiant ceiling panels to be built
into acoustical ceiling components.

PART 1 - GENERAL

- 1.1 References
- .1 American Society for Testing and Materials (ASTM International)
 - .1 ASTM F 1066-04(2010)e1, Specification for Vinyl Composition Floor Tile.
 - .2 ASTM F 1344-10, Specification for Rubber Tile.
 - .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-25.20-95, Surface Sealer for Floors.
 - .2 CAN/CGSB-25.21-95, Detergent-Resistant Floor Polish.
 - .3 South Coast Air Quality Management District (SCAQMD) rule 1168, January 7, 2005.
- 1.2 Samples
- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit tiles in size specified, and sample of base, 300 mm long.
- 1.3 Closeout Submittals
- .1 Provide maintenance data for resilient flooring for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- 1.4 Waste Management and Disposal
- .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 Collect and separate for disposal paper plastic corrugated cardboard packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.
-

PART 2 - PRODUCTS

- 2.1 Materials
- .1 Rubber tile to ASTM F 1344, Class 1 - homogeneous rubber tile, A - solid colour with two colours minimum of speckled chips throughout, 3.2 mm base thickness 500 x 500 mm or 610 x 610 mm size, a maximum of 4 colours to be selected by CSC Representative from manufacturer's colour range. Colour range to include red, blue, yellow, and green options in addition to neutrals.
 - .1 Rubber tile shall be PVC free.
 - .2 Acceptable manufacturers:
 - .1 Roppe.
 - .2 Johnsonite.
 - .3 Freudenberg/Nora.
 - .2 Finish:
 - .1 As recommended by manufacturer for product specified.
 - .3 Resilient base: to rubber, coved, minimum 1200 mm length and 100mm high x 3.2mm thick, including premoulded external corners for coved base only, a maximum of 2 colours selected by CSC Representative.
 - .1 Rubber base shall contain a minimum of 10% recycled content and/or 10% natural rubber.
 - .2 Acceptable material:
 - .1 'Rubber wall base DC' by Johnsonite.
 - .2 'Pinnacle' rubber wall base by Roppe.
 - .3 'Nora cove base' by Freudenberg/Nora.
 - .4 Resilient stair tread with integrated riser: rubber, 45mm vertical face, square nose, full tread deep, 4 mm thick, raised round surface speckled colour way pattern, with contrasting phosphorescent coloured strip at tread nosings, colour as selected by CSC Representative from manufacturer's standard colour range of at least six options.
-

- 2.1 Materials
(Cont'd)
- .5 Primers and adhesives: as recommended by flooring manufacturer for specific material on applicable substrate, above, at or below grade.
 - .6 Sub-floor filler and leveller: as recommended by flooring manufacturer for use with their product.
 - .7 Metal edge strips: aluminum extruded, smooth, mill finish with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.
 - .8 Sealer: follow recommendation by flooring manufacturer. N/A for most rubber products.
 - .9 Wax: follow recommendation by flooring manufacturer. N/A for most rubber products.

PART 3 - EXECUTION

- 3.1 Inspection
- .1 Ensure concrete floors are dry, by using test methods recommended by tile manufacturer.
- 3.2 Sub-floor Treatment
- .1 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
 - .2 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.
 - .3 Prime or Seal concrete to flooring manufacturer's printed instructions.
-

3.3 Tile
Application

- .1 Provide a high ventilation rate, with maximum outside air, during installation, and for 48 hours after installation. If possible, vent directly to the outside. Do not let contaminated air recirculate through a district or whole building air distribution system. Maintain extra ventilation for at least one month following building occupation.
 - .2 To minimize emissions from adhesives, use water-based, solvent-free styrene-butadiene-rubber adhesive for linoleum. Butadiene exposure may cause eye and nose irritations, headaches, dizziness, and vomiting.
 - .3 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.
 - .4 Lay flooring with joints parallel to building lines to produce symmetrical tile pattern. Border tiles minimum half tile width.
 - .5 Install flooring with pattern grain alternating to produce basket weave pattern, parallel to length of room.
 - .6 As installation progresses, and after installation, roll flooring in 2 directions with 45 kg minimum roller to ensure full adhesion.
 - .7 Cut tile and fit neatly around fixed objects.
 - .8 Install feature strips and floor markings where indicated. Fit joints tightly.
 - .9 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.
 - .10 Install metal edge strips at unprotected or exposed edges where flooring terminates.
-

- 3.3 Tile Application (Cont'd)
- .11 Install static dissipative vinyl tile in accordance with manufacturers recommendations including floor preparation, adhesive, grounding strips, and finish.
- 3.4 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.
- 3.5 Initial Cleaning and Waxing
- .1 Remove excess adhesive from floor, base and wall surfaces without damage.
- .2 Clean, seal and wax floor and base surface to flooring manufacturer's instructions.
- 3.6 Protection of Finished Work
- .1 Protect new floors from time of final set of adhesive until final inspection.
- .2 Prohibit traffic on floor for 48 hours after installation.
-

3.7 Schedule .1 Refer to drawings for floor finish patterns
and locations.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 Architectural Painting Specifications Manual, Master Painters Institute (MPI).
 - .1 Architectural Painting Specification Manual - current edition.
 - .2 Maintenance Repainting Manual - current edition.
 - .2 National Fire Code of Canada 2015.
- 1.2 QUALITY ASSURANCE
- .1 Contractor shall have a minimum of five years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.
 - .2 Conform to latest MPI requirements for interior painting work including preparation and priming.
 - .3 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- 1.3 SCHEDULING OF WORK
- .1 Schedule painting operations to prevent disruption of occupants in and about the building.
- 1.4 SUBMITTALS
- .1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be used in accordance with Section 01 33 00.
 - .2 Submit WHMIS MSDS.- Material Safety Data Sheets.
-

1.5 SAMPLES

- .1 Submit full range colour sample chips in accordance with Section 01 33 00. Indicate where colour availability is restricted.
- .2 Submit 200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards.
- .3 When approved, sample panels shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

1.6 DELIVERY,
HANDLING AND
STORAGE

- .1 Deliver, store and handle materials in accordance with Section 01 61 00.
 - .2 Labels shall clearly indicate:
 - .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 Provide and maintain dry, temperature controlled, secure storage.
 - .5 Observe manufacturer's recommendations for storage and handling.
 - .6 Store materials and supplies away from heat generating devices.
 - .7 Store materials and equipment in a well ventilated area with temperature range 7°C to 30°C.
 - .8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
-

1.6 DELIVERY,
HANDLING AND
STORAGE
(Cont'd)

- .9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.
- .10 Remove paint materials from storage only in quantities required for same day use.
- .11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- .12 Fire Safety Requirements:
 - .1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.7 SITE
REQUIREMENTS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces.
 - .2 Perform no painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application until paint has cured sufficiently.
 - .3 Coordinate use of existing ventilation system with Departmental representative and ensure its operation during and after application of paint as required.
 - .4 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

1.7 SITE
REQUIREMENTS
(Cont'd)

- .1 (Cont'd)
 - .5 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities shall be provided by General Contractor.
- .2 Surface and Environmental Conditions:
 - .1 Apply paint finish only 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 only to adequately prepared surfaces and to surfaces within moisture limits noted herein.
 - .3 Apply paint only when previous coat of paint is dry or adequately cured.

1.8 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 20.
- .2 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.,) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
- .3 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

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 Paint materials for paint systems shall be products of a single manufacturer.

- 2.2 COLOURS
- .1 Colour schedule will be based upon the selection of three colours.
 - .2 Selection of colours will be from manufacturers full range of colours.
- 2.3 MIXING AND TINTING
- .1 Perform colour tinting operations prior to delivery of paint to site.
 - .2 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 shall be defined as the sheen rating of applied paint, in accordance with the following values:
 - .2 Gloss level ratings of painted surfaces as indicated and as noted on Finish Schedule.
- PART 3 - EXECUTION
- 3.2 EXISTING CONDITIONS
- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
 - .2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Departmental representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
-

3.3 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 such surfaces as directed by Departmental Representative.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .4 Removal of electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings shall be done prior to undertaking any painting operations by General Contractor. Items shall be securely stored and re-installed by General Contractor after painting is completed.
- .5 Move and cover equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .6 As painting operations progress, place "WET PAINT" signs in occupied areas to approval of Departmental Representative.

3.4 CLEANING AND PREPARATION

- .1 Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
 - .2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly.
-

3.4 CLEANING AND
PREPARATION
(Cont'd)

- .2 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.
- .3 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes.
- .4 Touch up of shop primers with primer as specified in applicable section.

3.5 APPLICATION

- .1 Apply paint by brush or roller. Conform to manufacturer's application instructions unless specified otherwise.
 - .2 Brush and Roller Application:
 - .1 Apply paint in a uniform layer using brush and/or roller of types 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 shall be free of roller tracking and heavy stipple unless approved by Departmental representative.
 - .5 Remove runs, sags and brush marks from finished work and repaint.
 - .3 Backpaint metal fabrications prior to installation to protect surfaces in contact with concrete or masonry at exterior locations.
 - .4 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
-

3.5 APPLICATION
(Cont'd)

- .5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .6 Sand and dust between coats to remove visible defects.
- .7 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
- .8 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/
ELECTRICAL
EQUIPMENT

- .1 Unless otherwise specified, paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.
- .2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .3 Do not paint over nameplates.

3.7 FIELD QUALITY
CONTROL

- .1 Field inspection of painting operations to be carried by Departmental Representative.
- .2 Advise Departmental Representative when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
- .3 Co-operate with Departmental Representative and provide access to areas of work.

3.8 RESTORATION

- .1 Clean and re-install all hardware items removed before undertaken painting operations.
-

- 3.8 RESTORATION
(Cont'd)
- .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.

PART 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA B149.1-10, Natural gas and propane installation code.
 - .2 CSA C390-10, Test methods, marking requirements, and energy efficiency levels for three-phase induction motors.
- .2 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 90.1-13, Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI Approved; IES Co-sponsored).
- .3 Canadian General Standards Board (CGSB).
 - .1 CGSB 1-GP-181M, Coating, Zinc-Rich, Organic, Ready-Mixed.
- .4 Ontario Building Code (OBC).
- .5 Canada Green Building Council (CaGBC).
 - .1 LEED Canada-ID+C Version 4, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide for Interior Design and Construction.

1.2 GENERAL

- .1 This section covers items common to all sections of Division 20, 22, 23. Division 20 items apply to Divisions 20, 22, 23.
- .2 All of division 01 applies to divisions 20, 22 and 23. In case of conflict, the more stringent requirement shall apply.
- .3 Obtain and pay for all required permits and approvals.
- .4 The following codes shall apply:
 - .1 Ontario Building Code-12.
 - .2 Ontario Building Code; Part 7 Plumbing.
 - .3 Ontario Fire Code.
 - .4 Ontario Gas Utilization Code.
 - .5 National Fire Protection Association; N.F.P.A.
 - .6 Technical Standards and Safety Authority (T.S.S.A.) Safety Act and associated documents.
- .5 All code references shall be the latest edition, including revisions and addenda.
- .6 Materials and equipment to be new and free from blemishes, oxidation, damage, etc. New materials and equipment to be of proven design and quality, and for which replacement parts are readily available. Use current models of equipment.
- .7 It is the intent of the specification that there be one prime contractor for all of Division 20, 22, 23 work. The prime mechanical shall be responsible for all Division 20, 22, 23 subtrades. The prime mechanical shall be responsible for overall coordination and commissioning of systems.

- .8 The work completed under this Contract is intended to meet or exceed credits to obtain a minimum of the Silver Level of certification LEED from the Canadian Green Building Council. All Sub-Contractors are to submit the necessary Documentation in order to comply with the LEED prerequisite and credit requirements.
- .1 The VOC content of paints and coating used in the interior of the building envelope must be less than the VOC content limits of GS-11 and GS-03 respectively. The VOC content of interior paints and coatings not already covered by GS-11 and GS-03 must be less than the VOC content limits of SCAQMD Rule #1168.
 - .1 Sub-Contractor to provide cut sheets, Material Safety Data Sheets, signed attestations or other official literature from manufacturers clearly identifying product emission rates. Documentation showing amount (in gallons) of each materials used should also be provided.

1.3 EQUIPMENT INSTALLATION

- .1 Unions or flanges: provide for ease of maintenance and disassembly.
- .2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.
- .3 Equipment drains: pipe to drains, or funnel floor/hub drains.
- .4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.
- .5 Provide and install all necessary vibration control components.
- .6 Provide and install all backflow preventers necessary to protect the potable water system.
- .7 Pipe humidifier and other interior mounted equipment drains, such as fan coils, to funnel floor/hub drains.

1.4 ANCHOR BOLTS AND TEMPLATES

- .1 Supply and install anchor bolts and templates for equipment provided by this division.

1.5 EQUIPMENT USAGE

- .1 Consultant may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing. Trial usage to apply to all systems.

1.6 DEFINITIONS

- .1 This definition shall apply to all sections and drawings of Division 22, 23.
 - .1 "CONCEALED" - mechanical services and equipment in hung ceilings and non-accessible chases and furred spaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein, e.g. Mechanical Rooms.
 - .3 "PROVIDE" - will mean supply, installation and connection.
 - .4 "T.S.S.A." shall mean "Technical Standards and Safety Authority".

1.7 PROTECTION OF OPENINGS

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

1.8 ELECTRICAL

- .1 Electrical work to conform to Division 26 including the following.
- .2 Provide all controls, disconnects, magnetic starters, transformers, relays, wiring and panels for all motors and devices for packaged equipment as indicated in various specification sections.
- .3 Electrical equipment shall bear CSA labels and/or ULC approvals to comply with Ontario Hydro requirements. Conform to the requirements of the Canadian Electrical Code, Ontario Building Code, local, municipal and provincial authorities.
- .4 Control panels to be complete with barriered numbered terminal strip for interconnecting of conductors between master control panel and remote control panel and associated equipment.
- .5 Controls
 - .1 All power and control wiring, relays, transformers and wiring related to motorized dampers, thermostats, controllers, sensors, control panels, control devices, valves, pressure limit switches, etc., which are related to control systems to be provided by Division 22 and 23, unless specifically indicated on electrical drawings otherwise. Refer to electrical control schematics.
 - .2 All wiring in walls to be run in conduit. All wiring in plenum spaces to be plenum rated type FT6. Refer to Division 26 for further details.
 - .3 Control wiring to be copper conductor type RW 90 (XLPE); minimum #14 AWG for power circuits and minimum #18 AWG for control only.
 - .4 Conduit to be E.M.T. minimum 21 mm complete with set screw cast couplings. Provide ground conductor in all conduit runs.
 - .5 Use liquid tight flexible conduit for final connection to motorized dampers and vibrating equipment.
- .6 Panels to be complete with required components including but not limited to:
 - .1 One main fused switch suitable current rating for the station load. Pad lockable in both open and closed positions. Mechanically interlocked door to prevent opening when handle is in "on" position.
- .7 Ensure that electrical contractor has provided for auxiliary contacts for the building control systems.

1.9 MOTORS

- .1 Provide motors for mechanical equipment as specified.
- .2 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by Consultant for temporary use. Final acceptance of equipment will not occur until specified motor is installed.
- .3 Motors under 1/2HP: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120V, unless otherwise specified or indicated.

- .4 Motors 1/2HP and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40°C, 3 phase, 575V, unless otherwise specified or indicated.
- .5 Motor efficiency shall be in accordance with CSA C390. Motors 1 HP and larger to be energy efficient motors conforming to ASHRAE 90.1.
- .6 Power factor correction shall apply to all motors with 3.73KW (5 hp) rating or more.
- .7 All motor starters for loads with a running ampacity (RLA) greater than 20 amps shall be of the solid state reduced voltage type with current ramp and current limit capability. Current limit shall be set at 4 times RLA and ramped to this value over a period of not less 1½ seconds.

1.10 BELT DRIVES

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
- .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.
- .3 For motors under (7.5kW) 10HP: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.
- .4 For motors (7.5 kW) 10HP and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
- .5 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .6 Motor slide rail adjustment plates to allow for centre line adjustment.
- .7 Provide one complete set of spare belts for every drive supplied under this contract.

1.11 GUARDS

- .1 Provide guards for unprotected drives.
- .2 Guards for belt drives:
 - .1 Expanded metal screen welded to steel frame.
 - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
 - .3 38 mm dia. holes on both shaft centers for insertion of tachometer.
 - .4 Removable for servicing.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.
- .4 Install belt guards to allow movement of motors for adjusting belt tension.
- .5 Guard for flexible coupling:
 - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
 - .2 Securely fasten in place.
 - .3 Removable for servicing.

- .6 Unprotected fan inlets or outlets:
 - .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
 - .2 Net free area of guard: not less than 80% of fan openings.
 - .3 Securely fasten in place.
 - .4 Removable for servicing.
- .7 Guards to meet safety requirements of Provincial Ministry of Labour and local Authorities Having Jurisdiction.

1.12 EQUIPMENT SUPPORTS

- .1 Equipment supports supplied by equipment manufacturer: specified elsewhere in Division 22, 23.
- .2 Equipment supports not by equipment manufacturer: fabricate from structural grade steel.
- .3 Provide all necessary mechanical equipment vibration control, specified or recommended by equipment manufacturer.
- .4 Size anchor bolts to withstand seismic zone acceleration and velocity forces for region of installation.
- .5 Provide seismic restraint of equipment, ducting, piping, tanks and machinery in accordance with Section 20 05 20 - Seismic Restraints.
- .6 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm (4") high and 150 mm (6") larger than equipment dimensions all around. Concrete shall be as specified in Division 03. Housekeeping pads for equipment shall be the responsibility of Division 3. Coordinate dimensions and locations with Division 3 Contractor.

1.13 SLEEVES

- .1 Pipe sleeves: at points where pipes pass through masonry, concrete or fire rated assemblies and as indicated.
- .2 Schedule 40 steel pipe.
- .3 Cast iron sleeves or steel sleeves with annular fin continuously welded at midpoint:
 - .1 Through foundation walls.
 - .2 Where sleeve extends above finished floor.
- .4 Sizes: maximum 6 mm (1/4") clearance all around, between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm (1") above other floors. For equipment room floors, terminate 100 mm (4") above floor and provide concrete curb.
- .6 Fill voids around pipes:
 - .1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.

- .2 Where sleeves pass through walls or floors, provide space for firestopping. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity.
 - .3 Ensure no contact between copper tube or pipe and ferrous sleeve.
 - .4 Fill future-use sleeves with lime plaster or other easily removable filler.
 - .5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M+Amdt.
- .7 This Division shall prepare sleeving drawings indicating the size and locations of openings required in concrete floor slabs, roof slabs/decks and walls for piping, ductwork and equipment. In case of failure to provide information in time (i.e. before the concrete is poured) any extras incurred shall be at the expense of this Division.
 - .8 Where ducts pass through equipment room floors, provide 100 mm (4") high concrete curb around duct allowing adequate space for fire damper sleeve and room for expansion. Concrete curbs where pipes and ducts pass through equipment room floors shall be by Division 22, 23.

1.14 PREPARATION FOR FIRESTOPPING

- .1 Firestopping 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 Coordinate firestopping systems with separation ratings as outlined in Architectural documents.
- .2 Firestopping material and installation within annular space between pipes, ducts, insulation and adjacent fire separation: Section 07 84 00 - Firestopping.
- .3 Uninsulated unheated pipes not subject to movement: no special preparation.
- .4 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit to move without damaging firestopping material.
- .5 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation. Insulation material used to meet requirements of ULC listing of firestopping system.

1.15 ESCUTCHEONS

- .1 On pipes passing through walls, partitions, floors and ceilings in finished areas. On pipes passing through millwork and cabinetry.
- .2 Chrome or nickel plated brass or Type 302 stainless steel, one piece type with set screws. Use cast iron type in equipment rooms.
- .3 Outside diameter to cover opening or sleeve.
- .4 Inside diameter to fit around finished pipe.
- .5 Do not use split-type escutcheon plates.
- .6 Secure to pipe on finished surface but not insulation.

1.16 TESTS

- .1 Give 24h written notice of date for tests.
- .2 Insulate or conceal work only after testing and approval by Consultant.
- .3 Conduct tests in presence of Consultant or authority having jurisdiction.
- .4 Bear costs including retesting and making good.
- .5 Piping:
 - .1 General: maintain test pressure without loss for 4h unless otherwise specified.
 - .2 Hydraulically test hydronic piping systems at 1½ times system operating pressure or minimum 860 kPa, whichever is greater.
 - .3 Test drainage, waste and vent piping to Ontario Building Code and authorities having jurisdiction.
 - .4 Test domestic hot, cold and recirculation water piping at 1½ times system operating pressure or minimum 860 kPa, whichever is greater.
 - .5 Test natural gas system to CAN/B149.1 and requirements of authorities having jurisdiction.
 - .6 Test fire systems in accordance with NFPA & authorities having jurisdiction.
- .6 Equipment: test as specified in relevant sections.
- .7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.
- .8 Provide written confirmation for each test conducted.
- .9 Provide any equipment required to conduct tests.
- .10 Test water shall be potable water and should be from a municipal system that treats water with chlorination or some other appropriate means to kill bacteria.
- .11 Test fire systems in accordance with NFPA & Authorities Having Jurisdiction.

1.17 PAINTING

- .1 Apply at two coats of corrosion resistant primer paint to ferrous supports and site fabricated work.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up. Items suffering major damage to finish shall be replaced entirely, if in the opinion of the Consultant, the damage is too extensive to be remedied by touch up.
- .4 Convectors, wall fins, unit heaters, cabinet unit heaters (force flows) and other mechanical equipment exposed in finish areas shall be finish painted by manufacturer with minimum baked enamel finish. Color to be selected by Architect during shop drawing submittals.

1.18 ACCESS DOORS

- .1 Supply access doors to concealed mechanical equipment for operating, inspecting, adjusting and servicing.
- .2 Flush mounted 600 x 600 mm (24" x 24") for body entry and 300 x 300 mm (12" x 12") for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.
- .3 Material:
 - .1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Consultant.
 - .2 Remaining areas: use prime coated steel.
- .4 Installation:
 - .1 Locate so that concealed items are accessible.
 - .2 Locate so that hand or body entry is achieved.
 - .3 Installation by Division 09.
- .5 Standard of Acceptance: Acudor UF-5000.
 - .1 Alternate: Mifab UA.
- .6 Fire rated access panels: 16 ga. mounting frame, 20 gauge sandwich type insulated self-closing door with concealed hinge, 50 mm thickness of fire rated insulation in door, self latching ring pull latch, primer coated, 1½ hour rating.
 - .1 Standard of Acceptance: Acudor FW-5050.
 - .2 Alternate: Mifab MPFR.
- .7 Access doors must maintain fire rating if installed in a fire rated assembly. Refer to Architectural Drawings for location of fire rated walls and ceilings.

1.19 DIELECTRIC COUPLINGS

- .1 General:
 - .1 To be compatible with and to suit pressure rating of piping system.
 - .2 Where pipes of dissimilar metals are joined.
- .2 Pipes NPS 2 and under: isolating unions.
- .3 Pipes NPS 2½ and over: isolating flanges.

1.20 DRAIN VALVES

- .1 Locate at low points and at section isolating valves unless otherwise specified. Locate so that exterior piping and coils can be drained.
- .2 Minimum NPS 3/4 unless otherwise specified: bronze, with hose end male thread and complete with cap and chain.

1.21 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Where specified elsewhere in Mechanical Specification, manufacturers to provide demonstrations and instructions.
- .3 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Where deemed necessary, Consultant may record these demonstrations on video tape for future reference.
- .6 Demonstration and Operating and Maintenance Instructions to building operating staff to be completed prior to requesting Certification of Substantial Performance. Provide a written certificate that all training has been completed signed by each manufacturer's representative and the Owner's representative.

1.22 OPERATION AND MAINTENANCE MANUAL

- .1 Provide operation and maintenance data for equipment supplied. Faxed copies are not acceptable. Photocopied data must be clear.
- .2 Operation and maintenance manual to be approved by, and final copies deposited with, Consultant before final inspection. Operation and Maintenance Manuals shall be prepared in English.
- .3 Operation data to include:
 - .1 Control schematics for each system including environmental controls.
 - .2 Description of each system and its controls.
 - .3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for each system and each component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .8 Symbol and legend description.
- .4 Maintenance data shall include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .3 Replacement parts list.
 - .4 Warranties.
- .5 Performance data to include:
 - .1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.

- .2 Equipment performance verification test results.
- .3 Special performance data as specified elsewhere.
- .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
 - .1 Submit 1 copy of draft Operation and Maintenance Manual to Consultant for review. Submission of individual data will not be accepted unless so directed by Consultant. Manual must be compiled in a hard cover, 3-ring, 'D' ring binder complete with inside pockets, index page and index tabs. The name of the project must be clearly visible on the front and spine of each binder.
 - .2 Make changes as required and re-submit as directed by Consultant.
 - .3 Submit four (4) copies of the approved operation and maintenance manual to the Consultant two weeks prior to substantial completion.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.
 - .2 The contact information (name, address, contact, telephone number, fax number) of the Mechanical and all Sub-Contractors and all suppliers must be included in the manual.
- .8 Conform also to Section 01 77 00 - Closeout Procedures.

1.23 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit 6 copies of shop drawings and product data for equipment supplied. Refer to Section 01 33 00 - Submittal Procedures.
 - .1 Faxed copies of equipment data will not be accepted.
 - .2 Shop drawings indicating a range of models and sizes with no selection shown will not be accepted.
- .2 Shop drawings and product data shall show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances. eg. access door swing spaces.
 - .3 Make model and nameplate data for each piece of equipment.
 - .4 Size and capacity of each piece of equipment.
 - .5 Electrical characteristics.
- .3 Shop drawings and product data shall be accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify as to current model production.
 - .5 Certification of compliance to applicable codes.
 - .6 All operating and performance data indicated in relevant specification sections.
- .4 Shop drawings shall be submitted by specification section. Do not combine more than one section into one submission.

- .5 Shop drawings shall indicate clearly the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each shop drawing shall give the identifying number of the specific pump, fan, etc. for which it was prepared (e.g. fan F-7).
- .6 Each shop drawing for non-catalogue items shall be prepared specifically for this project. Shop drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.
- .7 Each shop drawing or catalogue sheet shall be stamped and signed by the contractor to indicate that he has checked the drawing for conformance with all requirements of the drawings and specifications, that he has co-ordinated this equipment with other equipment to which it is attached and/or connected and that he has verified all dimensions to ensure the proper installation of equipment within the available space and without interference with the work of other trades. Ensure that electrical co-ordination is complete before submitting drawings for review. If shop drawings are submitted without the contractors stamp and initials, or it is apparent that the contractor has not completed their review, the shop drawings will be returned by the Consultant and identified to be resubmitted.
- .8 Installation of any equipment shall not start until after final review of shop drawings by the Consultant has been obtained.
- .9 When requested, shop drawings shall be supplemented by data explaining the theory of operation - for example: a variable speed motor control - the Consultant may also request that this information be added to the maintenance and operating manual.
- .10 Provide a lead sheet with the project name, issue date, issue number, specification section number, title of section and with space for shop drawing review stamps for the Contractor and Consultant.
- .11 One original shop drawing will be returned. All copies required for the trades, suppliers or other consultants will be printed by the Contractor.
- .12 Any equipment data, requested calculations, written certifications or other similar information specified or shown on the drawings shall be included with shop drawing submittals.
- .13 The Contractor shall make notations with respect to the following aspects and any other deviations from the contract documents:
 - .1 Deviation from specified performance, electrical requirements and equipment specified.
 - .2 Changes in dimensions from equipment indicated or specified, including confirmation that equipment will fit into space allotted. Contractor shall provide written notation how deviations are being addressed and what coordination with other affected trades has been or will be undertaken.
- .14 Consultant review of shop drawings is for general conformance only, and does not relieve the contractor from meeting all aspects of specification. The contractor is solely responsible for the completeness, correctness, and all information presented on shop drawings. There shall be no additional cost to Project for failure of the consultant to complete a thorough review of shop drawings for compliance. The contractor shall not assume consultant has performed a thorough review and the contractor shall be ultimately responsible for completeness of shop drawings and the equipment conformance with specifications.

- .15 Shop drawings shall be submitted in order of delivery requirements. That is, the items which have long deliveries or are to be installed first shall be submitted first. Not all shop drawings shall be submitted at once. The contractor shall coordinate the sequence of submittals with the Consultant at start of project. The Consultant requires 2 weeks to review individual submissions. For submission of complete systems or for multiple units, such as fan coils submissions, the Consultant requires 3 weeks for their review. The Contractor shall allow for Consultant review times in their schedule.

1.24 CLEANING

- .1 Clean interior and exterior of all systems including strainers.
- .2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.
- .3 Upon completion remove temporary protection. Remove stains and smudges from paint work. Wash and polish plumbing fixtures.
- .4 During the course of construction, each - Subcontractor shall keep his work tidy and not allow an accumulation of debris resulting from his work.
- .5 Upon completion of this work he shall leave the premises in a broom clean condition.
- .6 Replace broken, damaged or scratched fixtures.

1.25 AS-BUILT DRAWINGS

- .1 Site records:
 - .1 The Consultant will provide the mechanical contractor with two extra sets of white prints on which the mechanical contractor shall clearly mark, as the job progresses, all changes and deviations from that shown on contract drawings. This shall also include changes to existing mechanical systems, control systems and low voltage control wiring. It will not be sufficient to check off line locations. Definite measurements shall be taken for each service line. Drawings shall be kept up-to-date during construction and in addition to field measurements shall include variation orders, field instructions and all other changes. On completion of the building, the mechanical contractor shall forward to the Consultant the two sets of drawings indicating all such changes and deviations for review by the Consultant.
 - .2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection at all times.
- .2 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
 - .3 Submit to Consultant for approval and make corrections as directed.
 - .4 TAB to be performed using as-built drawings.

- .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .3 Submit copies of as-built drawings for inclusion in final TAB report.
- .4 CAD As-builts
 - .1 Mechanical Contractor shall, at the end of the project update the original CAD drawing files to as-built drawings at no extra cost.
 - .2 CAD as-built drawings shall follow the same layering convention and symbology as the original drawing.
 - .3 Revised CAD files will be reviewed by the Consultant and drawings shall be plotted by Mechanical contractor at no extra cost.
 - .4 The project will remain incomplete and a holdback will be retained until satisfactory as-built drawings and data storage devices are provided.
 - .5 Final as-builts prints/plots shall not contain markings or corrections by hand (i.e. marker, pen, pencil, etc.). Drawings containing mark-ups shall be revised on computer and printed/plotted. Provide two sets of data storage device and two sets of prints to the Owner.
- .5 Conform also to Section 01 77 00 - Closeout Procedures.

1.26 EXAMINATION OF SITE AND INFORMATION

- .1 The contractor, before tendering shall examine the site, the existing building construction and services, the Architectural, Structural, Mechanical and Electrical drawings and he shall familiarize himself with the building construction and finish in order that his tender may include everything necessary for the proper completion of the work.
- .2 It shall be this contractor's responsibility that material and equipment be brought in such assemblies and sizes as to enter into the spaces where they are to be located and to be small enough to be hoisted onto the building without difficulty. Any cutting, patching, etc. involved in getting large assemblies into place shall be the responsibility of this contractor. Coordinate equipment installation access with Architectural.
- .3 Immediately inform the Consultant, in writing, of all discrepancies, errors, omissions, contradictions and ambiguities. The necessary Addendum or bulletin will be issued to all Bidders. Include a complete cross-checking of Drawing and Specifications for sizes and quantities to correspond correctly. Data mentioned in the Specifications and not shown on Drawings, and vice-versa, must be interpreted as part of the Work. Oral, telephone or "Faxed" instructions are not valid. Bring obvious discrepancies or omissions to the attention of the Consultant during the Tender Period. Questions may be presented by bidders up to time of tender closing. Questions presented near this time may not be answered. Where the contractor is not able to obtain directions on questions, they shall prepare quotation based on specifications or drawings and include all items required to comply. Where discrepancies still exist within the documents, contractors shall allow for the more demanding installation, more stringent requirement or more expensive equipment specification. Contractors shall instruct all suppliers and distributors of this time limitation.
- .4 The drawings and specifications are intended to describe complete working systems including all necessary labour and materials. Where items required to complete working system are not specified or showing on drawings, contractor shall include costs at no additional expense to Project.

1.27 CUTTING AND REMEDIAL WORK

- .1 Assume full responsibility for laying out mechanical work and for any damage caused by incorrectly located equipment and mechanical services.

1.28 CO-ORDINATION

- .1 Locate distribution systems, equipment and materials to provide minimum interference and maximum useable space.
- .2 Where interference occurs, Consultant shall approve relocation of equipment and materials.
- .3 This contractor shall notify other Subcontractors who are concerned, of all openings, foundation work, hangers, inserts, anchors, or other provisions necessary in their work for the installation of this work and he shall furnish all information and necessary materials in ample time so that proper provisions can be made for same, and shall supply and correctly and accurately place all inserts, sleeves, anchors, etc.
- .4 Division 20 shall supply inserts, hangers, sleeves, anchors, etc. which must be placed within concrete forms to other subcontractors that are concerned. Division 20 shall inform responsible contractor of locations. Where anchors are required to be drilled and placed, Division 20 shall be responsible for their supply and installation. Pipe hangers and supports listed in Section 20 05 29 - Pipe Hangers and Supports shall be provided by Mechanical Contractor.
- .5 Excavation, trenching and backfilling required for the work of Division 20, 22, 23 shall be by Division 31. Division 20, 22, 23 shall coordinate the work of Division 31 for their required work. Divisions 20, 22, 23 shall be responsible for laying out excavation work and advising Division 31 contractor of required grades.

1.29 REQUIREMENTS OF INSPECTION DEPARTMENTS

- .1 All work shall be installed in accordance with all laws and regulations of all authorities having jurisdiction in each case, particularly all affected departments of the Municipality and Province. Electrical equipment supplied must conform to the regulations of CSA and the local utility. Anything necessary to make the work comply with these requirements shall be provided by this contractor without additional cost to the Project if reasonably could have been foreseen when tendering.
- .2 The contractor shall prepare drawings in addition to Consultant's drawings as may be required by various Inspection Departments having jurisdiction, and obtain their approval before proceeding with the work.
- .3 In the event that the Inspection Department's request deviates from the Consultant's layout, contractor shall consult the Consultant before proceeding with same.
- .4 Provide all inspection certificates prior to request for substantial completion. Include copy of inspection certificates in Operation and Maintenance Manuals.

1.30 DRAWINGS

- .1 The drawings shall be considered to show the general character and scope of the work and not the exact details of the installation. The installation shall be complete with all accessories required for a complete and operative installation.
- .2 The drawings show the approximate location for the special apparatus and the materials throughout the building. The arrangement shown on the drawings is more or less diagrammatic and as such approximate only, and may be altered, as approved by the Consultant, to meet the requirements of the apparatus, etc., and of the building. Each Subcontractor shall be held responsible for all measurements for his work throughout, and he shall arrange his piping, wiring and apparatus to conform to the Architectural and Structural details in a satisfactory manner and shall cooperate with other contractors to ensure that work shall meet all requirements of diverse Contracts.
- .3 The contractor is particularly cautioned that small scale Consultant's plans must be supplemented by his own detail drawings where necessary for proper coordination of the work.
- .4 Items shown on the drawings but not specified or specified but not shown shall be included.
- .5 Items obviously required to provide a complete working system, but not specified nor shown shall be included.
- .6 In order to show more clearly the arrangement of the work, plans and sections do not show every valve, thermometer, pressure gauge or other system accessory. Refer to the Mechanical Standards details and to the specifications to determine the requirements.
- .7 Certain details indicated on the drawings are general in nature and specific labelled detail references to each and every occurrence of use are not indicated, however, such details shall be applicable to every occurrence on the drawings.
- .8 The location and size of existing services shown on the drawings are based on the best available information. The actual location of existing services shall be verified in the field before work is commenced. Particular attention shall be paid to buried services.
- .9 Changes and modifications necessary to ensure co-ordination and to avoid interference and conflicts with other trades, or to accommodate existing conditions, shall be made at no extra cost to the Project.
- .10 Leave areas clear of piping and ducts where space is indicated reserved for future equipment, and equipment for other trades.
- .11 Adequate space and provisions shall be left for removal of coils and servicing of equipment, with minimum inconvenience to the operation of systems.
- .12 Before fabricating piping or ducting for installation, make certain that such items can be installed as shown on the drawings without interfering with the structure or the work of all other trades. Any problems that cannot be solved in agreement with the other trades affected, shall be submitted for decision. If piping or ducting is prefabricated prior to the investigation and reaching of a solution to possible interference problems, necessary changes in such prefabricated items shall be made at no extra cost to the Project.

- .13 Off-sets in piping or ducting may not be indicated in all cases, but are to be included in the contract as required.
- .14 All piping and ductwork in finished areas shall be concealed in ceiling spaces and shafts or chased into walls. No exposed piping or ductwork shall be installed in such areas unless specifically reviewed by the Consultant. No piping shall be concealed in outside walls.
- .15 Vent pipes, exhaust hoods or other mechanical equipment mounted on roof, or housing for such equipment, shall not be closer to the edge of roof than 6'-0", unless specifically reviewed by the Consultant.
- .16 The actual location of thermostats, switches, etc. shall be reviewed by the Consultant before installation.
- .17 Where equipment is shown to be 'roughed-in only' obtain accurate information from the Consultant before proceeding with the work.

1.31 INSTALLATION, INTERFERENCE AND SETTING DRAWINGS

- .1 Installation, interference and setting drawings dimensioned and to scale, shall be submitted for review to the Consultant, as may be required or requested by the Consultant to make clear the work intended or to show its relation to adjacent work or to the work of other trades. When an alternative piece of equipment is to be substituted for equipment shown, drawings of the area involved shall be prepared by this division. Three copies of such drawings shall be submitted for review, of which one will be retained by the Consultant.
- .2 Installation working drawings to 1:50 scale for the mechanical room showing plan and sections of the plant, services, bases, curbs, drains, motor terminals, shall be prepared by this division.
- .3 Interference drawings are required for shafts, ceiling spaces and wherever there is possible conflict in the positioning of mechanical equipment, piping, ductwork subtrades or architectural features.
- .4 The design of the structural framing of the mechanical equipment and major pipe run supports has been based on assumed loadings supplied during the design phase. Well ahead of the construction of the affected areas, prepare and submit drawings for review to the Consultant showing the layout and weights of all finally selected mechanical equipment including details of concrete pads, concentrated pipe loads and point reactions of the equipment onto the structure. Structural design has been based on equipment listed by model number. Alternate equipment shall not exceed weight and dimensions of equipment listed without prior approval of Consultant. If alternate equipment is not approved by Consultant, contractor shall supply equipment listed at no additional cost to project. If alternate equipment is selected, contractor shall provide all structural revisions necessary and pay all cost including engineering.
- .5 Pump capacities, control valve sizing, etc., have been based on equipment specified. Upon submission of shop drawings, contractor shall review with consultant all design and equipment changes and where required to accommodate design or equipment changes contractor shall consult consultant and revise equipment capacities as required. There shall be no extra cost to Project for changes to equipment to accommodate changes discussed above. No installations shall proceed until this coordination has been completed.

1.32 ALTERNATES

- .1 Tenders shall be prepared only on the basis of specified or listed equivalent material.
- .2 The design, space allocation, orientation, piping, control systems, etc., are arranged to suit the material and equipment named by model number in the text of the specifications and shown on the drawings. Assume responsibility for adjustments or extension of the work of this or other Division necessary for the accommodation of equivalent or substitute equipment.
- .3 Structural design has been based on equipment listed by model number. Alternate equipment shall not exceed weight and dimensions of equipment listed without prior approval of Consultant. If alternate equipment is not approved by Consultant, Contractor shall supply equipment listed at no additional cost to project. If alternate equipment is selected, contractor shall provide all structural revisions necessary and pay all cost including engineering.

1.33 ENERGY CONSUMPTION

- .1 Consultant may reject equipment submitted for approval on basis of performance or energy consumed or demanded.

1.34 CONFORMANCE

- .1 Materials specified by referenced standard, select any material that meets or exceeds the specified standard.
- .2 Materials specified by "Prescriptive" or "Performance" specification, select any material meeting or exceeding specification.
- .3 When materials are specified by a Standard, Prescriptive or Performance specifications, upon request of the Consultant, obtain from manufacturer an independent testing laboratory report showing that the material or equipment meets or exceeds the specified requirements.
- .4 Materials specified by naming one or more materials, select any material named. Where only one name appears in the specification, the tender shall include for the specified equipment. For the purpose of these specifications, the term "Acceptable Material" is deemed to be a complete and working commodity as described by a manufacturer's name, catalogue number, trade name or any combination thereof.
- .5 Manufacturers or subcontractors specified by naming one or more, select any one named. Where only one name appears in the specification, the tender shall include for the specified name.

1.35 STATEMENT OF PRICES

- .1 To form a basis for progress payments the successful bidder shall submit a statement of his estimated prices for the various portions of the work, including labour, materials and equipment shown separately. The total price of all portions of the work shall equal the total price of the work covered under the mechanical division.

- .2 The successful bidder shall confer with the Consultant to determine the breakdown of work for this contract.
- .3 The breakdown shall have commissioning cost separated. A minimum of 2% of the contract value shall be assigned for commissioning.
- .4 Equipment values shall not be paid out in full until the equipment is commissioned and working as intended by the design. Ten percent of the equipment value will be held back until such time that the equipment is commissioned and all closeout documentation requested is also submitted.

1.36 METRIC CONVERSIONS

- .1 Particular care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, but not limited to, equipment, pipes, ductwork and site services in both new and existing installations.
- .2 When converting from one form of measure to the other, do not round-off numbers.

1.37 ASHRAE 90.1

- .1 All mechanical equipment must meet the minimum efficiency standards set out in ASHRAE 90.1. Submit all necessary information to substantiate conformance.

1.38 SCHEDULE

- .1 This contractor shall provide a schedule outlining all aspects of the work in sufficient detail to track the progress of the work. Include all critical dates, including delivery to and return of shop drawings to Consultant, inspection dates, dates for training and commissioning systems. Submit schedule to Consultant for review at start of project.
- .2 Contractor shall review schedule on a regular basis and at each construction meeting. The contractor shall provide additional workers as required to meet the schedule. Update schedule as required in conjunction with General Contractor and Consultant.

1.39 PIPE TROUGHS

- .1 Avoid running piping above electrical, telephone and server rooms. If unavoidable provide pipe troughs beneath piping.
- .2 Provide galvanized steel troughs below all pipes or groups of pipes passing over electrical, telephone and server rooms.
- .3 Troughs to be fabricated from 1.0mm (20 ga.) galvanized steel, formed wide enough to catch drips from piping.
- .4 Troughs to be adequately supported and sloped for positive drainage. Provide low point drain and pipe to nearest funnel floor drain, hub drain or janitor sink.

1.40 HOISTING AND RIGGING

- .1 Provide and arrange for transportation, of all equipment and materials to site, and for the rigging, hoisting, storing and setting in place of equipment.

1.41 WORKMANSHIP AND QUALIFICATIONS OF WORKERS

- .1 Perform the work in a neat and careful manner so that items are installed, and will remain, plumb, square and straight. Items not so installed will be rejected and redone at no extra cost to the Consultant.
- .2 When required either by the specifications or manufacturer's instructions, have manufacturer or his accredited agent or the supplier supervise the work.
- .3 Provide qualified tradespeople to perform all the work. Provide an onsite supervisor to supervise the work of Division 20, 22, 23. When requested of the Consultant provide documentation demonstrating experience of tradespeople and supervisor. If tradesperson or supervisor does not have adequate experience or qualifications remove from site and provide suitable replacement. Site supervisor to have minimum of 10 years of experience with demonstrated supervisory experience on similar sized projects. Provide resume of site supervisor to Consultant prior to start of project. Consultant has the right to reject or remove at any time any worker or site supervisory if in his opinion the individual does not possess the required experience or qualifications. When a personnel has been removed or rejected provide suitable replacement.

1.42 CERTIFICATES, PERMITS & FEES

- .1 The contractor shall give all necessary notices, obtain all required permits, and pay all fees, in order that the work herein specified may be carried out, and he shall furnish any certificates needed as evidence that the work installed conforms with the laws and regulations of the Municipality and Province and as approved by the local utility.

1.43 SPECIAL TOOLS

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers.

1.44 INSPECTION/ TAKEOVER PROCEDURES

- .1 Conform to General Instruction Section and Closeout Procedures specification sections.
- .2 Contractor's Inspection: The Contractor and all Subcontractors shall conduct an inspection of the Work, identify deficiencies and defects; repair as required. Notify the Consultant in writing of satisfactory completion of the contractor's Inspection and that corrections have been made. Request a Consultant's review.
- .3 Consultant's review: Consultant and the Contractor will perform an review of the Work to identify obvious defects or deficiencies. The contractor shall correct Work accordingly. If during the Consultant's review it is obvious that the work is incomplete, the Consultant will notify the

- Contractor without provision of a deficiency list and the contractor shall complete and correct deficiencies as per item 1.
- .4 Final Review: When the items noted above are complete, request a final review of the Work by the Consultant. If Work is deemed incomplete by the Consultant, complete the outstanding items and request another review.
 - .5 Declaration of Substantial Performance: When the Consultant considers that deficiencies and defects have been corrected and it appears requirements of the Contract have been substantially performed, make application for Certificate of Substantial Performance. All other requirements noted elsewhere shall be completed prior to request for Certificate of Substantial Completion.
 - .6 Do not apply for substantial performance until:
 - .1 All systems are complete and operational.
 - .2 All systems have been commissioned and successfully past testing over the entire range of their operating capacities under automatic control. (Note: seasonal or environmental conditions resulting in the delay of some testing will be accommodated by issuance of conditional certificate).
 - .3 Commissioning and testing reports have been submitted for the Consultant's review.
 - .4 Air and water balancing has been completed and reports have been submitted for the Consultant's review.
 - .5 "As-built" and/or record drawings have been prepared and submitted for the Consultant's review.
 - .6 Final Operations and Maintenance Manuals have been prepared and submitted to the Consultant.
 - .7 The Owner, operating and maintenance personnel have received training on all systems and equipment and the required certificate has been submitted to the Consultant.
 - .8 Packaged rooftop air conditioning unit certification and training session.
 - .9 Packaged rooftop VAV unit certification and training session.
 - .10 Controls verification and training session.
 - .11 Boiler certification and training session.

1.45 SCHEDULE, ACCESS, PROTECTION AND CLEAN-UP

- .1 The construction schedule places restrictions on the duration of construction within areas and the duration of shut-down of equipment. Refer to the General Requirements and General contractor for all requirements.
- .2 Access to the site is limited to location and time of day. Access to areas of the building is limited to location and time of day. Refer to the General Requirements for all requirements.
- .3 Refer to the security and protection requirements in the General Requirements, conform to all requirements. In particular no open flames shall be used without prior written approval of the Consultant. There shall be no smoking, and the site shall be kept clean at all times.
- .4 Contractor shall complete all work required in the various spaces during the time scheduled for that phase. Where work or connections are to be made into systems located in a prior phase, the contractor shall complete the work or connections outside of normal hours of operations. Contractor shall complete all work required to systems. Contractor shall place systems back into operation prior to start of normal hours of operation. Include in tender for all overtime costs.

1.46 CUTTING AND PATCHING

- .1 The cost of cutting, patching and finishing is not included in this divisions contract.
- .2 This division shall advise the trade responsible for cutting, in advance of the time required, of the location and extent of cutting required, and any other pertinent information.
- .3 This division shall advise the trade responsible for patching and finishing of any pertinent information such as, clearance requirements.
- .4 Refer also to item 27 - Coordination, and 12 - Sleeves, for other coordination requirements.
- .5 In case of costs arising to correct work, due to failure to provide coordination information on time, incorrect sizes or locations or other incorrect pertinent information, shall not be extra to Project.

1.47 GUARANTEE

- .1 This contractor shall guarantee all material and workmanship used in the work to be in strict accordance with the specifications, of best quality and type obtainable to give first-class construction and proper and efficient operation, and free from any defects. Any such defects which may appear in any of the work within one year after written acceptance of this work shall be repaired and replaced by this contractor without additional expense to the Owner. Where such defects occur, this contractor shall be held responsible for all costs incurred in making the defective work good.
- .2 This shall not obsolete any longer warranties on specific items of equipment.
- .3 All injuries to adjacent work particularly plaster, wood finishes or other materials, or damage to other equipment, caused by such defects of this contractor's work or by subsequent replacement and repairs, shall be made good at the expense of this contractor. All repair work shall be done by trades responsible for the original work.

1.48 SPARE PARTS

- .1 Furnish spare parts as specified in relevant sections.

1.49 PROTECTION OF EQUIPMENT

- .1 Temporarily protect all equipment and systems throughout construction from damage as required. Remove measures of protection at end of job.
- .2 Temporarily enclose boilers in plywood box designed and constructed to protect boiler jacketing from damage due to work above. Remove enclosures at end of job.
- .3 Any damaged equipment shall be replaced by contractor at no cost to Owner.
- .4 Do not use equipment or systems as support platforms for work above, provide necessary work platforms as required.

1.50 EXISTING SYSTEMS

- .1 Connections into existing systems to be made at time acceptable to Owner. Request written approval of time when connections can be made. Assume connections are to be completed outside of normal work hours and include for any overtime and premium charges.
- .2 Be responsible for damage to existing plant by this work.
- .3 Where connections are made to existing services, existing insulation shall be made good under this division.

1.51 INTERRUPTION OF SERVICES

- .1 Any interruption of mechanical services to any part of the building shall be scheduled with the Owner and General Contractor. Make all necessary arrangements with those concerned. Assume interruptions are to occur outside of normal work hours and include for any overtime required. Ensure that the interruption is held to a minimum (maximum 4 hours).
- .2 All such overtime work shall be carried out without additional cost to the Project.

1.52 DEMOLITION

- .1 Division 20 contractor shall remove existing systems and equipment indicated on drawings. In order to determine the extent of the demolition of the existing system, the contractor, before tendering, shall examine the site and determine the extent of existing systems to be removed. The contractor shall be responsible for obtaining an understanding of the extent of the existing systems. No additional cost to the Project will be entertained due to failure of the contractor from reviewing on site the extent of the existing systems to be removed.
- .2 The demolition drawings showing existing mechanical systems may not represent "as-built" conditions and it shall be the responsibility of the contractor to verify on site the extent of the existing systems. Contractor shall visit site and confirm extent of existing equipment and system before submitting tender price to determine extent of systems to be demolished. No extras will be allowed for failure of the contractor in completing a thorough review of the site prior to submitting tender price.
- .3 Provide temporary equipment and systems as indicated on the drawings and remove upon completion.
- .4 For exact details and total extent each service must be carefully checked on site. Before removing any service, follow the service through to its source to ensure other areas of the building are not adversely affected by the removal of this service. Open shafts, walls and ceilings as required to examine the service.
- .5 If there are no isolating valves readily available to isolate sections of pipe that requires removal, add valves as required. Coordinate with the facilities manager to shut-down systems. Install caps on all services. Add caps to all valves at the termination point of existing services.

- .6 Where valves are removed, remove valve tags, revise existing charts and hand tags over to facility manager.
- .7 Where services are to be removed as part of the demolition, obtain written consent from the owner before starting any work or removing any services.
- .8 Unless noted otherwise, removed equipment shall become the property of the contractor and disposed of offsite at an approved location.

1.53 ABANDONED SERVICES

- .1 Within the work areas of the existing building unknown abandoned services may be encountered. Obtain clarification from the Owner regarding these services and remove any sections of services from the work areas as directed.

1.54 HALOCARBONS

- .1 Comply with Federal Halocarbon Regulations 2003 under the Canadian Environmental Protection Act 1999, EPAM and Correctional Service Canada ISD 318-4 Environmental Management of Halocarbons and associated decommissioning and commissioning forms

PART 2 PRODUCTS

2.1 NOT USED

- .1 Not used.

PART 3 EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings/product data sheets to regulatory authority for review and approval prior to submitting to Consultant. Conform to following requirements:
 - .1 submit shop drawings/product data sheets for all products specified in this Section except pipe and fittings;
 - .2 submit complete CAD layout drawings indicating source of water supply with test flow and pressure, "head-end" equipment piping schematic, pipe routing and sizing, and zones, all signed and sealed by a qualified professional mechanical engineer registered in jurisdiction of the work as specified below;
 - .3 submit copies of all calculations, including hydraulic calculations, stamped and signed by same engineer who signs layout drawings, and a listing of all design data used in preparing the calculations, system layout and sizing, including occupancy-hazard design requirements;
 - .4 in addition to submitting shop drawings to regulatory authority as specified above, shop drawings must be approved by Owner's insurer prior to being submitted to Consultant for review
- .2 Submit a complete sprinkler system test certificate as specified in Part 3 of this Section.
- .3 Sprinklers are to be identified on drawings and product submittals, and be specifically identified by manufacturer's listed model or series designation. Trade names and other abbreviated listings are unacceptable.

1.2 QUALITY ASSURANCE

- .1 Fire protection sprinkler system work is to be in accordance with following Codes and Standards:
 - .1 NFPA 13, Standard for the Installation of Sprinkler Systems;
 - .2 CSA B137.2, Polyvinylchloride (PVC) Injection-Moulded Gasketed Fittings for Pressure Applications;
 - .3 CSA B137.3, Rigid Polyvinylchloride (PVC) Pipe for Pressure Applications;
 - .4 ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless;
 - .5 ASTM A135, Standard Specification for Electric-Resistance-Welded Steel Pipe;
 - .6 ASTM A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service;
 - .7 ASTM A536, Standard Specification for Ductile Castings;
 - .8 ASTM A795, Standard Specification for Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use;
 - .9 ANSI/ASME B16.4, Grey Iron Threaded Fittings (Classes 125 and 250);
 - .10 CAN/CSA B64.10, Backflow Preventers and Vacuum Breakers.
- .2 Fire protection sprinkler work is to be performed by a sprinkler company who is a member in good standing of the Canadian Automatic Sprinkler Association. Site personnel are to be licensed in

- jurisdiction of the work and under the continuous supervision of a foreman who is an experienced fire protection system installer and a journeyman pipe fitter licensed in jurisdiction of the work.
- .3 Check and verify dimensions and conditions at site and ensure work can be performed as indicated. Coordinate work with trades at site and accept responsibility for and cost of making adjustments to piping and/or spacing to avoid interference with other building components.
 - .4 Verify working condition of existing sprinkler system equipment which has direct interface with project work and is to remain. Replace with new equipment where necessary.
 - .5 System components must be ULC listed and labelled.
 - .6 Grooved couplings, and fittings, valves and specialties are to be products of a single manufacturer. Grooving tools are to be of same manufacturer as grooved components.
 - .7 Castings used for coupling housings, fittings, valve bodies, etc., are to be date stamped for quality assurance and traceability.

1.3 DESIGN REQUIREMENTS

- .1 Fire protection sprinkler work is to be designed in accordance with NFPA 13 and Provincial Standards, and, where required, local building and fire department requirements and standards of Owner's Insurer. If water supply flow and pressure test data is not available, conduct Municipal main water flow and pressure tests at nearest fire hydrant to obtain criteria to be used in system design. Include hydrant location and flow and pressure test data with system design calculations.
- .2 Include for a qualified mechanical professional engineer registered and licensed in the jurisdiction of the work to design the fire protection standpipe work. Refer to Section entitled Mechanical Work General Instructions for requirements regarding Contractor retained engineers.
- .3 Sprinkler /System Occupancy – Hazard Design requirements: In accordance with NFPA 13 occupancy-hazard density requirements, unless otherwise specified.

Part 2 PRODUCTS

2.1 PIPE, FITTINGS AND JOINTS

- .1 Pipe, fittings and joints are to be as follows, with exceptions as specified in Part 3 of this Section:
 - .1 PVC
 - .1 Class 200, DR14, rigid, hub and spigot pattern PVC pipe and CSA certified fittings to CAN/CSA B137.2 and B137.3 and complete with gasketed joints.
 - .2 Schedule 40 Steel – Grooved Coupling Joints
 - .1 Schedule 40 mild black carbon steel, ASTM A53, Grade B, complete with grooved ends and mechanical fittings and couplings equal to Victaulic "FireLock" fittings and Victaulic Style 009N, 107H, and 107N QuickVic and 005 rigid coupling joints. Strap type outlet fittings such as Victaulic "Snap-Let" are not acceptable.
 - .3 Schedule 40 Steel – Screwed and Welded Joints
 - .1 Schedule 40 mild black carbon steel, ASTM A53, Grade B. Screwed piping complete with Class 125 cast iron screwed fittings to ANSI/ASME B16.4. Welded piping complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, long sweep pattern wherever possible.

- .4 Schedule 10 Steel – Grooved Coupling Joints
 - .1 Schedule 10 mild black carbon steel, ASTM A53, Grade B, complete with grooved ends and fittings and couplings equal to Victaulic "FireLock" fittings and Victaulic Style 009N, 107H, and 107N QuickVic and 005 rigid coupling joints.
- .5 Schedule 10 Steel – Screwed Joints
 - .1 Schedule 10 mild black carbon steel, ASTM A53, Grade B, complete with mill or site threaded ends, Class 125 cast iron screwed fittings to ANSI/ASME B16.4, and screwed joints.
- .6 "Lightwall" Steel – Grooved Coupling Joints
 - .1 Commercial quality. "Lightwall" rolled mild carbon steel pipe to ASTM A135, Grade A, complete with a galvanized exterior, grooved ends, and fittings and couplings equal to Victaulic "Fire Lock" grooved fittings and Victaulic Style 009N QuickVic or 005 rigid coupling joints.
- .7 "Lightwall" Steel – Screwed Joints
 - .1 Commercial quality, "Lightwall" rolled mild carbon steel pipe to ASTM A135, Grade A, ULC listed, mill or site threaded, complete with galvanized exterior, Class 125 cast iron screwed fittings to ANSI/ASME B16.4, and screwed joints.
- .8 CPVC Pipe
 - .1 Equal to IPEX BlazeMaster solvent weld, orange, SDR 13.5 pipe and Schedule 80 fittings, ULC listed for use in wet pipe automatic sprinkler systems, with a flame spread rating less than 25 and a smoke developed rating less than 50 when tested in accordance with CAN/ULC S102.2, and in accordance with NFPA 13 requirements.
- .9 Standard Mechanical Couplings: Equal to Victaulic
 - .1 Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets are to be pressure-responsive synthetic rubber, grade to suit intended service, conforming to ASTM D-2000. Mechanical coupling bolts are to be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A-449 and ASTM A-183. Couplings are to comply with ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
- .2 Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads are to be used to provide system rigidity and support and hanging in accordance NFPA-13. Couplings are to be fully installed at visual pad-to-pad offset contact. Couplings that require exact gapping of bolt pads at specific torque ratings are not permitted.
- .3 Flexible Type: Use in locations where vibration attenuation and stress relief are required; Victaulic Style 177 (Quick-Vic™) flexible coupling.

2.2 SHUT-OFF VALVES

- .1 Minimum 2070 kPa (300 psi) rated full port brass or bronze body screwed ball valves and lug body or grooved end type butterfly valves.
 - .1 Butterfly valves are to include a pressure responsive seat, and stem is to be offset from disc centerline to provide complete 360° circumferential seating.
 - .2 Standard of Acceptance: Victaulic Style 705.

- .3 Supervised closed applications standard of acceptance Victaulic Series 707C supervised closed butterfly valve.
- .2 OS&Y Gate Valves: 1725 kPa (250 psi), grooved ends with ductile iron body, yoke, and handwheel conforming to ASTM A-536, EPDM coated ASTM A-126-B cast iron disc, ASTM B16 brass rising stem, flanged and epoxy coated ductile iron bonnet, EPDM O-ring stem seals and body gasket. Equal to Victaulic Series 771H (Grooved ends) and Series 771F (Grooved x Flanged).

2.3 CHECK VALVES

- .1 Minimum 1725 kPa (250 psi) resilient seat check valves, suitable for vertical or horizontal installations. Standard of Acceptance: Victaulic Series 717.
- .2 Check valves associated with Fire Department connections and fire pump test connection are to be tapped for site installation of a 20 mm ($\frac{3}{4}$ ") diameter ball drip.

2.4 EXCESS PRESSURE PUMP

- .1 Close coupled, 1750 RPM, all bronze gear pump sized to maintain sufficient pressure in fire protection main to prevent alarm check valve(s) from initiating flow alarms during fluctuations in pressure of Municipal water supply. Pump is to be complete with:
 - .1 stainless steel shaft with maintenance free seal;
 - .2 lifetime lubricated carbon bearings;
 - .3 TEFC motor conforming to requirements specified in Section entitled Basic Mechanical Materials and Methods, and secured to a mounting base;
 - .4 accessory package consisting of flexible suction and discharge connection hoses, a Monel inlet strainer, relief valve factory set at 862 kPa (120 psi), and a steel mounting plate designed to mount pump to alarm check valve flange;
 - .5 power and control panel.
- .2 Factory pre-wired power and control panel, CSA certified, designed to automatically start and stop pump in response to water pressure variations in the main and consisting of a surface wall mounting NEMA 2 enamelled steel panel with hinged front door equipped with Corbin catch, and following:
 - .1 door interlock fused disconnect with HRC fuses;
 - .2 protected type pump starter;
 - .3 door mounted H-O-A rotary selector switch;
 - .4 fused control transformer;
 - .5 115 volt adjustable pressure switch to suit the application;
 - .6 set of NO/NC dry contacts for connection of lack of power availability alarm;
 - .7 door mounted "POWER ON" LED.

2.5 DRY PIPE VALVE

- .1 Equal to a Victaulic Series 768-NXT:
 - .1 Series 746-LPA accelerator quick opening device;
 - .2 Series 757 regulated air maintenance trim assembly;
 - .3 required air pressure: 90 kPa (13 psig);
 - .4 externally resettable valve;

- .2 Valve to be complete with internal components that are replaceable without removing valve from installed position.
- .3 Systems requiring a quick opening device are to use a regulated, tank mounted air supply.

2.6 SPRINKLER HEADS

- .1 Sprinkler heads, unless otherwise specified, are to be as scheduled in Part 3 of this Section.
- .2 Sprinkler body is to be die-cast, with a hex-shaped wrench boss integrally cast into sprinkler body to reduce risk of damage during installation. Wrenches are to be provided by sprinkler manufacturer that directly engages wrench boss.
- .3 For locations where corrosive resistant coatings are required, body is to be coated with ULC listed and FM approved anti-corrosion VC-250 coating (silver colouring).
- .4 Recessed sprinkler heads in finished areas are to be chrome plated unless otherwise specified. Concealed sprinkler head ceiling plates are to match ceiling colour.
- .5 Where exposed pendent heads occurs in areas with suspended ceilings, they are to be complete with chrome plated escutcheon plates. Similarly, sidewall heads with concealed piping are to be complete with chrome plated escutcheon plates.
- .6 Sprinkler heads which are exposed in areas where they may be subject to damage are to be complete with wire guards, chrome plated where in finished areas.
- .7 Escutcheons and guards are to be listed, supplied, and approved for use with sprinkler by sprinkler manufacturer.
- .8 Sprinkler heads located in areas or over equipment where high ambient temperature is present are to be, unless otherwise specified, 74°C (165°F) heads. All other heads, unless otherwise specified or required, are to be 57°C (135°F) rated.
- .9 Acceptable manufacturers are:
 - .1 Victaulic Co.;
 - .2 Tyco Fire Suppression & Building Products;
 - .3 The Viking Corporation;
 - .4 The Reliable Automatic Sprinkler Co.

Part 3 EXECUTION

3.1 MONITORING OF SYSTEMS

- .1 Daily monitor and supervise existing sprinkler system serving renovated areas to ensure that each respective system is left in proper operating condition at end of each working day. Include for but not be limited to performing following:
 - .1 Under presence of Owner's representative, check each morning and evening (start and end of work) of each day, sprinkler system to ensure that it is in proper working condition;
 - .2 If portions of sprinkler system is not in proper working order, provide temporary provisions subject to approval of local fire authority or local governing authority, to ensure that proper sprinkler coverage is provided and/or provide supervisory personnel to monitor areas where sprinkler system is not operational;

- .3 Document and sign off with Owner's representative signing off also, each respective daily check condition;
- .4 Ensure that work to sprinkler system does not affect portion of system serving areas outside of renovation areas.

3.2 DEMOLITION

- .1 Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.3 PIPING INSTALLATION REQUIREMENTS

- .1 Provide required sprinkler system piping.
- .2 Perform piping work in accordance with requirements of NFPA 13, governing regulations, and "Reviewed" shop drawings.
- .3 Piping, unless otherwise specified, is as follows:
 - .1 for underground piping inside or outside building – Class 200, DR14 rigid PVC, braced and secured at bends and tees with concrete blocks in accordance with Municipal standards and details;
 - .2 for piping inside building and above ground except as noted below – Schedule 40 grooved end black steel with Victaulic or equal fittings and coupling joints, or, for piping to and including 50 mm (2") diameter, screwed fittings and joints, or, for piping 65 mm (2-½") diameter and larger, welding fittings and welded joints;
 - .3 for wet system piping inside building and above ground – at your option, CPVC sprinkler pipe and fittings;
 - .4 for piping downstream of "head end" alarm valve(s) and equipment – Schedule 10 or "Lightwall" black steel pipe with Victaulic or equal fittings and coupling joints or screwed fittings and joints;
 - .5 for branch piping to heads in MRI suites – copper pipe, fittings, and sprinkler head adapters with stainless steel hangers and support hardware.
- .4 Exceptions to piping requirements specified above are as follows:
 - .1 dry pipe zone steel piping, fittings, unions, couplings and flanges are to be galvanized;
 - .2 wet zone steel piping, fittings, unions, couplings and flanges for sprinkler work exposed to weather either inside or outside building (including parking garages), are to be galvanized;
 - .3 PVC piping is not to be used above grade;
 - .4 ferrous pipe hangers, supports, and similar hardware used for galvanized steel piping are to be electro-galvanized.
- .5 Pipe sizes, pipe routing, sprinkler head quantities and locations, and layout of work shown on drawings are to assist during tendering period. Ensure adequate head coverage, head quantities and pipe sizing as specified in Part 1 of this Section. Do not reduce size of sprinkler main or re-route main unless reviewed with and approved by Consultant.
- .6 Install grooved joints in accordance with manufacturer's latest installation instructions. Grooved ends are to be clean and free from indentations, projections and roll marks. Gaskets are to be moulded and produced by coupling manufacturer, and verified as suitable for intended service. Have factory-trained representative from mechanical joint manufacturer provide on-site training in proper use of grooving tools and installation of grooved piping products. Have factory-trained

representative periodically review product installation and ensure best practices are being followed. Remove and replace any improperly installed products.

- .7 Clean pipe, fittings, couplings, flanges and similar components after erection is complete. Wire brush clean any ferrous pipe, fitting, coupling, flange, hanger, support and similar component which exhibit rust and carefully coat with suitably coloured primer.
- .8 Provide non-freeze, glycol-water solution filled sprinkler piping. Install piping complete with a CSA certified reduced pressure backflow preventer, valves and glycol solution fill facilities in accordance with requirements of Chapter 3 of NFPA 13. Fill piping with a solution of 50% Union Carbide Canada Ltd. "UCAR THERMO-FLUID 17" or Dow Chemical Co. "Dowtherm SR1" propylene glycol with corrosion inhibitors, and 50% clean water. Prior to filling piping, check the specific gravity of the solution using a hydrometer with proper scale. Specific gravity is to be approximately 1.069 at 15.6°C.
- .9 When sprinkler work is complete, test system components and overall system(s) and submit completed test certificate and other documentation in accordance with Chapter 8 of NFPA 13.

3.4 INSTALLATION OF SHUT-OFF VALVES AND CHECK VALVES

- .1 Provide shut-off valves and check valves in piping where shown and wherever else required.
- .2 Locate valves for easy operation and maintenance.
- .3 Confirm exact locations prior to roughing-in.

3.5 INSTALLATION OF DRY PIPE VALVES

- .1 Provide dry pipe valves for zones.
- .2 Connect compressed air piping to each valve, as well as all compressed air piping trim.
- .3 When installation is complete, check and test valve operation and adjust as required.
- .4 Provide drum drips in dry type fire protection sprinkler zone piping where shown or required. Wherever possible locate drum drips in heated areas. Where drum drips are located in unheated areas ensure trades performing thermal insulation work and electric heating cable pipe tracing work are aware of the number of drum drips required, and the size and location. Identify each drum drip. Locate drum drips in heated areas wherever possible.

3.7 INSTALLATION OF SPRINKLER HEADS

- .1 Provide required sprinkler heads in accordance with following schedule:

APPLICATION	SPRINKLER HEAD TYPE
Rooms/areas with a suspended ceiling	Victaulic V38/V39 or Tyco Series RFII "Royal Flush II" concealed pendent Victaulic V27 or Tyco Series TY-FRB recessed pendent Victaulic V27 or Tyco Series TY-FRB pendent with escutcheon plates
Rooms/areas without a suspended ceiling	Victaulic V27 or Tyco Series TY-FRB pendent

- .2 Sprinkler head manufacturers indicated on schedule are for type indication purposes. Acceptable manufacturers are listed in Part 2 of this Section.
- .3 Coordinate sprinkler head locations with all drawings, including architectural reflected ceiling plan drawings, and, where applicable, electrical drawings. Coordinate sprinkler head locations in areas with suspended ceilings with the location of lighting, grilles, diffusers, and similar items recessed in or surface mounted on the ceiling as per the reflected ceiling plans. In areas with lay-in tile, centre the sprinkler head both ways in the lay-in tile wherever possible. Confirm locations prior to roughing-in.
- .4 Maintain maximum headroom in areas with no ceilings.
- .5 Provide guards for heads where they are subject to damage.
- .6 Provide high temperature heads in equipment rooms and similar areas over heat producing or generating equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings/product data sheets for all products specified in this Section except pipe and fittings.
- .2 Submit a copy of plumbing inspection certificate prior to application for Substantial Performance of the Work.

Part 2 PRODUCTS

2.1 PIPE, FITTINGS AND JOINTS

- .1 PVC - DWV
 - .1 Equal to Ipex System XFR 15-50 rigid PVC drain, waste and vent pipe and fittings to CAN/CSA B181.2, complete with a flame spread rating less than 25 and a smoke developed rating less than 50 when tested to CAN/ULC S102.2, solvent weld joints, and, for fire barrier penetration, approved firestop conforming to CAN/ULC S115.
- .2 Copper - Solder Joint
 - .1 Type DWV hard temper to ASTM B306, with forged copper solder type drainage fittings and 50% lead - 50% tin solder joints.
- .3 Galvanized Steel - Victaulic Coupling Joint
 - .1 Schedule 40 mild steel, galvanized, ASTM A53, factory or site rolled grooved, complete with Victaulic galvanized ductile iron grooved end fittings and, unless otherwise specified, Victaulic Style 77 hot dip galvanized mechanical joint couplings with Grade M gaskets.

2.2 SHUT-OFF AND CHECK VALVES

- .1 Shut-off Valves
 - .1 Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass body, blowout-proof stem, chrome plated solid brass ball, solder or screwed ends as required, and removable lever handle.
 - .2 Acceptable products are:
 - .1 Toyo Valve Co. Fig. 5049A or Fig. 5044A;
 - .2 Milwaukee Valve Co. #BA-155 or #BA -125;
 - .3 Kitz Corporation Code 58 or Code 59;
 - .4 Victaulic Co. of Canada Ltd. Series 722;
 - .5 Apollo Valves # 77-100 or # 77-200;
 - .6 Watts Industries (Canada) Inc. #FBVS-3C.
- .2 Check Valves

- .1 Class 125, bronze, 1725 kPa (250 psi) WOG rated vertical lift check valve with solder or screwed ends as required, and, for horizontal piping, Class 125, bronze 1380 kPa (200 psi) WOG rated swing check valves with solder or screwed ends.
- .2 Acceptable products are:
 - .1 Toyo Valve Co. Fig. 231 or Fig. 236 or Fig. 237;
 - .2 Milwaukee Valve Co. #1510 or #510;
 - .3 Kitz Corporation Code 36 or Code 22 or Code 23.

2.3 FLOOR CLEANOUT TERMINATIONS

- .1 Factory finished cast iron terminations, each adjustable and complete with a cast iron body with neoprene sleeve, solid, gasketed, polished nickel-bronze scoriated top access cover to suit floor finish, a seal plug, and captive, vandal-proof, stainless steel securing hardware.
- .2 Acceptable products are:
 - .1 Watts Industries (Canada) Ltd. # CO-200-R-1;
 - .2 Jay R. Smith #4020-F-C Series;
 - .3 Zurn # ZN-1602-SP Series;
 - .4 Mifab # C1100-XR-1 or #C1000-R-3.
- .3 Cleanout terminations in areas with a tile or sheet vinyl floor finish are to be as above but with a square top in lieu of a round top.

2.4 FLOOR DRAINS, FUNNEL FLOOR DRAINS AND HUB DRAINS

- .1 Unless otherwise specified or indicated, floor drains are to be vandal-proof drains in accordance with drawing symbol list, each complete with a cast iron body and a trap seal primer connection. Cast iron components are to be factory finished with latex based paint coating.
- .2 Floor drains in areas with a tile or sheet vinyl floor finish are to be as above but with a square grate in lieu of a round grate.
- .3 Acceptable manufacturers are:
 - .1 Watts Industries (Canada) Ltd.;
 - .2 Jay R. Smith Manufacturing Co.;
 - .3 Zurn Industries Ltd.;
 - .4 Mifab Inc.

2.5 BACKWATER VALVES

- .1 Heat bonded powder epoxy coated cast iron in-line type, each complete with a bolted and gasketed cover, bronze flapper, stainless steel extension, and stainless-steel hardware.
- .2 Acceptable products are:
 - .1 Watts Industries (Canada) Inc. BV-230-R Series;
 - .2 Jay R. Smith #7022-CAN;
 - .3 Zurn #Z-1095-15-MJ.

Part 3 EXECUTION

3.1 DEMOLITION

- .1 Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.2 DRAIN AND VENT PIPING INSTALLATION REQUIREMENTS

- .1 Provide required drainage and vent piping. Pipe, unless otherwise specified, as follows:
 - .1 for underground pipe inside building and to points 1.5 m (5') outside building lines – rigid PVC sewer pipe, minimum 75 mm (3") dia.;
 - .2 for pipe inside building and aboveground in sizes less than or equal to 65 mm (2-½") dia. – type DWV copper;
 - .3 for pipe inside building and aboveground in sizes greater than or equal to 75 mm (3") dia. – Class 4000 cast iron;
 - .4 for pipe inside building and aboveground in lieu of type DWV copper and cast iron, at your option and where permitted by governing Codes and Regulations – rigid PVC DWV;
 - .5 for drainage pump discharge pipe connections from pump to and including shut-off and check valve connections – Type "DWV" copper with Victaulic "Copper Connection" fittings and couplings, or Schedule 40 galvanized steel with Victaulic fittings and couplings.
- .2 Unless otherwise specified, slope horizontal drainage piping aboveground in sizes to and including 75 mm (3") dia. 25 mm (1") in 1.2 m (4'), and pipe 100 mm (4") dia. and larger 25 mm (1") in 2.4 m (8').
- .3 Install and slope underground drainage piping to inverts or slopes indicated on drawings to facilitate straight and true gradients between points shown. Verify available slopes before installing pipes.
- .4 Unless otherwise specified, slope horizontal branches of vent piping down to fixture or pipe to which they connect with a minimum pitch of 25 mm (1") in 1.2 m (4').
- .5 Extend vent stacks up through roof generally where shown but with exact locations to suit site conditions and in any case a minimum of 3 m (10') from fresh air intakes. Terminate vent stacks a minimum of 330 mm (13") above roof (including roof parapets) in vent stack covers. Where not shown on drawings, route vent piping from source to building exterior as required in order to satisfy local governing codes and authority. Coordinate vent routing with other building services and ensure there is no architectural impact.
- .6 Provide cast brass dielectric unions at connections between copper pipe and ferrous pipe or equipment.

3.3 INSTALLATION OF SHUT-OFF AND CHECK VALVES

- .1 Provide a shut-off valve and a check valve in discharge piping of each drainage pump.
- .2 Locate valves so they are easily accessible without the use of ladders or other such devices.

3.4 INSTALLATION OF CLEANOUTS

- .1 Provide cleanouts in drainage piping in locations as follows:

- .1 in building drain or drains as close as possible to inner face of outside wall, and, if a building trap is installed, locate cleanout on downstream side of building trap;
 - .2 at or as close as practicable to the foot of each drainage stack;
 - .3 at maximum 15 m (50') intervals in horizontal pipe 100 mm (4") dia. and smaller;
 - .4 at maximum 30 m (100') intervals in horizontal pipe larger than 100 mm (4") dia.;
 - .5 wherever else shown on drawings.
- .2 Cleanouts are to be same diameter as pipe in piping to 100 mm (4") dia., and not less than 100 mm (4") dia. in piping larger than 100 mm (4") dia.
 - .3 Where cleanouts in vertical piping are concealed behind walls or partitions, install cleanouts near floor and so cover is within 25 mm (1") of the finished face of the wall or partition.

3.5

INSTALLATION OF FLOOR DRAINS, FUNNEL FLOOR DRAINS AND HUB DRAINS

- .1 Provide floor drains, funnel floor drains and hub drains.
- .2 Coordinate location of floor drains, funnel floor drains and hub drains with equipment provided by Mechanical Division and Owner's supplied equipment. Install in accordance with manufacturer's instructions.
- .3 Equip each drain with a trap.
- .4 In equipment rooms and similar areas, exactly locate floor drains to suit location of mechanical equipment and equipment indirect drainage piping. In washrooms, exactly locate floor drains to avoid interference with toilet partitions.
- .5 Confirm exact location of drains prior to roughing in. Where floor drains occur in washrooms coordinate locations with toilet partition installations.
- .6 Temporarily plug and cover floor drains during construction procedures. Remove plugs and covers during final clean-up work and when requested, demonstrate free and clear operation of each drain. Replace any damaged grates, and refinish any areas of the drain where cast iron finish has been damaged or removed, including rusted areas.
- .7

END OF SECTION

Part 1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings/product data sheets for all equipment and associated hardware specified in this Section.
- .2 Include pump motor product data sheets and pump performance curves with shop drawing/product data sheet submission.
- .3 Submit manufacturer/supplier installation certification letters as specified in Part 3 of this Section.
- .4 Submit, prior to Substantial Performance of the Work, start-up or test data specified in Part 3 of this Section.

Part 2 PRODUCTS

2.1 CONDENSATE DRAINAGE PUMP SET

- .1 Equal to Aspen Pumps type Mini-White Univolt kit, condensate drainage pump set in accordance with drawing schedule.

Part 3 EXECUTION

3.1 DRAINAGE COORDINATION

- .1 Coordinate drain requirements of plumbing equipment provided by Mechanical Division and/or Owner with location of drains.

3.2 INSTALLATION OF CONDENSATE DRAINAGE PUMP SET

- .1 Provide a mini condensate drainage pump kit to pump equipment condensate drainage into a gravity discharge main. Install in accordance with manufacturer's instructions and drawing installation requirements.
- .2 Power and control by mechanical. Confirm exact location prior to installation.
- .3 When installation is complete, arrange for pump set supplier to visit site to examine installation and certify it correct in writing. Submit a copy of the certification letter.

END OF SECTION

PART 1 GENERAL

1.1 USE OF SYSTEMS

- .1 Use of new and/or existing permanent heating and ventilating systems for supplying temporary heat is permitted only under the following conditions:
 - .1 Entire system is complete, pressure tested, cleaned, flushed out.
 - .2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.
 - .3 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
 - .4 There is no possibility of damage from any cause.
 - .5 Supply ventilation systems are protected by 60% filters (unless otherwise specified), which shall be inspected daily, changed every 2 weeks or more frequently as required.
 - .6 Return systems have approved filters over all openings, inlets, outlets.
 - .7 All systems will be:
 - .1 Operated as per manufacturer's recommendations or instructions.
 - .2 Operated by Contractor.
 - .3 Monitored continuously by Contractor.
 - .8 Warranties and guarantees are not thereby relaxed.
 - .9 Regular preventive and all other manufacturers recommended maintenance routines are performed by Contractor at his own expense and under supervision of Consultant.
 - .10 Before static completion, entire system to be refurbished, cleaned internally and externally, restored to "as- new" condition, filters in air systems replaced.
- .2 Filters referred to herein are over and above those specified elsewhere in this specification.
- .3 Exhaust systems are not included in any approvals for temporary heating ventilation.

PART 2 PRODUCTS

2.1 NOT USED

- .1 Not Used

PART 3 EXECUTION

3.1 NOT USED

- .1 Not Used

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Common Work Results for Mechanical, all mechanical sections, and all other disciplines related to the project.
- .2 Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

PART 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 EXECUTION

3.1 CONNECTIONS TO EQUIPMENT

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

3.3 DRAINS

- .1 Install piping with grade in direction of flow except as indicated or specified otherwise.
- .2 Install drain valve at low points in piping systems, at heating and cooling coils, at major equipment, at section isolating valves, and at base of all risers.
- .3 Drain valves: NPS 3/4 full port ball valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 AUTOMATIC AIR VENTS

- .1 Install automatic air vents at high points of piping systems.
- .2 Install full port ball at each automatic air vent.
- .3 Air vents must have minimum connection of 13 mm (1/2").

3.5 DIELECTRIC COUPLINGS

- .1 General: Compatible with system, to suit pressure rating of system.

- .2 Locations: Where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.
- .4 Over NPS 2: Isolating flanges.

3.6 PIPEWORK INSTALLATION

- .1 Screwed fittings shall be jointed with Teflon tape
- .2 Protect openings against entry of foreign material.
- .3 Install so that equipment can be isolated and removed without interruption to operation of any 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 the main. Hole saw (or drill) and ream main so as to maintain full inside diameter of branch line prior to welding saddle. Provide isolation valves at each branch connection.
- .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .7 Install concealed pipework so as to minimize furring space, maximize headroom, conserve space.
- .8 Except where indicated otherwise, slope piping in direction of flow for positive drainage and venting.
- .9 Except where indicated, install so as to permit separate thermal insulation of each pipe.
- .10 Group piping wherever possible and as indicated.
- .11 Ream pipes, remove scale and other foreign material before assembly.
- .12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .13 Provide for thermal expansion as indicated and specified.

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 all around between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
 - .1 Concrete, masonry walls, and 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.
- .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 FLUSHING OUT OF PIPING SYSTEMS

- .1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.
- .3 Provide test results upon completion and retain written report on status after complete.

3.10 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Consultant 48 hour's minimum prior to performance of pressure tests.
- .2 Piping: Test to 1½ time's normal operating pressure to a maximum of the piping systems working pressure including devices (i.e. valves, fittings, accessories). Minimum test pressure to be 862 kPa (125 psi).
- .3 Maintain specified test pressure without loss for four 4 hours minimum. Temperature of system to remain constant during duration of test.
- .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 Consultant.
- .6 Bear costs for repairs or replacement, retesting, and making good. Consultant to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Consultant.

3.11 EXISTING SYSTEMS

- .1 Be responsible for damage to existing plant by this work.
- .2 Ensure daily clean-up of existing areas.
- .3 Cleaning and flushing of new piping to be done prior to making final connection to existing system. Refer to Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.3-2010, Process Piping.
 - .2 ANSI/ASME Boiler and Pressure Vessel Code-2010:
 - .1 BPVC 2010 Section I: Power Boilers.
 - .2 BPVC 2010 Section V: Non-destructive Examination.
 - .3 BPVC 2010 Section IX: Welding and Brazing Qualifications.
- .2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C206-11, Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS)
 - .1 AWS B3.0-1941, welding procedure and performance qualification.
 - .2 AWS C1.1M/C1.1-2000(R2012), Recommended Practices for Resistance Welding.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA W47.2-11, Certification of Companies for Fusion Welding of Aluminum.
 - .2 CSA W48-06 (R2011), Filler Metals and Allied Materials for Metal Arc Welding.
 - .3 CSA B51-09, Boiler, Pressure Vessel and Pressure Piping Code.
 - .4 CSA W117.2-06 (R2011), Safety in Welding, Cutting and Allied Processes.
 - .5 CSA W178.1-08, Certification of Welding Inspection Organizations.
 - .6 CSA W178.2-08, Certification of Welding Inspectors.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Welders:
 - .1 Welding qualifications in accordance with CSA B51, T.S.S.A and CRN registration.
 - .2 Use qualified and licensed welders possessing certificate for each procedure performed.
 - .3 Submit welder's qualifications to Departmental Representative.
 - .4 Each welder to possess identification symbol issued by authority having jurisdiction.
 - .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.
 - .2 Inspectors:

- .1 Inspectors qualified to CSA W178.2.
- .3 Certifications:
 - .1 Registration of welding procedures in accordance with CRN, ASME B31.1, CSA B51 and T.S.S.A. Information shall be provided to the 3rd party reviewer for review and approvals.
 - .2 Copy of welding procedures available for inspection.
 - .3 Safety in welding, cutting and allied processes in accordance with CSA W117.2.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 ELECTRODES

- .1 Electrodes: in accordance with CSA W48 Series.

Part 3 EXECUTION

3.1 QUALITY OF WORK

- .1 Welding: in accordance with ANSI/ASME B31.1, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS C1.1, special procedures specified elsewhere in Mechanical Divisions, and applicable requirements of provincial authority having jurisdiction.

3.2 INSTALLATION REQUIREMENTS

- .1 Identify each weld with welder's identification symbol.
- .2 Backing rings:
 - .1 Where used, fit to minimize gaps between ring and pipe bore.
 - .2 Do not install at orifice flanges.
- .3 Fittings:
 - .1 NPS 2 and smaller: install welding sockets.
 - .2 Branch connections: install welding tees or forged branch outlet fittings.

3.3 INSPECTION AND TESTS – GENERAL REQUIREMENTS

- .1 Review weld quality requirements and defect limits of applicable codes and standards with Consultant before work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with Consultant.

- .3 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.
- .5 Piping system test procedures and pressure to be used shall be approved by TSSA.

3.4 SPECIALIST EXAMINATIONS AND TESTS

- .1 General:
 - .1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by engineer.
 - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51, ASME B31.1 and requirements of authority having jurisdiction.
 - .3 To requirements of TSSA.
 - .4 Inspect and test 10% of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination and full gamma ray radiographic (hereinafter referred to as "radiography") tests.
 - .5 To requirements for CRN.
- .2 Hydrostatically test welds to ANSI/ASME B31.1 and T.S.S.A.
- .3 Visual examinations: include entire circumference of weld externally and wherever possible internally.
- .4 Failure of visual examinations.
 - .1 Upon failure of welds by visual examination, perform additional testing as directed by Consultant of total of up to 10% of welds, selected at random by Consultant by radiographic tests.
- .5 Full radiographic tests for piping systems.
 - .1 Spot radiography:
 - .1 Conduct spot radiographic tests of up to 10% of welds, selected at random by Consultant from welds which would be most difficult to repair in event of failure after system is operational.
 - .2 Radiographic film:
 - .1 Identify each radiographic film with date, location, name of welder, and submit to Departmental Representative. Replace film if rejected because of poor quality.
 - .3 Interpretation of radiographic films:
 - .1 By qualified radiographer.
 - .4 Failure of radiographic tests:
 - .1 Extend tests to welds by welder responsible when those welds fail tests.
- .6 3rd party reviewer shall review and approve all methods and test results. See 23 05 00 for 3rd party variance requirement.

3.5 DEFECTS CAUSING REJECTION

- .1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

3.6 REPAIR OF WELDS WHICH FAILED TESTS

- .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

3.7 CLEANING

- .1 Clean in accordance with Section 01 74 11.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA).
 - .1 CAN/CSA-B149.1-10, Natural Gas and Propane Installation code, Includes Update No.1.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-24.3-2009, Identification of Piping Systems.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2013, Standard for the Installation of Sprinkler Systems.

1.2 SUBMITTALS

- .1 Product Data:
 - .1 Submittals: in accordance with Section 01 33 00.
 - .2 Product data to include paint colour chips, other products specified in this section.
- .2 Samples:
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling.
 - .2 Do not dispose of unused paint and/or coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

Part 2 PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer. Metal for all equipment associated with steam, blow down and condensate.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

- .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
 - .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
 - .1 Conform to following table:

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

- .2 Use maximum of 25 letters/numbers per line.

2.3 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.
- .3 Before starting work, obtain written approval of identification system from Departmental Representative.

2.4 PIPING SYSTEMS GOVERNED BY CODES

- .1 Identification:
 - .1 Sprinklers: to NFPA 13.
 - .2 Natural Gas: To CAN/CSA B149.1.

2.5 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as PIPING SYSTEMS necessary), legend; direction of flow by arrows. To CAN/CGSB-24.3 except where specified otherwise.
 - .1 Legend:
 - .1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.
- .2 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.
- .3 Extent of background colour marking:
 - .1 To full circumference of pipe or insulation.
 - .2 Length to accommodate pictogram, full length of legend and arrows.
- .4 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 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.
- .5 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
Domestic hot water	Green	DOM. HW
Domestic cold water	Green	DOM. CWS
Sanitary	Green	SAN
Plumbing vent	Red	SPRINKLERS
Chemical Feed Line	Yellow	CHEM. FEED
Condenser water	Green	COND. WATER
Chilled Water Supply	Green	CHILLED WATER SUPPLY
Chilled Water Return	Green	CHILLED WATER RETURN
Control wiring	To Controls Specification	

- .4 Natural gas: paint entire system and identify.

2.6 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm high stenciled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: Black, or coordinated with base colour to ensure strong contrast.
- .3 Stencil over final finish only.

2.7 VALVES, CONTROLLERS

- .1 Brass tags with 12mm stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

2.9 LANGUAGE

- .1 Identification in English.

2.10 REGISTERED SYSTEMS

- .1 Provide any additional identification required for CRN registration.

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 TIMING

- .1 Provide identification only after painting.

3.3 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and/or CSA registration plates as required by respective agency.
- .3 Identify systems, equipment to conform to PWGSC PMSS.

3.4 NAMEPLATES

- .1 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.

- .2 Standoffs:
 - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection:
 - .1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

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

3.7 CLEANING

- .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ASME B31.1-2012, Power Piping.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM A125-96(2013) e1, Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-12, Specification for Carbon Steel Bolts, Studs, Threaded Rod 60000 PSI Tensile Strength.
 - .3 ASTM A563-07a, Specification for Carbon and Alloy Steel Nuts.
- .3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP-58-2009, Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation.

1.2 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 SP-58.
- .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 all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings and product data results in accordance with Section 20 05 01 - Common Work or Mechanical.
- .2 Submit shop drawings and product data for following items:
 - .1 All bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.

1.4 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Common Work Results for Mechanical. Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

Part 2 PRODUCTS

2.1 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP-58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: painted with zinc-rich paint after manufacture.
 - .2 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: 8 mm (0.35") UL listed.
 - .2 Cold piping NPS 2 1/2 or greater, all 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 SP-58-1993.
- .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 SP-58.
 - .2 Cold piping NPS 2 1/2 or greater, all 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 anchor bolt & clevis hanger.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS SP-58.
- .5 Hanger rods: threaded rod material to MSS SP-58.
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22 mm (0.9") or 28 mm (1.1") rod.
- .6 Pipe attachments: material to MSS SP-58-1993.
 - .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.
- .7 Adjustable clevis: material to MSS SP-69-2002 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for riveting to insulation shields.
- .8 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-58.

- .9 U-bolts: carbon steel to MSS SP-58 with 2 nuts at each end to ASTM A563.
 - .1 Finishes for steel pipework: black.
 - .2 Finishes for copper, glass, and brass or aluminum pipework: black, with formed portion plastic coated.
- .10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-58.

2.3 RISER CLAMPS

- .1 Steel or cast iron pipe: black carbon steel to MSS SP-58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS SP-58, 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 (4 lbs./ft.³) density insulation plus insulation protection shield to: MSS SP-58, galvanized sheet carbon steel. Length designed for maximum 3 m (10 ft.) span.
- .2 Insulated hot piping:
 - .1 Curved plate 300 mm (12") long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP-58.

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 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 (1") minimum.
- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment Manufacturer from structural grade steel. Submit calculations with Shop Drawings.

2.7 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
 - .1 Install on piping systems at pumps, boilers, water heaters, elsewhere 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 be 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 12 mm (½") or more,
 - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.

3.2 HANGER SPACING

- .1 Plumbing piping: most stringent requirements of Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.
- .2 Fire protection: to applicable fire code.
- .3 Copper piping: up to NPS ½: every 1500 mm (5 ft.).
- .4 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.
- .5 Within 300 mm (12") of each elbow.

Maximum Pipe Size: NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1¼	7 ft. (2.1 m)	6 ft. (1.8 m)
1½	9 ft. (2.7 m)	8 ft. (2.4 m)
2	10 ft. (3.0 m)	9 ft. (2.7 m)
2½	12 ft. (3.6 m)	10 ft. (3.0 m)
3	12 ft. (3.6 m)	10 ft. (3.0 m)
3½	13 ft. (4.0 m)	11 ft. (3.3 m)
4	14 ft. (4.3 m)	12 ft. (3.6 m)
5	16 ft. (4.9 m)	
6	17 ft. (5.2 m)	

8 19 ft. (5.8 m)

- .6 Pipework greater than NPS 12: to MSS SP-58.

3.3 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.4 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4° from vertical.
- .2 Where horizontal pipe movement is less than 12 mm (1/2"), offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.5 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

Part 1 GENERAL

1.1 TAB AGENCY

- .1 General:
 - .1 All work described in this section to be performed by third-party TAB contractor.
- .2 Certification:
 - .1 Submit documentation to confirm qualifications and experience of TAB Agency personnel.
- .3 Quality assurance:
 - .1 Perform TAB to standards of NEBB, CAABC or AABC.
- .4 Co-ordination:
 - .1 Co-ordinate all work specified in this Section.
 - .2 Provide all facilities required by TAB Agency in order to carry out work of this Section.
 - .3 Coordinate TAB activity with controls contractor as required and carry costs associated with controls requirements to complete TAB.
- .5 Adequacy of work for TAB:
 - .1 TAB Agency to review contract documents before work is started and confirm in writing to Consultant adequacy of provisions for TAB and all other aspects of installation pertinent to TAB.

1.2 GENERAL

- .1 TAB: means to test, adjust and balance all systems to perform in accordance with Contract Documents and to do all other work as specified in this section.
- .2 Follow start-up procedures as recommended by manufacturer unless otherwise specified.
- .3 Special start-up procedures may be specified elsewhere.
- .4 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions.
- .5 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges. Contractor shall allow for 1 sheave change for each instance of belt-driven equipment.
- .6 Notify Consultant 7 days prior to start of TAB.
- .7 Operate all systems to permit TAB to be performed. Coordinate operation with controls contractor as required. See 1.1.4.3.
- .8 TAB to apply to systems, equipment and related controls specified in Divisions 22 and 23.
- .9 Reference organization standards:
 - .1 Do TAB over entire operating range in accordance with most stringent conditions of this specification and standard of following organization.

- .1 CAABC (Canadian Associated Air Balance Council).
 - .2 NEBB (National Environmental Balancing Bureau).
 - .3 SMACNA (Sheet Metal & Air Conditioning Contractors National Association).
 - .4 ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers).
- .10 Start TAB only when building is essentially completed, including:
- .1 Installation of ceilings, doors, windows and other construction affecting TAB.
 - .2 Application of sealing, caulking and weather-stripping.
 - .3 All pressure, leakage and other tests specified elsewhere in Divisions 22 and 23 completed.
 - .4 All provisions for TAB are installed and operational.
 - .5 Start-up, verification for proper, safe and normal operation of mechanical and associated electrical and control systems affecting TAB including, but not limited to, the following:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air Systems:
 - .1 Filters in place and in clean condition.
 - .2 Duct systems clean of debris.
 - .3 Air shafts, ceiling plenums are airtight to within specified tolerances.
 - .4 Correct fan rotation.
 - .5 Fire and volume dampers in place and open.
 - .6 Coil fins cleaned and combed.
 - .7 Access doors closed and duct end caps in place.
 - .8 All outlets installed and connected.
 - .6 Liquid systems:
 - .1 Flushed, filled, vented.
 - .2 Correct pump location.
 - .3 Strainers in place, baskets clean.
 - .4 Isolating and balancing valves installed open.
 - .5 Chemical treatment systems complete, operational.
- .11 Accuracy tolerances:
- .1 Do TAB to following tolerances of design values:
 - .1 HVAC systems:
 - .1 Supply:
 - .1 Positive pressure areas: +10%, -0%.
 - .2 Negative pressure areas: +0%, -10%.
 - .3 Neutral pressure areas: +/-5%.
 - .2 Exhaust:
 - .1 Positive pressure areas: +0%, -10%.
 - .2 Negative pressure areas: +10%, -0%.
 - .3 Neutral pressure areas: +/-5%.
 - .2 Hydronic systems: ±5%.

- .2 Measurements to be accurate to within plus or minus 2% of actual values.
- .12 Instrument calibration: to be in accordance with TAB referenced organization standard, and completed within 12 months of commencement of TAB.
 - .1 Provide proof of calibration to Consultant upon request.
- .13 Submittals prior to commencement of TAB:
 - .1 Proposed methodology and procedures for performing TAB.
 - .2 Proposed check lists and report forms.
 - .3 List of instrumentation, including details and certificates of calibration.
- .14 Report:
 - .1 Format to be in accordance with TAB referenced organization standard, but using SI units.
 - .2 Report to include record full system schematics showing results of TAB.
 - .3 Submit, prior to formal submission of TAB reports, for checking and approval by Consultant, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.
 - .4 Submit an electronic copy of TAB reports.
- .15 Verification:
 - .1 Reported measurements shall be subject to verification by Consultant. Provide instrumentation and manpower to verify results of up to 30% of all reported measurements. Number and location of verified measurements to be at discretion of Consultant.
 - .2 Bear costs to repeat TAB, as required, to satisfaction of Consultant.
- .16 If for any reason design values cannot be reached, TAB Contractor shall submit a preliminary report of balancing activity for discussion with Consultant.
- .17 Settings: lock and permanently mark settings as required by reference standard.
- .18 Completion: TAB to be considered complete only when final reports are reviewed and accepted by Consultant.
- .19 The project will be considered incomplete until a TAB report is accepted by Consultant. Substantial completion will only be issued once the TAB report is accepted by Consultant.

1.3 AIR MOVING SYSTEMS

- .1 General: measurements as required by referenced organization standards, including, but not limited to, following:
 - .1 Measurements:
 - .1 Air velocity.
 - .2 Static pressure.
 - .3 Velocity pressure.
 - .4 Flow rate.

- .5 Pressure drop.
- .6 Temperature:
 - .1 Wet bulb.
 - .2 Dry bulb.
- .7 Cross sectional area.
- .8 Fan RPM.
- .9 Electrical power:
 - .1 Voltage.
 - .2 Current draw.
- .10 Noise and Vibration
- .2 Location of equipment measurements:
 - .1 Inlet and outlet of each:
 - .1 Fan.
 - .2 Coil.
 - .3 Filter.
 - .4 Damper.
 - .5 VAV Box.
 - .6 Bypass Box.
 - .7 Fan Coil
 - .8 Other auxiliary equipment.
 - .3 Location of system measurements:
 - .1 Main ducts.
 - .2 Main branch ducts.
 - .3 Sub-branch ducts.
 - .4 Each supply, exhaust and return air inlet and outlet.
 - .5 Fresh air inlet to fan coils
 - .6 Other auxiliary equipment.
 - .7 All areas served by system.
 - .8 Locations as required to determine compliance with flow rates indicated in contract documents.

1.4 HYDRONIC SYSTEMS

- .1 Definitions: for purposes of this section, to include low pressure hydronic heating/cooling system.
- .2 Measurements: to include, but not be limited to the following as appropriate for systems, equipment, components or controls:
 - .1 Flow rate
 - .2 Static pressure
 - .3 Pressure drop (or pressure loss)
 - .4 Temperature
 - .5 Motor and pump RPM

- .6 Electrical power/amperage
- .3 Locations of equipment measurements to include, but not be limited to, following as appropriate:
 - .1 Inlet and outlet of each boiler, chiller, heating coil, cooling coil, pump, PRV, control valve, and other equipment causing changes in flow or pressure conditions.
 - .2 At each controller-controlled device.
- .4 Locations of systems measurements to include, but not be limited to the following as appropriate:
 - .1 Supply and return of each main
 - .2 Main branch
 - .3 Each branch
 - .4 Sub-branch of all hydronic systems
 - .5 Inlet connection of make-up water

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 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 B 209M-02, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
 - .2 ASTM C 449/C 449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .3 ASTM C 553-00, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .4 ASTM C 612-00a, Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .5 ASTM C 795-92, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
 - .6 ASTM C 921-92(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-89, 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-M88(R2000), Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-01, 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 23 05 00 - Common Work Results for Mechanical.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.4 SAMPLES

- .1 Submit samples in accordance with Section 23 05 00 - Common Work Results for Mechanical.
- .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

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 herein 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 C 335.
- .3 Insulation is required on the following ductwork:
 - .1 All supply ductwork with the exception of supply ductwork exposed in space serviced by system.
 - .2 On all ductwork that is used for heating or cooling.
 - .3 On ductwork systems where both thermal insulation is required and acoustic lining is indicated on the drawings, acoustic lining only shall be provided for the sections indicated and thermal insulation shall be provided for the remainder.
 - .4 For roof mounted exhaust fans: 4.6 m (15 ft.) of exhaust ducting before exhaust fan.
 - .5 For cabinet exhaust fans: exhaust air ducting from fan damper to exhaust louver/cowl.
 - .6 Entire fume hood ductwork.
 - .7 Fresh air ducting from fresh air intake louvres to air handling units.
 - .8 Exhaust air ducting from air handling units to exhaust outlets/louvres.
 - .9 Thickness.
 - .1 Supply ducting: 25mm (1").
 - .2 Outside and fresh air ducting: 50mm (2").
 - .3 Exhaust ducting: 25mm (1").
 - .4 Attic ducting: 50mm (2").
 - .5 Fume hood ducting: 25mm (1").

- .4 Mineral fiber blanket to ASTM C 553 with vapour barrier to CGSB-S1-GP-52Ma.
 - .1 For use on all round ductwork requiring insulation.
- .5 Rigid mineral fibre board to ASTM C 612 with factory applied vapour retarder jacket to CGSB 51-GP-52Ma.
 - .1 For use on rectangular ducting requiring insulation.

2.3 JACKETS

- .1 Canvas:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire-retardant lagging adhesive to ASTM C 921.
- .2 Lagging adhesive: Compatible with insulation.

2.4 ACCESSORIES

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.
- .4 ULC Listed Canvas Jacket:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire-retardant lagging adhesive to ASTM C 921.
- .5 Tape: self-adhesive, aluminum, reinforced, 75 mm wide minimum.
- .6 Contact adhesive: quick-setting
- .7 Canvas adhesive: washable.
- .8 Banding: 19mm wide, 0.5 mm thick stainless steel.
- .9 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation.
- .10 Fasteners: 4mm diameter pins with 35mm square clips, length to suit thickness of insulation.

Part 3 EXECUTION

3.1 PRE-INSTALLATION REQUIREMENTS

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

3.2 INSTALLATION

- .1 Install in accordance with TIAC National Standards, NFPA 90A and NFPA 90B.
- .2 Apply materials in accordance with manufacturers instructions and this specification.

- .3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of insulation and vapour retarder jacket and finishes.
 - .1 Hangers, supports, standing duct seams to be outside vapour retarder jacket.
 - .2 Insulation and vapour barrier to be without interruption at sleeves and supports.
- .5 Supports, Hangers in accordance with Section 23 05 29 - Bases, Hangers and Supports.
 - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Mechanical fastenings:
 - .1 On rectangular ducts, use 100% coverage of insulating cement and weld pins at not more than 200mm centres, but not less than 2 rows per side and bottom.
 - .2 For round ducts provide row of pins and mechanical fasteners on top of duct. Pins to be spaced at maximum 200mm centres. Apply vapour barrier tape on vapour barrier seam and over top of mechanical fasteners.
- .7 Use stand-offs for duct mounted control accessories, including balancing and control dampers.
- .8 Apply 1mm thick galvanized sheet metal corners (nosing) to ductwork in mechanical rooms and exterior ducting.

END OF SECTION

Part 1 GENERAL

1.1 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 CPF: Code Piping Finish.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. 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.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.
- .5 Quality assurance submittals: submit following in accordance with Section 01 33 00.
 - .1 Instructions: submit manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.
- .3 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
 - .2 Place excess or unused insulation and insulation accessory materials in designated containers.

Part 2 PRODUCTS

2.1 FIRE AND SMOKE RATING

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

2.2 INSULATION

- .1 Rigid moulded mineral fiber (glass fibre, rock wool, slag wool, etc) to CGSB-51.9 with factory applied vapour retarder jacket to CGSB-51-GP-52Ma, for use on:
 - .1 Domestic hot water piping and hot water recirc
 - .2 Domestic cold water piping
 - .3 Storm drainage piping, above ground
 - .4 Sanitary piping, above ground
 - .5 Hydronic heating piping
 - .6 Valves and fittings for above piping systems
- .2 Thickness:
 - .1 Domestic hot water, including recirculation piping, TIAC A-1:
 - .1 up to NPS 1 1/4: 25 mm (1") thick.
 - .2 NPS 1½ & up: 40 mm (1½") thick.
 - .2 Domestic Cold Water, including non-potable, feed water, and other cold piping, TIAC A-3:
 - .1 up to NPS 1 1/4: 12mm (1/2") thick

- .2 NPS 1 1/2 and up: 25mm (1") thick
- .3 Storm drainage piping, TIAC A-3:
 - .1 All sizes: 25 mm (1") thick.
- .4 Sanitary, TIAC A-3:
 - .1 All sizes: 25 mm (1").
- .5 Hydronic heating piping, including glycol, and heat pump loop piping, TIAC A-1:
 - .1 up to NPS 1 1/4 = 25 mm (1") thick.
 - .2 NPS 1 1/2 & up = 40 mm (1½") thick.
- .3 Insulation systems shall include all flanges, fittings, unions, and other equipment within piping systems. Insulation systems shall include all valves. Insulation for valves and other equipment requiring regular maintenance shall be easily removable and installed per TIAC standards.

2.3 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.
- .4 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

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

2.5 VAPOUR RETARDER LAP ADHESIVE

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

2.6 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colours: white.
 - .3 Minimum service temperatures: -20 degrees C.
 - .4 Maximum service temperature: 65 degrees C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Thickness: 0.5mm.
 - .7 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
- .2 Aluminum jackets:

- .1 To ASTM B 209-02a.
- .2 Thickness: 24 ga. (0.5mm) sheet.
- .3 Finish: embossed.
- .4 Joining: Longitudinal and circumferential slip joints with 2" (50mm) laps.
- .5 Fittings: 24 ga. (0.5mm) thick die-shaped fitting covers with factory-attached protective liner.
- .6 Metal jacket banding and mechanical seals: stainless steel, 3/4" (19mm) wide, 24 ga. (0.5mm) thick at 1 ft. (300mm) spacing.
- .7 All insulation shall be weatherproofed with stucco embossed aluminum jacketing conforming to ASTM B 209-02a designation and come with a factory installed moisture barrier of 2½ mil thick polysurlyn, thermally bonded to the inside surface.
- .8 All joints of jacketing shall be overlapped by 50mm (2") and shall be weather sealed by applying a 6.031mm (1/8") bead of sealant underneath the lap. All overflow of sealant shall be removed with solvents. Note: all laps on the horizontal should be arranged so that the lap is facing down at either the 10 o'clock or 2 o'clock position in order to shed water.
- .9 To secure laps use 13mm (½") wide x 0.015 thick stainless steel banding of 225mm (9") centres and secure with stainless closed seals.
- .10 Aluminum weatherproofing for items which are pre-fabricated or machine fabricated (90° elbows, tees, etc.) shall be 0.006096mm (0.024") thick, temper per ASTM B 209-02a with an epoxy moisture barrier on the inside surface.

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, and free from foreign material.

3.3 INSTALLATION

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

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 Application: at valves, unions at equipment.
- .2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
 - .1 Insulation, fastenings and finishes: same as system.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry. Overlaps to manufacturer's instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
 - .1 Securements: SS bands or Tape at 300 mm on center.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
 - .1 Securements: SS bands or Tape at 300 mm on center.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .4 TIAC Code C-2 with vapour retarder jacket.
 - .1 Insulation securements: ss bands at 150mm on center seals: closed.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .5 Thickness of insulation as listed in part 2.
 - .1 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.
- .6 Finishes:
 - .1 Exposed indoors, (other than steam, condensate, blow-down, and boiler feed water piping): PVC jacket.
 - .2 Exposed in mechanical rooms (other than steam, condensate, blow-down, and boiler feed water piping): PVC jacket.
 - .3 Concealed, indoors (other than steam, condensate, blow-down, and boiler feed water piping): No further finish.
 - .4 Outdoors: Aluminum.
 - .5 Finish attachments: SS bands, at 150 mm on center. Seals: closed.
 - .6 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.7 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

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

1.2 RELATED SECTIONS

- .1 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E202-12, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.4 ACTION INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet. Include product characteristics, performance criteria, and limitations.
- .2 Quality assurance submittals:
 - .1 Instructions: submit manufacturer's installation instructions.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling.

Part 2 PRODUCTS

2.1 CLEANING SOLUTIONS

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

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 CLEANING HYDRONIC AND STEAM SYSTEMS

- .1 Timing: systems operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.
- .2 Cleaning Agency:
 - .1 Retain qualified water treatment specialist to perform system cleaning.
- .3 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete by water treatment specialist.
- .4 Cleaning procedures:
 - .1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:
 - .1 Cleaning procedures, flow rates, elapsed time.
 - .2 Chemicals and concentrations used.
 - .3 Inhibitors and concentrations.
 - .4 Specific requirements for completion of work.
 - .5 Special precautions for protecting piping system materials and components.
 - .6 Complete analysis of water used to ensure water will not damage systems or equipment.
- .5 Conditions at time of cleaning of systems:
 - .1 Systems: free from construction debris, dirt and other foreign material.
 - .2 Control valves: operational, fully open to ensure that terminal units can be cleaned properly.
 - .3 Strainers: clean prior to initial fill.
 - .4 Install temporary filters on pumps not equipped with permanent filters.
 - .5 Install pressure gauges on strainers to detect plugging.
- .6 Report on Completion of Cleaning:
 - .1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.
- .7 Hydronic Systems:
 - .1 Fill system with water, ensure air is vented from system.
 - .2 Fill expansion tanks 1/3 to 1/2 full, charge system with compressed air to at least 35 kPa (does not apply to diaphragm type expansion tanks).
 - .3 Use water meter to record volume of water in system to +/- 0.5%.
 - .4 Add chemicals under direct supervision of chemical treatment supplier.

- .5 Closed loop systems: circulate system cleaner at 60 degrees C for at least 36 h. Drain as quickly as possible. Refill with water and inhibitors. Test concentrations and adjust to recommended levels.
- .6 Flush velocity in system mains and branches to ensure removal of debris. System pumps may be used for circulating cleaning solution provided that velocities are adequate.
- .7 Add chemical solution to system.
- .8 Establish circulation, raise temperature slowly to maximum design. Circulate for 12 h, ensuring flow in all circuits. Remove heat, continue to circulate until temperature is below 38 degrees C. Drain as quickly as possible. Refill with clean water. Circulate for 6 hrs at design temperature. Drain and repeat procedures specified above. Flush through low point drains in system. Refill with clean water adding sodium sulphite (test for residual sulphite).
- .8 Steam Systems:
 - .1 In addition to procedures specified above perform specified following procedures:
 - .1 Remove internal components of steam traps until flushing and warm-up have been completed.
 - .2 Open drip points to atmosphere. If needed for protection of personnel or environment, install flexible hose and direct discharge to safe location.
 - .3 Starting at drip point closest to source, verify removal of condensate, then reinstall steam trap internal parts.
 - .4 Repeat sequence down the line.
 - .5 Water Hammer: determine source and eliminate cause.

3.3 START-UP OF HYDRONIC SYSTEMS

- .1 After cleaning is completed and system is filled:
 - .1 Establish circulation and expansion tank level, set pressure controls.
 - .2 Ensure air is removed.
 - .3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
 - .4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.
 - .5 Clean out strainers repeatedly until system is clean.
 - .6 Repeat with water at design temperature.
 - .7 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.
 - .8 Bring system up to design temperature and pressure slowly.
 - .9 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .10 Adjust pipe supports, hangers, and springs as necessary.
 - .11 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.
 - .12 If sliding type expansion joints bind or if bellows type expansion joints flex incorrectly, shut down system, re-align, and repeat start-up procedures.
 - .13 Re-tighten bolts using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.

- .14 Check operation of drain valves.
- .15 Adjust valve stem packings as systems settle down.
- .16 Fully open balancing valves (except those that are factory-set).
- .17 Check operation of over-temperature protection devices on circulating pumps.
- .18 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

3.4 CLEANING

- .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 ASME
 - .1 ASME B16.22-12, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.
 - .2 ASME B16.24-11, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 600, 900, 1500 and 2500.
 - .3 ASME B16.26-11, Cast Copper Alloy Fittings for Flared Copper Tubes.
 - .4 ASME B31.5-10, Refrigeration Piping and Heat Transfer Components.
- .2 ASTM International
 - .1 ASTM A 307-12, Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rod 60,000 PSI Tensile Strength.
 - .2 ASTM B 280-08, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .3 CSA Group
 - .1 CSA B52-05(R2009), B52 Package, Mechanical Refrigeration Code.
- .4 Environment Canada (EC)
 - .1 EPS 1/RA/1-96, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 20 05 01.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for refrigerant piping, fittings.
- .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .4 Submit TSSA registration certificate for entire refrigeration system.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 20 05 01.
- .2 Provide all test reports in O&M Manuals.
- .3 Include TSSA registration certificate in O&M manuals.

1.4 DELIVERY, STORAGE AND HANDLING

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

- .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect refrigerant piping, fittings from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials.

Part 2 PRODUCTS

2.1 TUBING

- .1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
 - .1 Hard copper: to ASTM B 280, type ACR.
 - .2 Annealed copper: to ASTM B 280, with minimum wall thickness as per CSA B52 and ASME B31.5.
 - .3 Refrigerant will be R-410A.

2.2 FITTINGS

- .1 Service: design pressure 2070 kPa and temperature 121 degrees C, for use with R-410A.
- .2 Brazed:
 - .1 Fittings: wrought copper to ASME B16.22.
 - .2 Joints: silver solder, 15% Ag-80% Cu-5%P and non-corrosive flux.
- .3 Flanged:
 - .1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.
 - .2 Gaskets: suitable for service.
 - .3 Bolts, nuts and washers: to ASTM A307, heavy series.
- .4 Flared:
 - .1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

- .1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and insulation.

2.4 VALVES

- .1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.
- .2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

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 GENERAL

- .1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5 Section 23 05 05 - Installation of Pipework.
- .2 Provide TSSA with all required documents for registration of entire refrigeration system.

3.3 BRAZING PROCEDURES

- .1 Bleed inert gas into pipe during brazing.
- .2 Remove valve internal parts, solenoid valve coils, sight glass.
- .3 Do not apply heat near expansion valve and bulb.

3.4 PIPING INSTALLATION

- .1 General:
 - .1 Soft annealed copper tubing: bend without crimping or constriction.
 - .2 Hard-drawn copper tubing: do not bend, minimize use of fittings.
- .2 Hot gas lines:
 - .1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
 - .2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
 - .3 Provide inverted deep trap at top of risers.
 - .4 Provide double risers for compressors having capacity modulation.
 - .1 Large riser: install traps as specified.
 - .2 Small riser: size for 5.1 m³/s at minimum load. Connect upstream of traps on large riser.

3.5 PRESSURE AND LEAK TESTING

- .1 Close valves on factory charged equipment and other equipment not designed for test pressures.
- .2 Leak test to CSA B52 before evacuation to 2 MPa and 1 MPa on high and low sides respectively.
- .3 Test procedure: build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.6 FIELD QUALITY CONTROL

- .1 Site Tests/Inspection:
 - .1 Close service valves on factory charged equipment.

- .2 Ambient temperatures to be at least 15 degrees C for at least 12 hours before and during dehydration.
- .3 Use copper lines of largest practical size to reduce evacuation time.
- .4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa absolute and filled with dehydrated oil.
- .5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.
- .6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
 - .1 Twice to 14 kPa absolute and hold for 4 hours.
 - .2 Break vacuum with refrigerant to 14 kPa.
 - .3 Final to 5 Pa absolute and hold for at least 12 hours.
 - .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
 - .5 Submit test results to Consultant.
- .7 Charging:
 - .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
 - .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
 - .3 Re-purge charging line if refrigerant container is changed during charging process.
- .8 Checks:
 - .1 Make checks and measurements as per manufacturer's operation and maintenance instructions.
 - .2 Record and report measurements to Consultant.

3.7 CLEANING

- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and waste bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible, 1985.
- .2 SMACNA HVAC Duct Leakage Test Manual, 1985.
- .3 CSA B228.1-1968, Pipe Ducts and Fittings for Residential Type Air Conditioning Systems.
- .4 ASTM A 480/A 480M-02, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
- .5 ASTM A 525M-91b, Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process. (Metric).
- .6 ASTM A 621/ A 621M-97, Specification for Steel Sheet and Strip, Carbon, Hot-Rolled, Drawing Quality.
- .7 ANSI/NFPA 90A-1999, Installation of Air Conditioning and Ventilating Systems.
- .8 ANSI/NFPA 90B-1999, Installation of Warm Air Heating and Air Conditioning Systems.
- .9 ANSI/NFPA 96-1998, Vapour Removal from Cooking Equipment.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit Shop Drawings and product data in accordance with Section 20 05 01 – Common Work Results for Mechanical.
- .2 Indicate the Following:
 - .1 Sealants
 - .2 Tape
 - .3 Proprietary Joints

1.3 CERTIFICATION OF RATINGS

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 PRODUCTS

2.1 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum	
System Total	SMACNA
Pressure	Seal
Pa	Class
500	A

- .2 Seal classification:
 - .1 Class A: longitudinal seams, transverse joints and connections made airtight with combination of sealant and tape.

- .3 Application:
 - .1 All supply ductwork.
 - .2 All exhaust and return ductwork.
 - .3 Transfer ducts, etc.

2.2 SEALANT

- .1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30°C to plus 93°C.

2.3 TAPE

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

2.4 DUCT LEAKAGE

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

2.5 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
 - .1 Rectangular: standard radius: 1.5 times width of duct.
 - .2 Round: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 400 mm: with single thickness turning vanes.
 - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch: 45° with radius on branch 1.5 times width of duct.
 - .2 Round main and branch: enter main duct at 45° with conical connection.
 - .3 Provide volume control damper in branch duct near connection to main duct.
 - .4 Main duct branches: with splitter damper.
- .5 Transitions:
 - .1 Diverging: 20° maximum included angle.
 - .2 Converging: 30° maximum included angle.
- .6 Offsets:
 - .1 Full radiused elbows.
- .7 Obstruction deflectors: maintain full cross-sectional area. Maximum included angles: as for transitions.

2.6 FIRESTOPPING

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

2.7 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A 525M-91b, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA.

2.8 STAINLESS STEEL (FUME HOOD EXHAUST)

- .1 To ASTM A 480/A 480M-02, Type 316, continuous inert gas welded joints, in accordance with SMACNA.

2.9 HANGERS AND SUPPORTS

- .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500mm.
- .2 Hanger configuration: to SMACNA.
- .3 Hangers: black steel angle with black steel rods to SMACNA following table:

<u>Duct Size</u> <u>(mm)</u>	<u>Angle Size</u> <u>(mm)</u>	<u>Rod Size</u> <u>(mm)</u>
up to 750	25 x 25 x 3	6
775 to 1050	38 x 38 x 3	6
1075 to 1500	38 x 38 x 3	10
1525 to 2100	50 x 50 x 3	10
2125 to 2400	50 x 50 x 5	10
2425 and over	50 x 50 x 5	10

- .4 Upper hanger attachments:
 - .1 For steel joist: manufactured joist clamp or steel plate washer.
 - .2 For steel beams: manufactured beam clamps.

Part 3 EXECUTION

3.1 GENERAL

- .1 Do work in accordance with ANSI/NFPA 90A-1999, ANSI/NFPA 90B-1999, ASHRAE CSA B228.1 and SMACNA.
- .2 No duct penetrations shall be allowed unless approved by engineer.
- .3 Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 100 mm (4") beyond insulated duct.
- .4 Support risers in accordance with ASHRAE and SMACNA.
- .5 Install breakaway joints in ductwork on each side of fire separation.

- .6 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .7 Manufacture duct in lengths to accommodate installation of acoustic duct lining.
- .8 All open ducts shall be sealed during construction.

3.2 HANGERS

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

<u>Duct Size (mm)</u>	<u>Spacing (m)</u>
to 1500	3.0
1525 and over	2.4

3.3 SEALING AND TAPING

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

3.4 LEAKAGE TESTS

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .2 Do leakage tests in sections.
- .3 Make trial leakage tests as instructed to demonstrate workmanship.
- .4 Install no additional ductwork until trial test has been passed.
- .5 Test section minimum of 30.5 m long with not less than 3 branch takeoffs and two 90° elbows.
- .6 Complete test before insulation or concealment.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 20 05 01 - Mechanical General Requirements.

1.2 REFERENCES

- .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Indicate the following:
 - .1 Single Blade Dampers.
 - .2 Multi-Bladed Dampers.

Part 2 PRODUCTS

2.1 GENERAL

- .1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

- .1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 300 mm.
- .3 Locking quadrant, with shaft extension to accommodate insulation thickness.
- .4 Channel frame of same material as adjacent duct, complete with angle stop.
- .5 Provide shaft extension and standoff for insulated ducts.
- .6 Standard of Acceptance: Nailor Industries model 1870-HLQ-SB for rectangular ductwork and model 1890-HLQ-SB for round ductwork.

2.3 MULTI-BLADED DAMPERS

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height: 100 mm.
- .4 Bearings: pin in bronze bushings.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.
- .7 Provide shaft extension and stand off for insulated ducts.
- .8 Standard of Acceptance: Nailor Industries model 1820-BO-HL2. Frame and transitions as required.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 For supply, return and exhaust systems, balancing dampers are to be located in each branch duct.
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 All dampers to be vibration free.
- .6 Ensure damper operators are observable and accessible.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 90A-12, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B-12, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.
- .3 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.
 - .2 SMACNA IAQ Guideline for Occupied Buildings under Construction, 2005.
- .4 Underwriters' Laboratories (UL)
 - .1 UL 181-2005, Standard for Factory-Made Air Ducts and Air Connectors.
- .5 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S110-2007, Standard Methods of Tests for Air Ducts.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for flexible ducts and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate:
 - .1 Thermal properties.
 - .2 Friction loss.
 - .3 Acoustical loss.
 - .4 Leakage.
 - .5 Fire rating.
- .3 Test and Evaluation Reports:
 - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

Part 2 PRODUCTS

2.1 GENERAL

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

2.2 METALLIC - UNINSULATED

- .1 Spiral wound flexible aluminum, as indicated.
- .2 Performance:
 - .1 Factory tested to 2.5 kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.

2.3 METALLIC - INSULATED

- .1 Spiral wound flexible aluminum with factory applied, 25 mm thick flexible glass fibre thermal insulation with vapour barrier and vinyl jacket, as indicated.
- .2 Performance:
 - .1 Factory tested to 2.5 kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.

Part 3 EXECUTION

3.1 DUCT INSTALLATION

- .1 Install in accordance with: CAN/ULC-S110, SMACNA, NFPA 90A, UL 181, NFPA 90B.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 20 05 01 - Mechanical General Requirements.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Indicate the following:
 - .1 Capacity.
 - .2 Throws.
 - .3 Noise criteria.
 - .4 Finish.
 - .5 Fastening details.

1.3 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Include:
 - .1 Keys for volume control adjustment.
 - .2 Keys for air flow pattern adjustment.

1.4 MANUFACTURED ITEMS

- .1 Grilles, registers and diffusers shall be product of one manufacturer for generic type.

1.5 CERTIFICATION OF RATINGS

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

Part 2 PRODUCTS

2.1 GENERAL

- .1 Standard product to meet capacity, throw, noise level, throat and outlet velocity as indicated.
- .2 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board.
 - .3 Concealed fasteners.
 - .4 Dimensions to suit T-bar ceiling where applicable.

- .3 Concealed operators.
- .4 Colour: to suit installation surface.

2.2 DIFFUSERS, GRILLES & REGISTERS

- .1 Sizes and types as indicated on drawings.
- .2 Standard of acceptance: E.H. Price, Titus, Nailor Hart, Krueger.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Install with oval head stainless cadmium plated screws in countersunk holes where fastenings are visible. Locate and install manual alarm stations and connect to alarm circuit wiring.

END OF SECTION

Part 1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings/product data sheets, complete with control components, and piping and wiring schematics.
- .2 Submit a start-up and certification letter from equipment supplier as specified in Part 3 of this Section.
- .3 Prepare and submit a schematic layout of refrigerant piping showing all piping components required for satisfactory operation and maintenance of the system(s), including but not limited to pipe sizes, charging valve, isolating valves, sight glasses, strainers, driers, traps, etc. Schematic diagram must be reviewed with and approved by air conditioning equipment supplier prior to submittal to Consultant.

1.2 QUALITY ASSURANCE

- .1 Split system air conditioning equipment and installation of equipment are to be in accordance with requirements of following:
 - .1 All applicable Provincial Codes and Standards.
 - .2 ANSI/AHRI Standard 210/240, Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
- .2 Split system air conditioning system installation tradesmen are to be journeyman refrigeration mechanics.

Part 2 PRODUCTS

2.1 SPLIT SYSTEM AIR CONDITIONING EQUIPMENT

- .1 Factory assembled and tested, package type equipment consisting of an indoor evaporator unit and an exterior condensing unit in accordance with drawing schedule, CSA or ETL listed and labelled, AHRI rated and certified and with a minimum system efficiency of 13 SEER.
- .2 Wall mounting evaporator assembly consisting of a white moulded high-strength plastic cabinet with front access panel, a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction and which closes when fan operation is stopped, motorized vertical vanes controlled remotely, and a mounting plate supplied loose. Evaporator complete with
 - .1 double inlet, forward curve fan(s) direct driven by a single 4-speed motor
 - .2 removable and washable return air filter
 - .3 factory pressure tested multi-angled coil of non-ferrous construction with aluminium fins, copper tubes with silver alloy solder joints, and an insulated condensate drain pan sloped to a drain connection for positive drainage.
 - .4 If noted in drawing schedule, condensate drainage pump shall be provided to meet section 22 30 00 – Plumbing Equipment. Insulate condensate line per thermal insulation specifications section 23 07 15.

- .3 Factory run tested, weatherproof condensing unit equipped with a control board to interface with indoor unit and perform all necessary operation functions. Pre-charge unit with R-410a refrigerant for a minimum of 21 m (70') of refrigerant tubing. Unit is to be capable of operation at -18°C (0°F) without additional low ambient controls, and capable of a height difference between condensing unit and evaporator of 30 m (100'). Each condensing unit complete with:
 - .1 Galvanized steel plate cabinet with an electrostatically applied thermally fused polyester powder finish, and an ABS plastic fan grille;
 - .2 Draw-through direct driven balanced fan with horizontal air discharge, mounted in front of coil, arranged to pull air across coil, and equipped with a raised fan guard;
 - .3 "L" shaped coil with copper tubes and aluminium fins, factory pressure tested, complete with an integral metal guard and refrigerant flow controlled by a linear expansion valve metering orifice controlled by a microprocessor controlled step motor;
 - .4 Vibration isolated DC rotary compressor driven by an inverter circuit to dynamically control compressor speed to match room load, complete with an accumulator, high pressure safety switch, and circuitry to permit a minimal amount of current to be applied to motor to maintain enough heat during off cycle to prevent liquid from accumulating.
- .4 System controls consisting of a microprocessor in each indoor and outdoor unit, and an indoor wall mounted controller site connected to indoor evaporator unit. System is to be capable of automatic restart after power interruption, and have self-diagnostics ability and indication of total compressor run time, and following:
 - .1 Indoor unit microprocessor is capable of monitoring return air temperature and evaporator coil temperature, receiving and processing commands from wall mounted controller, providing emergency operation, and controlling outdoor unit through its microprocessor and interface board;
 - .2 Controller is complete with an integral temperature sensor, able to perform input and output functions necessary to operate system, and equipped with following:
 - .1 Large DOT liquid crystal display to indicate diagnostic codes for both indoor and outdoor units, compressor run time, a weekly timer with up to 8 pattern settings per day, set temperature, room temperature, refrigerant piping temperatures, compressor operating conditions, and linear expansion valve opening pulses, sub-cooling and discharge super heat;
 - .2 On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Dry/Fan mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Vane Position selector, a Louvre Swing button, a Ventilation button, a Test Run button, and a Check Mode button.
- .5 Acceptable manufacturers are:
 - .1 Mitsubishi Electric Sales Canada Inc.;
 - .2 LG Electronics Canada Inc.;
 - .3 Panasonic Canada Inc.;
 - .4 Fujitsu General America Inc.;
 - .5 Daikin Industries Ltd.

Part 3 EXECUTION

3.1 INSTALLATION OF SPLIT SYSTEM AIR CONDITIONING EQUIPMENT

- .1 Provide split system air conditioning equipment consisting of an exterior condensing unit and an indoor evaporator.
- .2 Secure condensing unit in place, level and plumb, on vibration isolation pads on pressure treated wooden sleepers as indicated.
- .3 Mount indoor evaporator unit. Confirm exact location prior to roughing-in.
- .4 Connect condensing unit and indoor evaporator with refrigerant piping in accordance with piping shop drawing schematic. Refer to Section entitled Refrigerant Piping, Valves, and Accessories. Provide any required additional refrigerant.
- .5 Install loose control components and perform required control wiring (except building automation system connections) between condensing unit and evaporator in conduit in accordance with manufacturer's control wiring schematic and wiring standards of electrical work.
- .6 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements.
- .7 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.
- .8 Include for 4 hours of on-site operation demonstration and training session. Training is to be a full review of all components including, but not limited to, a full operation and maintenance demonstration, with control set-up and abnormal events.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA Group.
 - .1 CSA-C22.1-15, Canadian Electrical Code, Part 1 (26th Edition), Safety Standard for Electrical Installations.
 - .2 CAN/CSA-C22.3 No. 1-06, Overhead Systems.
 - .3 CAN3-C235-83(R2006), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 Institute of Electrical and Electronics (IEEE) National Electrical Safety Code Product Line (NESC).
 - .1 IEEE SP1122, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.
- .3 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
 - .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 The Ontario Electrical Safety Code 2015, and all bulletins (Ontario).
- .6 Hydro requirements and local applicable codes and regulations.

1.2 ACTION AND INTERNATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.
- .2 Product Data: submit WHMIS MSDS in accordance with Section 01 47 15 and Section 02 61 33.
- .3 Submit for review single line electrical diagrams in glazed frames and locate in electrical rooms.
 - .1 Electrical distribution system in main electrical room.
 - .2 Colour Code single line electrical diagrams as follows:
 - .1 Normal Power – Black
 - .2 Essential Power - Red
- .4 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario within 3 weeks of Award of Contract.
 - .2 Submit PDF shop drawings to inspection authorities.
 - .3 If changes are required, notify Departmental Representative of these changes before they are made.
- .5 Certificates: in accordance with Section 01 45 00.
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.

- .4 Permits and fees: in accordance with General Conditions of contract. Pay associated fees. Departmental Representative will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
- .5 Submit, upon completion of Work, load balance report as described in PART 3 - Load Balance.
- .6 Submit certificate of acceptance from Electrical Inspection Department authority having jurisdiction upon completion of Work to Departmental Representative.

1.3 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.
 - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.5 SYSTEM STARTUP

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

Part 2 PRODUCTS

2.1 DESIGN REQUIREMENTS

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

2.2 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Section 01 47 15.

2.3 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with Section 01 61 00.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - Submittals.
- .3 Factory assemble control panels and component assemblies.

2.4 Electric Motors, Equipment and Controls

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: in accordance with Section 26 29 03 except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.5 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of inspection authorities and Departmental Representative.
- .2 Decal signs, minimum size 175 x 250 mm.

2.6 WIRING TERMINATIONS

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

2.7 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
 - .1 Nameplates: lamicoïd 3 mm thick plastic engraving sheet, black face, white core, lettering accurately aligned and engraved into core mechanically attached with self-tapping screws.
 - .2 Lamicoïd 3mm thick plastic engraving sheet red face, white core, mechanically attached with self-tapping screws for essential (Emergency) power.
 - .3 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Wording on nameplates to be approved by Departmental Representative prior to manufacture.
- .3 Allow for minimum of twenty-five (25) letters per nameplate.

- .4 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .5 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .6 Terminal cabinets and pull boxes: indicate system and voltage.
- .7 Transformers: indicate capacity, primary and secondary voltages.

2.8 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA-C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.9 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code by pre-painting couplings, connectors and boxes.
- .3 Colours:

<u>Service</u>	<u>Colour</u>
up to 250 V	yellow
up to 600 V	brown
Telephone/lan	green
Public address/Intercom	purple
Cable television (CATV)	white
Closed Circuit television (CCTV)	orange
Fire Alarm	red
Fixed point alarm (Cell Call)	blue
<u>Door Control</u>	<u>black</u>

2.10 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green".
 - .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA-C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 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.

3.4 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 32.
- .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.
 - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.5 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
 - .1 Estimate the quantity of lime putty required to complete the work.
 - .2 Allow at least two weeks storage time for slaked lime putty before it is used.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise:
 - .1 Local switches: 1200 mm.
 - .2 Wall receptacles:
 - .1 General: 300 mm
 - .2 Above top of continuous baseboard heater: 1200 mm
 - .3 Above top of counters or counter splash backs: 175 mm
 - .4 In mechanical rooms: 1200 mm
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telephone and interphone outlets: 300 mm.
 - .5 Wall mounted telephone and interphone outlets: 1200 mm.
 - .6 Fire alarm stations: 1200 mm.
 - .7 Fire alarm bells/strobes: 2100 mm.
 - .8 Television outlets: 300 mm.

- .9 Doorbell pushbuttons: 1200 mm.
- .10 Manual starters: 1500 mm.
- .11 Isolating switches: 1500 mm.
- .12 Cell Call: 1400 mm.
- .13 Cell Call cancellation: 1400 mm.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.7 FIELD QUALITY CONTROL

- .1 Load Balance
 - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Provide upon completion of work, load balance report as directed in PART 1 - Submittals: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 45 00:
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .5 Systems: fire alarm system, communications.
 - .6 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Departmental Representative.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
- .6 Verification requirements in accordance with Section 01 47 17 include:
 - .1 Materials and resources.
 - .2 Storage and collection of recyclables.
 - .3 Construction waste management.
 - .4 Resource reuse.
 - .5 Recycled content.
 - .6 Local/regional materials.
 - .7 Certified wood.
 - .8 Low-emitting materials.

3.8 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
- .3 At time of final cleaning, clean lighting reflectors, lenses, and other lighting surfaces that have been exposed to construction dust and dirt.
- .4 Remove construction materials from wiring devices, coverplates, outlets, cabinets, enclosures, tubs, etc.

3.9 FIREPROOFING

- .1 Where cables or conduits pass through floors and fire rated walls proper firestopping for the specific construction shall be used.

3.10 POWER SHUTDOWN

- .1 Power shutdown shall be kept to a minimum. Schedule shutdowns well in advance with Departmental Representative stating time(s) and duration(s). Maintain all electrical services to the occupied areas of the buildings. Power shutdowns will be allowed during normal working hours and has to be approved by the institution. Shutdowns to be 4 hours maximum.
- .2 Provide temporary services, equipment and wiring as necessary to maintain continuity of services throughout, during construction of this project.
- .3 Ensure all services, i.e. security, fire alarm, telephone, land, normal and essential power, etc. remain operational during construction.

3.11 REMOVALS

- .1 Remove existing electrical equipment, wiring, conduit and other devices.
- .2 Where existing walls and partitions are to be removed, remove existing outlets, devices and wiring located therein and make safe. Remove existing equipment, devices and outlets as necessary. Relocate or reinstall these items as indicated and as required. Co-ordinate with applicable trades.
- .3 Maintain continuity of power, lighting, fire alarm and communication circuits as required.
- .4 Turn over all removed material to the Departmental Representative as described.

- .5 Remove all existing redundant wiring associated with all devices. Co-ordinate and arrange for telephone company to remove redundant telephone cables.
- .6 Any material the Departmental Representative does not want shall be removed from the site by the Contractor.

3.12 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into operation and maintenance manuals specified in Section 01780.
- .2 Include in operation and maintenance data:
 - .1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
 - .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.
 - .3 Wiring and schematic diagrams and performance curves.
 - .4 Names and addresses of local suppliers for items included in maintenance manuals.
 - .5 Copy of reviewed shop drawings.
- .3 Provide two distinct manuals, one for operational personnel and one for maintenance personnel. Provide a simplified operation instruction sheet for each system. (i.e. fire alarm, door control, intercom, public address, CCTV, CATV, Telephone/Lan, etc.).

3.13 TRIAL USAGE

- .1 Power supply, distribution system and equipment may be put into service for trial usage provided such use will not damage equipment or void guarantees.
- .2 Departmental Representative may use equipment and systems for test purposes prior to acceptance.
- .3 Provide labour and equipment required for testing.

3.14 AS-BUILT RECORDS

- .1 As work progresses, maintain accurate records to show deviations from contract drawings. The Departmental Representative will provide a set of clean white prints for this purpose.

3.15 MAINTENANCE SCHEDULE

- .1 Provide information for a computerized maintenance schedule indicating regular maintenance checks, procedures and results for insertion into a computerized maintenance program at the institution by –

- Manufacturer:
- Voltage:
- Phase:
- Model:
- Serial No.:
- Etc.

END OF SECTION

Part 1 GENERAL

1.1 PRODUCT DATA

- .1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

- .1 CSA C22.2 No .0.3-09(R2014), Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131-14, Type TECK 90 Cable.

1.3 PRODUCT DATA

- .1 Provide product data in accordance with Section 01 33 00.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600 or 1000 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE or RWU90 XLPE, Non-Jacketed.

2.2 TECK 90 CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131 and Section 26 05 00.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 or 1000 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: flat interlocking aluminum.
- .6 Overall covering: thermoplastic material.
- .7 To CSA C22.2 No. 0.3 Vertical Tray Fire Test.
- .8 Fastenings:
 - .1 'P' clamps on 'U' channels.
 - .2 Channel type supports for two or more cables at 900 mm centers.
 - .3 Threaded rods: 6 mm dia. to support suspended channels.

- .9 Connectors:
 - .1 Watertight approved for TECK cable.

2.3 ARMOURED CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Type: ACWU90 flame retardant jacket over thermoplastic armour and meeting requirements of vertical tray fire test of CSA C22.2 0.3 with maximum flame travel of 1.2 m.
- .5 Connectors: anti short connectors.

2.4 CONTROL CABLES

- .1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:
 - .1 Insulation: thermoplastic.
 - .2 Sheath : thermoplastic jacket.
- .2 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated
LVT: 2 soft annealed copper conductors, sized as indicated:
 - .1 Insulation: TWH.
 - .2 Shielding: tape coated with paramagnetic material wire over each conductor.
 - .3 Overall covering: polyethylene jackets.
- .3 Type: 600 V stranded annealed copper conductors, sizes as indicated:
 - .1 Insulation: RW90 (x-link).
 - .2 Shielding: non-magnetic tape over each conductor.
 - .3 Overall covering: thermosetting jackets

Part 3 EXECUTION

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00.
- .2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

- .1 Install cable in trenches in accordance with Section 33 71 73.02.
- .2 Lay cable in cable trays in accordance with Section 26 05 36.
- .3 Terminate cables in accordance with Section 26 05 20.
- .4 Cable Colour Coding: to Section 26 05 00.

- .5 Conductor length for parallel feeders to be identical.
- .6 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .7 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .8 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .9 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34.
 - .2 In underground ducts in accordance with Section 33.

3.4 INSTALLATION OF TECK 90 CABLE (0-1000 V)

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

3.5 INSTALLATION OF ARMoured CABLES

- .1 Group cables wherever possible on channels.
- .2 Install AC90 armoured cable from junction boxes located in main EMT runs in all accessible T-Bar ceilings, mechanical and electrical rooms with no ceilings to lights. Maximum length 1.5 meters.

3.6 INSTALLATION OF CONTROL CABLES

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

END OF SECTION

Part 1 GENERAL

1.1 PRODUCT DATA

- .1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

- .1 CSA C22.2 No .0.3-09(R2014), Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131-14, Type TECK 90 Cable.

1.3 PRODUCT DATA

- .1 Provide product data in accordance with Section 01 33 00.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600 or 1000 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE or RWU90 XLPE, Non-Jacketed.

2.2 TECK 90 CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131 and Section 26 05 00.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 or 1000 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: flat interlocking aluminum.
- .6 Overall covering: thermoplastic material.
- .7 To CSA C22.2 No. 0.3 Vertical Tray Fire Test.
- .8 Fastenings:
 - .1 'P' clamps on 'U' channels.
 - .2 Channel type supports for two or more cables at 900 mm centers.
 - .3 Threaded rods: 6 mm dia. to support suspended channels.

- .9 Connectors:
 - .1 Watertight approved for TECK cable.

2.3 ARMOURED CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Type: ACWU90 flame retardant jacket over thermoplastic armour and meeting requirements of vertical tray fire test of CSA C22.2 0.3 with maximum flame travel of 1.2 m.
- .5 Connectors: anti short connectors.

2.4 CONTROL CABLES

- .1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:
 - .1 Insulation: thermoplastic.
 - .2 Sheath : thermoplastic jacket.
- .2 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated
LVT: 2 soft annealed copper conductors, sized as indicated:
 - .1 Insulation: TWH.
 - .2 Shielding: tape coated with paramagnetic material wire over each conductor.
 - .3 Overall covering: polyethylene jackets.
- .3 Type: 600 V stranded annealed copper conductors, sizes as indicated:
 - .1 Insulation: RW90 (x-link).
 - .2 Shielding: non-magnetic tape over each conductor.
 - .3 Overall covering: thermosetting jackets

Part 3 EXECUTION

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00.
- .2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

- .1 Install cable in trenches in accordance with Section 33 71 73.02.
- .2 Lay cable in cable trays in accordance with Section 26 05 36.
- .3 Terminate cables in accordance with Section 26 05 20.
- .4 Cable Colour Coding: to Section 26 05 00.

- .5 Conductor length for parallel feeders to be identical.
- .6 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .7 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .8 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .9 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34.
 - .2 In underground ducts in accordance with Section 33.

3.4 INSTALLATION OF TECK 90 CABLE (0-1000 V)

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

3.5 INSTALLATION OF ARMoured CABLES

- .1 Group cables wherever possible on channels.
- .2 Install AC90 armoured cable from junction boxes located in main EMT runs in all accessible T-Bar ceilings, mechanical and electrical rooms with no ceilings to lights. Maximum length 1.5 meters.

3.6 INSTALLATION OF CONTROL CABLES

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

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CAN/CSA-C22.2 NO. 18.1-13, Metallic Outlet Boxes.
 - .3 CAN/CSA-C22.2 NO. 18.2-06(R2016), Non-metallic Outlet Boxes.
 - .4 CSA C22.2 No. 45-M1981 (R2003), Rigid Metal Conduit.
 - .5 CSA C22.2 No. 56-17, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .6 CSA C22.2 No. 83-07(R2017), Electrical Metallic Tubing.
 - .7 CSA C22.2 No. 211.2-06(R2016), Rigid PVC (Un-plasticized) Conduit

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children Products.

Part 2 PRODUCTS

2.1 CONDUITS

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

2.2 CONDUIT FASTENINGS

- .1 One-hole steel straps to secure surface conduits NPS 2 50 mm and smaller.

- .1 Two-hole steel straps for conduits larger than NPS 2 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.2 m on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for NPS 1 27 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas such as attics.
- .3 Use rigid hot dipped galvanized steel threaded conduit for surface mounting in simulated inmate areas.
- .4 Use electrical metallic tubing (EMT) in electrical rooms, mechanical rooms, areas not accessible to simulated inmates and inaccessible ceilings.
- .5 Use rigid PVC conduit underground.
- .6 Use flexible metal conduit for connection to motors in dry areas, transformers, connection to recessed incandescent fixtures and connection to surface or recessed fluorescent fixtures.
- .7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .8 Minimum conduit size for lighting and power circuits: 21 mm.
- .9 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .10 Mechanically bend steel conduit over 21 mm diameter.
- .11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .12 Install fish cord in empty conduits.

- .13 Run 27 mm spare conduits up to accessible ceiling space and 25 mm spare conduits down to accessible ceiling space from each flush panel.
 - .1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.
- .14 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .15 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

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

3.4 CONCEALED CONDUITS

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

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel.
 - .1 Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.
 - .1 Use cold mastic between sleeve and conduit.
- .5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 27 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Run conduits 27 mm and larger below slab and encase in 75 mm concrete envelope.
 - .1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

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

3.8 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

- .1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-C22.2 No.42-10(R2015), General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CAN/CSA-C22.2 No.42.1-13, Cover Plates for Flush-Mounted Wiring Devices (Bi-National standard, with UL 514D).
 - .3 CSA-C22.2 No.55-15, Special Use Switches.
 - .4 CSA-C22.2 No.111-10(R2015), General-Use Snap Switches (Bi-national standard, with UL 20).

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit Shop Drawings in accordance with Section 01 33 00.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 20.
- .2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

Part 2 PRODUCTS

2.1 SWITCHES

- .1 20 A, 120 V, single pole, three-way, four-way switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.
- .2 Manually-operated general purpose ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 Ivory toggle.
- .3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:
 - .1 Ivory urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and riveted grounding contacts.
- .2 Safety type duplex receptacles shall be CSA type 5-15R, 125V, U-ground with the following features:
 - .1 Duplex receptacle T-slot.
 - .2 Heavy duty, one-piece, chromate plated steel mounting strap secured to body of receptacle at both ends.
 - .3 Heavy-duty ivory urea molded housing.
 - .4 Break off links for use as split receptacle.
 - .5 Triple wipe constant power pressure contacts with fingers in contact when receptacle is not in use.
- .3 Surge suppression receptacles:
 - .1 Duplex receptacle, CSA 5-15R 125V, 15Amp, 'U' ground with following features:
 - .1 Blue urea molded housing for normal power, red for emergency and orange for UPS power.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Damage alter-alarm with muting screw.
 - .4 Power-on indicator.
 - .5 CSA certified to C22.2 No.42m.
 - .6 120V-60Hz.
 - .7 Response time 5NS.
 - .8 Peak energy 210 joules.
 - .9 Peak current 13000 amps.
 - .10 EMI/RFI attenuation at 50 OHMS-500KHZ-100MHZ.
 - .11 Metal oxide varistor to absorb and dissipate transient surges.
- .4 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following feature:
 - .1 Ivory urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Four back wired entrances, 2 side wiring screws.
- .5 Other receptacles with ampacity and voltage as indicated.
- .6 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

- .1 Cover plates for wiring devices to: CAN/CSA-C22.2 No.42.1.
- .2 Cover plates from one manufacturer throughout project.
- .3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .4 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.
- .5 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.
- .7 Maximum security grade wall plates for wiring devices in cells and all inmate areas. Maximum security wall plates shall include a 10 gauge CRS backplate with provision for attachment to outlet box and wall structure, mounting of the device and attachment of the cover. The cover shall be 10 gauge CRS, one piece die-formed, continuous welded with ground smooth edges attached with four security screws.

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 Mount toggle switches at height in accordance with Section 26 05 00.
 - .4 Locate light switches on latch side of door.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height in accordance with Section 26 05 00 as indicated.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .3 Cover plates:
 - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
- .4 Device Identification: 1 Identify all receptacles with self-adhesive marker describing circuit number (i.e. "A-32"). Marker shall be fastened around mounting ears of receptacle.
 - .1 Identify all receptacle coverplates with clear self-adhesive Mylar tape with black lettering.
 - .2 Identify receptacle coverplates for designated computer receptacles with additional label (as above) indicating "COMPUTER ONLY".

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.
- .3 Waste Management: separate waste materials for recycling reuse in accordance with Section 01 74 21 - - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials for moulded-case circuit breakers, and ground-fault circuit-interrupters.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-C22.2 No. 5-16, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2016).

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00.
- .2 Include time-current characteristic curves for breakers with ampacity of 600 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.
- .3 Certificates:
 - .1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 1 copy of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.
 - .1 Production certificate of origin must be submitted to Departmental Representative for approval.
 - .2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.
 - .3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate or origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.
 - .4 Production certificate of origin must contain:
 - .1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.
 - .2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.
 - .3 Contractor's name and address and person responsible for project.
 - .4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.
 - .5 Name and address of building where circuit breakers will be installed:
 - .1 Project title.
 - .2 End user's reference number.
 - .3 List of circuit breakers.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.
- .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 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan.

Part 2 PRODUCTS

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers, and Ground-fault circuit-interrupters: to CSA C22.2 No. 5.
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .5 Circuit breakers with interchangeable trips as indicated.
- .6 Circuit breakers to have minimum 10,000 A symmetrical rms interrupting capacity rating.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

- .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.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.
- .3 Waste Management: separate waste materials for recycling reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 GENERAL

1.1 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 20

1.3 REFERENCE STANDARDS

- .1 CSA Group.
 - .1 CSA C22.2 No.39-13, Fuse Holder Assemblies.

Part 2 PRODUCTS

2.1 DISCONNECT SWITCHES

- .1 Non-fusible, horsepower rated disconnect switch in CSA Enclosure 3R or 12, size as indicated.
- .2 Provision for padlocking in on-off switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size as indicated (if applicable).
- .5 Fuse Holders: to CSA C22.2 No.69 suitable without adaptors, for type and size of fuse indicated (if applicable).
- .6 Quick-make, quick-break action.
- .7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Indicate name of load controlled on size 4 nameplate.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses if applicable.
- .2 Mount securely at 1800 mm above finished floor to top of switch. Provide a minimum of 1000 mm clear floor space in front of the switch.

3.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section Identification 26 05 00.

- .2 Nameplate for each disconnect switch Size 5 engraved in accordance with Section 26 05 00. Indicate disconnect load, amperage, voltage, and phase (i.e., rooftop unit, 60 amp, 120/208V, 3 phase).
- .3 Identify circuit number on disconnect switch (i.e. "B-36").

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C82.1-2004 (R2008, R2015), American National Standard for Lamp Ballasts - Line Frequency Fluorescent Lamp Ballasts.
 - .2 ANSI C82.4-2017, American National Standard for Ballasts for High-Intensity Discharge and Low-Pressure Sodium (LPS) Lamps (Multiple-Supply Type).
- .2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 IEEE C62.41.2-2002, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- .3 ASTM International Inc.
 - .1 ASTM F1137 (2006), Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .4 Canadian Standards Association (CSA International)
- .5 ICES-005-07, Radio Frequency Lighting Devices.
- .6 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative.
 - .3 Photometric data to include:
 - .1 Total input watts.
 - .2 Candela.
 - .3 Distribution zonal lumen summary.
 - .4 Luminaire efficiency.
 - .5 Coefficient of utilization.
 - .6 Lamp type.
- .3 Quality assurance submittals: provide following in accordance with Section 01 45 00.
 - .1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, and cleaning procedures.
- .4 Submit a luminaire (and driver if LED) and lamp shop drawing for each luminaire type.

- .5 For LED fixtures, ensure that each of the specified driver features is specifically shown on shop drawings.
- .6 Provide test reports for LED modules and drivers.

1.3 QUALITY ASSURANCE

- .1 Provide mock-ups in accordance with Section 01 45 00.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets crates padding and packaging materials in accordance with Section 01 74 20.
- .4 Divert unused metal materials from landfill to metal recycling facility.
- .5 Disposal and recycling of fluorescent lamps as per local regulations.
- .6 Disposal of old PCB filled ballasts.

1.5 SPARE LAMPS AND BALLASTS

- .1 Provide spare lamps as follows:
 - .1 5% of each lamp type.
- .2 Provide spare ballasts as follows:
 - .1 Two (2) spare ballasts for each type and wattage of fluorescent ballast.

1.6 GUARANTEE

- .1 Replace:
 - .1 Incandescent and tungsten halogen lamps burning out within 3 months of Substantial Performance of Work.
 - .2 Fluorescent and HID lamps burning out within 6 months of takeover.
 - .3 Ballasts or LED drivers that fail or exceed their original noise level rating within 12 months of Substantial Performance of Work.
 - .4 LED fixtures that fall within 12 months of Substantial Performance of the work.

Part 2 PRODUCTS

2.1 LAMPS

- .1 "A" type incandescent lamps shall be rated at 130 volts, 2500 hour life, 1380 initial lumens (100W), extended service, inside frosted.
- .2 Fluorescent lamps shall be T8 diameter bulb, medium bipin, rapid start type, rated at 20,000 hour life, 3000 initial lumens (32W), 3500°K correlated colour temperature, 85 colour rendering index (CRI).

- .3 Compact fluorescent lamps shall be T-4 amalgam bulb type rated at 10,000 hour life, 3000°K correlated colour temperature, 82 colour rendering index (CRI).
 - 18 W 1200 initial lumens
 - 26 W 1800 initial lumens
 - 32 W 2400 initial lumens
 - 42 W 3200 initial lumens
- .4 High pressure sodium lamps shall be rated at 2100°K correlated colour temperature, coated.
 - 35W 2,150 initial lumens, 16,000 hour life
 - 50W 3,800 initial lumens, 24,000 hour life
 - 70W 6,000 initial lumens, 24,000 hour life
 - 100W 8,800 initial lumens, 24,000 hour life
 - 150W 15,000 initial lumens, 24,000 hour life
 - 250W 27,500 initial lumens, 24,000 hour life
 - 400W 47,500 initial lumens, 24,000 hour life
- .5 Metal halide lamps shall be rated at 3500°K correlated colour temperature, 70 colour rendering index (CRI).
 - 175W 14,000 initial lumens, 10,000 hour life
 - 250W 18,000 initial lumens, 10,000 hour life
 - 400W 36,000 initial lumens, 20,000 hour life
- .6 LED sources to be high power, minimum rated 50,000 hour, white, 3500°k ($\pm 500^\circ$ per full fixture), minimum 80CRI, replaceable modules. Exterior LED sources shall have a high power, minimum rated 50,000 hour, white, 4000°K.

2.2 BALLASTS

- .1 Fluorescent Ballasts (T8):
 - .1 Voltage rating shall be as indicated in luminaire schedule with a range of plus or minus 10% of nominal.
 - .2 Fluorescent ballasts shall be high frequency, electronic rapid start type, operating lamps at a frequency of 21 kHz or higher.
 - .3 Ballasts shall meet all applicable ANSI and IEEE standards regarding harmonic distortion, and as a minimum, input current THD content shall be less than 10%.
 - .4 Ballasts shall not be affected by lamp failure, and shall yield normal lamp life.
 - .5 Lamp current crest factor shall not exceed 1.6.
 - .6 Power factor shall be minimum 99%.
 - .7 Ballast shall carry a minimum five year warranty.
 - .8 Input line amps shall be less than 0.53 for two F32T8 lamps (120 Volt).
 - .9 Maximum total ballast watts (2-F32T8 lamps) shall not exceed 63 input watts.
 - .10 Sound level rating shall be Class A.
 - .11 EMI/RFI emissions shall meet FCC CFR 47 Part 18 Subpart C Class A.
 - .12 Line transient / auto surge protection compliance with ANSI 62.41.

- .13 Ballast factor: minimum 0.875.
- .14 Mounting: Integral with luminaire.
- .2 Fluorescent Dimming Ballast (T8):
 - .1 Dimming range of electronic dimming ballast shall be from 100% to 1% with continuous, smooth, and flicker free light level output over the entire dimming range.
 - .2 Dimming ballasts shall be high frequency, electronic rapid start, operating lamps at a frequency of 25 kHz or higher.
 - .3 Lamp current crest factor shall not exceed 1.6.
 - .4 Power factor shall be minimum 95%.
 - .5 Ballast shall carry a three year warranty.
 - .6 Input line amps shall be .57 for two F32T8 lamps (120 volt).
 - .7 Maximum total ballast watts (2-F32T8 lamps) shall not exceed 67 watts.
 - .8 Sound level rating shall be Class A.
 - .9 Line transient / auto surge protection compliance with ANSI C62.41.
 - .10 Ballast factor: minimum .93.
 - .11 Total harmonic distortion shall be less than 10%.
 - .12 Ballast shall internally limit in rush current to not exceed seven amps at 120 volts.
 - .13 Ballast shall preheat lamp cathodes to ensure rated lamp life is not diminished.
 - .14 EMI/RFI emissions shall meet FCC CFR 47 Part 18 Subpart C Class A.
- .3 Fluorescent Ballast (Compact Fluorescent Lamps):
 - .1 Electronic ballasts shall be high frequency, electronic rapid start, operating lamps at a frequency of 25 kHz or higher.
 - .2 Lamp current crest factor shall not exceed 1.5.
 - .3 Power factor shall be minimum 99%.
 - .4 Ballast shall carry a five year warranty.
 - .5 Input line amps shall be .44 for one 42 watt compact fluorescent lamp (120 volt).
 - .6 Maximum total ballast watts shall not exceed 44 watts (1-42 watt TT compact fluorescent lamp).
 - .7 Sound level rating shall be Class A.
 - .8 Line transient / auto surge protection compliance with ANSI C62.41.
 - .9 Ballast factor: minimum 1.0.
 - .10 Total harmonic distortion shall be less than 10%.
 - .11 EMI/RFI emissions shall meet FCC CFR 47 Part 18 Subpart C Class A.
- .4 High Pressure Sodium ballasts:
 - .1 Voltage rating shall be as indicated in luminaire schedule with a range of plus or minus 10% of nominal.
 - .2 Ballast shall be totally encased and designed for operation in 40oC ambient temperature.
 - .3 Power factor shall be minimum 95% with 95% of rated lamp lumens.
 - .4 Capacitor shall be non-PCB.
 - .5 Minimum starting temperature of minus 34oC at 90% line voltage.

.5 Metal Halide Ballasts:

- .1 Voltage rating shall be as indicated in luminaire schedule with a range of plus or minus 10% of nominal.
- .2 Ballast shall be totally encased and designed for operation in 40oC ambient temperature.
- .3 Power factor shall be minimum 95% with 95% of rated lamp lumens.
- .4 Capacitor shall be non PCB.
- .5 Minimum starting temperature of minimum 29oC at 90% line voltage.

2.3 LED DRIVERS

- .1 120V, 60Hz, Class I, LED drivers.
- .2 Power factor: 790%.
- .3 Total Harmonic Distortion (THD): <10% of full load.
- .4 Complete with integral 9kV surge suppression protection.
- .5 CSA approved and/or ULC listed and labelled.
- .6 Capable of step level dimming where indicated.

2.4 FINISHES

- .1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.5 OPTICAL CONTROL DEVICES

- .1 As indicated in detail sheets.

2.6 LUMINARIES

- .1 As indicated in detail sheets.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Locate and install luminaires as indicated.
- .2 Provide adequate support to suit ceiling system.
- .3 Provide plaster frame and trim as required, and turn over to trade providing ceiling installation.
- .4 Support luminaires directly from building structure.
- .5 Provide low temperature rated ballasts for exterior installations.
- .6 Install recessed fluorescent luminaires so that they can be completely removable from below the finished ceiling.
- .7 Recessed lighting luminaires in inaccessible ceilings shall be secured to blocking attached to building structure.

- .8 Where no finished ceiling exists, luminaires shall be suspended on rigid conduit hangers complete with ball aligner, and outlet box canopy. All suspension components shall be degreased and painted white, unless otherwise noted.
- .9 Replace ballasts, which in the opinion of The Departmental Representative, are found to exhibit excessive noise.
- .10 Coordinate installation of luminaires with Divisions 22, 23 and 24 to avoid conflicts between luminaires, and mechanical system components.
- .11 A maximum of two fluorescent luminaires recessed in T-bar shall be energized from one junction box mounted on the underside of the structural ceiling. A separate armoured cable drop shall be provided for each luminaire. Length of drop shall be adequate to allow relocation of luminaire one tile in all directions from its specified location.
- .12 Luminaires in inmate cells, range corridors, shower stalls and all maximum security areas shall be solidly attached to the building structure with concrete anchors and tamper-proof hardware to prevent luminaires from being knocked or pried off by the inmates. Seal all around the luminaire body with epoxy caulking to prevent concealment of contraband behind the luminaire.

3.2 WIRING

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

3.3 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support luminaires independently of ceiling.

3.4 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION