Environment and Climate Change Canada | Environnement et Changement climatique Canada

CONTRACT SPECIFICATIONS

Wye Marsh Wildlife Centre – Lighting Retrofit and Washroom Renovation

at

16160 Highway 12 East
Midland, Ontario
L4R 4K6

Real Property Management Division, Technical Division
Project No: WYE-003

TABLE OF CONTENTS 00 00 10

TABLE OF CONTENTS 00 00 10

TABLE OF CONTENTS 00 00 10

End of Table of Contents.

LIST OF DRAWINGS 00 00 15

1 **DRAWINGS**

1.1 The Drawings forming part of Contract Documents are listed below and bound separately.

DWG. NO TITLE

ARCHITECTURAL

A-1 REFLECTED CEILING PLANS
A-2 MAIN FLOOR PLAN
A-3 BASEMENT FLOOR PLAN, & MAINTENANCE SHOP: WASHROOM PLAN
A-4 DEMOLITION PLAN: UNIVERSAL WASHROOM & FLOOR PLAN: UNIVERSAL WASHROOM
A-5 ENLARGED FLOOR PLAN: WASHROOMS & PHOTOGRAPHS
A-6 REFLECTED CEILING PLANS: WASHROOMS
A-7 INTERIOR ELEVATIONS
A-8 MILLWORK DETAILS
A-9 SCHEDULES

MECHANICAL

M-1 MECHANICAL_UPPER_FLOOR_KEYPLAN
M-2 MECHANICAL_UPPER_FLOOR_DEMOLITION_PLAN
M-3 PLUMBING_UPPER_FLOOR_PLAN
M-4 HVAC_UPPER_FLOOR_PLAN
M-5 BASEMENT_DEMOLITION_NEW_PLUMBING_FLOOR_PLAN_& PART/DEMO_NEW_PLUMBING_SHOP_FLOOR_PLAN
M-6 SCHEDULES
M-7 MECHANICAL_DEMOLITION_UPPER_FLOOR_PLAN
M-8 MECHANICAL_UPPER_FLOOR_PLAN

ELECTRICAL

E-1 ELECTRICAL_KEYPLAN
E-2 ELECTRICAL_UPPER_FLOOR_DEMOLITION_PLAN
E-3 ELECTRICAL_UPPER_FLOOR_PLAN
E-4 BASEMENT_ELECTRICAL_FLOOR_PLAN
E-5 SCHEDULE_&_LUMINAIRE_DETAILS
E-6 SITE_LIGHTING_PLAN
E-7 LIGHTING_DEMO_PLANS
E-8 LIGHTING_UPPER_FLOOR_PLAN
E-9 LIGHTING_LOWER_FLOOR_PLAN
E-10 LIGHTING_ELECTRICAL_UPPER_FLOOR_PLAN

End of Document.

1. SUMMARY OF WORK

1. The Contractor shall provide all necessary labor, materials, and equipment, required to complete the lighting retrofit and washroom renovations located at Environment and Climate Change Canada's Wye Marsh Wildlife Centre, 16160 Highway 12 East, Midland, ON, as per drawings and specifications. This includes, but is not limited to:

    - Washroom: demolition, removals, architectural, mechanical, electrical work to replace all of the lighting fixtures, removal of the existing wood ceiling and replacing it with an acoustic tile ceiling as well as replacement of plumbing fixtures and fittings, construction of a new Universal Washroom, replacement of fixtures in the Staff Washroom, New coffee station, new pump for the Septic Tank, replace utility tubs at the Maintenance Shed and Display area;
    - Lighting: demolition and replacement of all exterior and interior lighting including site lighting where indicated on the drawings. Work shall include the removal and disposal of the existing wood slat ceiling at the Lobby and Display area, removal and disposal of the existing wood slat soffit at the building perimeter and the replacement of the ceilings and soffit as noted on the drawings and specifications. Any area affected by the work must be reinstated which includes asphalt paving and seeding areas affected by trenching.

    Project progress meetings are required at regular intervals with the designated representative and the contractor, the specifics intervals will be determined in more detail at the "start-up" meeting.

    The Facility has live animals in the display spaces which need to be protected and not disturbed. Care must be taken while undertaking the demolition, construction and the protocols of the Facility must be adhered to and 48 hours advance notice must be given for temporary removal if there is interference or a situation comes up that may impact the animals.

    The area of work shall be completely protected from the public where it has been taken out of commission and must be inaccessible to the public, dust-proof so that any debris or dust does not infiltrate into the public spaces.

    The work is to be performed in phases in order to ensure minimum disruption to the Facility and will require scheduling and coordination with the Facility in order to minimize the impact to the programming particularly when the demolition and installation of new ceilings and lighting takes place, and when the temporary decommissioning of the washrooms is undertaken.

    Sections of work must be completed BY the end of each work day whereby the space can be utilized by the Facility to carry on their programming each business day. All work shall be performed in the evenings or as may be arranged by the Facility in non-

public spaces such that it does not impact on the Facility. As the Facility is open to the public 7 days per week the work shall include a trailer with water that houses washroom facilities for the public and staff, to accommodate their needs during the construction of the new washrooms and lighting retrofit.

The General Contractor is responsible for the coordination and implementation of the Commissioning of all Sub-Contractor work, equipment and installations. All completed electrical and work is to be functionally and performance tested and verified by the installing Trade Contractor, and written reports indicating sign-offs provided when completed.

The Contractor is responsible for the instructions and training on equipment shall be given to Departmental Representative and Operating Personnel.

Further details are contained in the project plans, and specifications as well as General Conditions.

2. HOURS OF WORK

1. Hours of operation

Regular hours of the Facility – 7 days a week – 09:00 AM to 5:00 PM hours

- Work may be performed in non-public places as approved by the Facility Manager. Where the washroom renewal is contained to the washroom area and work is not disruptive to the scheduled programmed activities of the Facility, work may be conducted during regular hours of operation, once it got approved by the Facility Manager.
- Work may be performed in non-public places as approved by the Facility Manager. Where the lighting retrofit is contained to an area which work is not disruptive to the scheduled programmed activities of the Facility, work may be conducted during regular hours of operation, once it got approved by the Facility Manager.

Evening work - Monday to Sunday – 5:00PM to 07:00AM hours
All work must be performed during evening hours. Work requiring power shut downs and other utility shut downs should be coordinated with the Facility.

2. Work requiring power shutdown and/or utility shut down, bypassing, or isolating any initiating device or zone on the fire alarm system or the fire sprinkler system shall be undertaken as evening work (off hours) Monday through Sunday from 5:00PM to 07:00AM .

3. Provide an implementation strategy in writing three (3) weeks prior to the first shutdown which clearly lists which activities require after hours work, the sequence of shutdowns, and the maximum length of each shutdown, to insure the owner can organize the shutdown of lab equipment.

4. The Contractor shall not permit his personnel to work alone on this project when the following activities are undertaken;
    1. Work assessment determines that the potential health & safety risk is high;
    2. Work requiring entry into or work within a Confined Space;
    3. Work requiring Lock-Out and Tag-Out;
    4. Work requiring use of fall arrest equipment;
    5. Work on scaffolding;
    6. Work requiring supplied air respirators or similar equipment;
    7. Hot Work and/or Hot Tap activities;
    8. Work involving cranes or hoisting;
    9. Work or work situations identified by the Departmental Representative.

5. Staff training and demonstrations for the new equipment and installations shall be scheduled during regular business hours Monday to Friday. The Contractor shall obtain approvals from the Departmental Representative on the training schedules prior to the scheduled training date and time.

3. SCHEDULING

1. Within one week of contract award, submit a bar chart construction schedule for the work, indicating anticipated progress stages within time of completion. Minimum stages include mobilization, shop drawing submittal, order and delivery of major components and equipment, major approvals stages, interim and final inspection times, commissioning timeframes, final deficiency corrections and demobilization. When schedule has been reviewed and approved by the Departmental Representative take necessary measures to complete work within scheduled times. Do not change schedule without written approvals from the Departmental Representative. Contractor must confirm the required power shutdowns required and the activities for each shutdown and have these in his schedule

4. CONTRACT DOCUMENTS

1. Drawings and specifications are complementary, items shown or mentioned in one and not in the other are deemed to be included in the contract work.

2. Any questions that arise in relation to the design shall be brought to the attention of the Departmental Representative. Failure to comply with this procedure may necessitate amendments and other layout modifications as required to complete the Work, costs of which shall be solely the responsibility of the Contractor.

3. Study all documents, which describe, or are related to any operation before commencement of that operation. Report discrepancies discovered between existing conditions and documentation. Obtain ruling on required interpretation before commencing work.

4. Any changes to the scope of work are to be confirmed in writing by the Departmental Representative and Contract value changes approved, prior to start of said work.

5. CONTRACTOR'S USE OF SITE

1. Do not unreasonably encumber site, with material or equipment.

2. Execute the work with the least possible interference or disturbance to the normal use of the exiting premises. Make arrangements with the Departmental Representative to facilitate the work as stated.

3. Maintain existing services to the building and provide for personnel and vehicle access.

4. Where security is reduced by the work, provide temporary means to maintain security.

5. Contractor shall utilize assigned washroom facilities and shall maintain them neat and tidy.

7. Contractor shall be responsible to supply their own accommodations. No storage space will be provided within the building. Accommodation will be made for limited on-site storage at the discretion of the Departmental Representative in area designated by the Departmental Representative.

6. CONTRACTOR PROJECT SUPERINTENDENT

1. The Contractor shall, upon award of contract, designate a Project Superintendent. The Contractor shall provide the name, cellular phone number to the Departmental Representative at the pre-construction meeting. The Project Superintendent shall have full responsibility for the project and shall be authorized to accept and act upon any notice or direction provided by the Departmental Representative. Project Superintendent shall be available on site at all times that work is being performed under this contract.

2. Supervise and direct all person engaged in the work, including all tradesmen and suppliers. Become familiar with the requirements of each trade. Coordinate delivery and work operations. Examine the work of all trades during work operations to ensure compliance with the contract requirements. Expedite all work to maintain the contract schedule.

3. Cooperate with all other contractors working on site in parallel or related projects.

4. Attend coordination and project meetings at the direction of the Departmental Representative.

7. CONTRACTOR and SUB CONTRACTORS

1. The Contractor agrees to employ those sub-contractors proposed by him in writing as listed in the Contractor's tender submission.

2. Do not change or substitute approved sub-contractors without prior authorization from the Departmental Representative.

3. Contractor and sub-contractor personnel shall be qualified as per definitions under the Ontario Trades Qualification and Apprenticeship Acts and as required by regulatory agencies in Ontario.

4. Electrical work shall be carried out by qualified and licensed electrical contractors as per Ontario regulations.

5. Fire alarm work shall be carried out by qualified and accredited personnel as per Ontario regulations.

8. WORKMANSHIP

1. Workmanship shall be the best quality, executed by workers experienced and skilled in the respective duties for which they are employed. Immediately notify the Departmental Representative, if required, if work is such as to make it impractical to produce required results.

2. Do not employ any person unfit or unskilled in their required duties. The Departmental Representative reserves the right to require the dismissal from the site, workers deemed incompetent, careless, insubordinate or otherwise objectionable.

3. The Work as covered by the tender documents is intended to comply exactly with the latest rules and regulations of the inspection authorities, and these rules are to be considered an integral part of the tender documents. In case of conflict, any ruling by the Inspection Authority shall be final. All changes and alterations to the Contractor's work required by an authorized inspector or any authority having jurisdiction shall be carried out at the expense of the Contractor.

4. Decisions as to the quality or fitness of workmanship in cases of dispute rest solely with the Departmental Representative, whose decision is final.

9. RECORD DRAWINGS

1. As work progresses, maintain accurate records to show deviations from the contract drawings. Just prior to completion of work, supply to the Departmental Representative one set of white prints with all deviations neatly inked in. Contractor to show actual layouts for underground services including elevations, all mechanical piping and ductwork and all electrical wiring diagrams, locations and sizes of electrical conduits, pull boxes and wiring, circuits etc. The contractor will deliver the "as-built" records to the Departmental Representative, and will then provide 2 copies on digital CD's of the "Final Record Drawings" in PDF, and AutoCad formats for the owners records.

10. SHOP DRAWINGS

1. Provide four (4) copies of the shop drawings as listed in the specifications and/or drawings to the Departmental Representative prior to ordering materials. Shop drawings to illustrate details of portion of work specific to the project requirements. Information to clearly indicate the items to be reviewed. Generic drawings are not acceptable. Shop drawings shall be forwarded electronically to the Departmental Representative.

2. Allow two (2) working weeks for the Departmental Representative to review of each shop drawing submission.

11. CODES AND STANDARDS

1. The following codes and Standards are in place for work under this contract. The latest edition applicable at the time to be utilized.

   .1 The National Building Code of Canada
   .2 The National Fire Code of Canada
   .3 The Ontario Electrical Safety Code
   .4 Ontario Plumbing Code
   .5 Ontario Occupational Health and Safety Act and Regulations for Construction
   .6 Projects
   Canada Labor Code Part II and Federal Occupational Health and Safety Policies

12. FEES AND CERTIFICATES

1. Submit a completed Notice of Project Form to the Ontario Ministry of Labour as required by the notification requirements under the Regulations for Construction Projects made pursuant to the Ontario Occupational Health and Safety Act. Provide copy to the Departmental Representative.

2. Submit to the Electrical Inspection Authority the necessary number of working drawings and specifications for examination and approval prior to commencement of work and pay all associated fees.
   1. Obtain and pay for all electrical inspection fees.
   2. On completion of the work provide copies of the Electrical Inspection Authority inspection approval certificates.

13. CONSTRUCTION SAFETY MEASURES

1. Observe and enforce construction safety measures required by Ontario Occupational Health and Safety Acts and Regulations for Construction Projects, Canada Labor Code Part II, Occupational Health and Safety, Workers' Compensation Board and municipal statutes and authorities and site specific Health and Safety Policies and Directives

2. In the event of conflict between any provisions of above authorities, the most stringent will apply.

3. Provide and maintain guardrails, fences, barricades, lights, signs and other devices required for protection of workmen and public in accordance with the requirements of the Canada Labour Code Part II, Occupational Health and Safety, Ontario Occupational Health and Safety Act and Regulations for Construction Projects and Local by-laws. All signs shall be bilingual or CSA universal pictograms.

4. Ensure the safety of building personnel at all times when performing work.

5. Refer to Specifications Section 01 35 30 Health and Safety for additional requirements

14. FIRE SAFETY REQUIREMENTS

1. Comply with the National Building Code of Canada for fire safety in construction and the National Fire Code of Canada for fire prevention, fire fighting and life safety in building in use.

2. Comply with Human Resources Development Canada (HRDC), Fire Commissioner of Canada (FCC) Standards;

.1 No. 301: Standard for Construction Operations
.2 No. 302: Standard for Welding and Cutting
.3 No. 374: Fire Protection Standard for General Storage (Indoor and Outdoor) available from Fire protection Engineering Services, Labor program, HRDC or following internet site:
http://info.load-otea.hrdc-drhc.gc.ca/~fireweb/standards/fccen.htm
.4 Retain all fire safety documents on site.

3. Refer to Section 01 35 30 of this document for further information on Health and Safety

15. WORKPLACE SAFETY AND INSURANCE BOARD

1. Prior to commencing the work, throughout the total performance of the work when requesting payments and prior to receiving final payment, the Contractor shall provide evidence of good standing with Workplace Safety and Insurance Board of Ontario.

16. UTILITIES

1. Water supply is available on site and will be provided for construction usage at no cost. Departmental Representative reserves the right to limit volume of water utilized.

2. Existing electrical services to a maximum of 15 KVA required for the work may be used by the Contractor without charge. Ensure capacity is adequate prior to connecting and imposing additional loads. Connect and disconnect at own expense and responsibility.

17. PROTECTION

1. Protect finished work against damage until take-over.

2. Protect the work and all surrounding equipment, landscape, structures, floors, ceilings, walls, etc., from damage.

2. Make good, at no cost to the Owner, any damage caused.

3. Protect any services, which are uncovered during work.

4. Protect all areas adjacent to the construction areas from dust and debris produced during construction. Use hoarding, solid walls, drop cloths, sealed dust screens and tarps and clean up and vacuum up all debris daily.

18. PRODUCT HANDLING AND STORAGE

1. Deliver materials in original and unopened containers or wrappings with Manufacturers' seals and labels intact and legible.

2. Deliver materials in sufficient quantity to allow continuity of the work. Do not encumber site with unnecessary materials.

3. All unused materials at the end of any working day shall be properly protected from damage.

4. All materials, equipment, etc. to be handled and stored as not to interfere with the operation of the building.

5. All material and equipment to be new unless specified otherwise.

6. Contractors who use controlled products must ensure that their workers are properly trained in the safe use and handling of such products in compliance with the Workplace Hazardous Materials Information System (WHMIS).

7. Comply with all requirements with respect to Controlled products labeling and Material Safety Data Sheets (MSDSs) according to the requirements of WHMIS and the Hazardous Products Act.

19. PRODUCT AVAILABILITY

1. Upon award of contract immediately review product delivery requirements and advise the Departmental Representative of any foreseeable delays.

2. In the event of failure to notify the Departmental Representative at commencement of the work, the Departmental Representative reserves the right to require the supply of substitute products of equivalent quality at no increase in contract price to ensure adherence to project schedule.

20. MATERIALS STANDARDS

1. Materials shall be new and work shall conform to the minimum applicable standards of the Canadian General Standards Board, the Canadian Standards Association, the National Building Code of Canada and all applicable Provincial and Municipal codes. In the case of conflict or discrepancy the most stringent requirements shall apply.

2. Products (materials, equipment and articles) incorporated in work shall be new, not damaged or defective and of best quality compatible with specifications for purpose intended. If requested by Departmental Representative, furnish evidence as type, source, and quality of product.

3. Defective products will be rejected, regardless of previous inspections. Inspection

does not relieve responsibility but is a precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

4. Should any dispute arise as to the quality of fitness of products, the decision shall rest with the Departmental Representative based upon requirements of Contract Documents. Departmental Representative decisions shall be final.

5. Ensure that materials, equipment, services and labour are brought to site in sufficient quantity and in accordance with requirements of the work schedule.

21. MATERIALS OTHER THAN SPECIFIED

1. Secure in writing, permission from the Departmental Representative to use any materials other than those specified.

22. HAZARDOUS MATERIALS

1. Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials: and regarding labeling and the provision of Material Safety Data Sheets (MSDS) acceptable to Human Resources Development Canada, Labour Program.

23. REMOVED MATERIALS

1. Unless otherwise specified, materials for removal become the Contractor’s property and shall be taken from the site.

24. PROJECT CLEANLINESS

1. Remove waste materials and debris from the site at the end of each day. Leave the work area unencumbered upon completion of each work shift. Store materials and equipment.

2. Ensure site is clean, orderly and neat at all times during the work shift. Provide additional cleaning as requested by the Departmental Representative.

3. At the end of the project, remove dirt, dust and other disfigurations from all surfaces affected by the project including, but not limited to ceilings, walls, floors, fixtures and lights. Clean by dusting, damp wiping, washing, waxing and polishing to the satisfaction of the Departmental Representative.

4. Upon completion, remove scaffolding, temporary protections and surplus materials. Make good any defects noted at this stage.

5. Clean areas affected under contract, to a condition at least equal to that previously existing and to satisfaction of the Departmental Representative.

6. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

25. WASTE MANAGEMENT

1. Comply with the Environmental Protection Act, Ontario Regulations O.Reg. 102/94 and O. Reg. 103/94 for waste management programs on construction and demolition projects.

26. EXISTING SERVICES

1. Where work involves breaking into or connecting to existing services, Carry out work at times directed by the Departmental Representative. Connection to existing services shall be after hours and/or on weekends.

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

3. Submit schedule to and obtain approval from the Departmental Representative for any shutdown or closure of active service or Facility. Adhere to approved schedule and provide notice to affected parties. Do not alter schedule without prior written consent of the Departmental Representative.

4. Give the Departmental Representative 96 hours' notice related to each necessary interruption of any mechanical or electrical service throughout the course of the work. Obtain written authorization from the Departmental Representative prior to any interruption. Keep duration of those interruptions to a minimum.

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

6. Fire alarm shutdowns, re-activation shall be the responsibility of the Contractor. Shutdown, bypassing or isolating any initiating device or zone on the fire alarm system or the sprinkler system shall be undertaken after hours Monday to Friday from 18:00hrs to 06:00hrs or on weekends from 07:00hrs to 18:00hrs. All shutdowns, bypassing or isolation activities on the fire alarm system or the fire sprinkler system must be authorized in writing by the Property Management District 1 Senior Operations Technician prior to initiating work. Approvals for shutdowns, bypassing or isolation activities require a minimum of 96 hours. Contractors shall schedule their request submittals through the Departmental Representative.

27. CUTTING, PATCHING AND MAKING GOOD

1. Cut existing surfaces as required to accommodate new work. Openings shall be neatly cut and dimensioned to fit electrical conduits, mechanical pipes and/or ductwork passing through the surfaces. Obtain the Departmental Representative approval before cutting into structure. Cutting torches shall not be permitted.

2. Patch and make good cut on both sides of surfaces, damaged or disturbed to match or better existing conditions to the satisfaction of the Departmental Representative.
Note: The Contractor shall patch and make good existing openings when Contractor utilizes the existing openings for his work.

3. Fill voids left around all electrical conduits, mechanical pipes and/or ductwork with appropriate fire-proofing material to maintain fire stop integrity. Finish patching with finishing compounds to the satisfaction of the Departmental Representative.

28. DEMOLITION

1. Except if expressly stated otherwise, materials indicated for removal, become the Contractor's property and shall be promptly taken from the site.

29. EQUIPMENT

1. Provide and maintain equipment such as temporary stairs, ladders, ramps, scaffolds, swing stages, runways, chutes and the like, as required for execution of work

2. Maintain conveying equipment such as cranes, hoists, derricks and the like, as required for execution of work.

3. Assume complete responsibility for construction strength, placing, anchoring and operation of derricks, cranes, hoists and other mechanical contrivances used for work; and ensure that loads carried thereon can be safely supported and be free from accidents to all persons.

4. Have hoist capacities, with regard to anticipated loads, verified by a Professional Engineer registered in the Province of Ontario.

5. Comply with all governing safety regulations in force at the time of construction.

6. Remove immediately such equipment when not required for work.

7. Provide and maintain, on site, suitable fire extinguishers in sufficient quantities, as required by the Safety Code.

30. LOADING

1. Take precautions to prevent the overloading of any part of the structure during the progress of the work. Make good, at no expense to Owner, any damage resulting from such overloading.

31. HOISTING

1. .1 All crane operations are restricted to the following:

    a) All craning of materials and equipment must be done outside normal building operating hours, ensure interior areas below are kept unoccupied.

32. POWDER ACTUATED GUNS

1. Do not employ powder-actuated guns using explosives, unless expressly permitted by the Departmental Representative. If permitted, comply with requirements of CAN3-Z166.2-M85 (Use and Handling of Powder Actuated Tools).

33. TAXES

1. Pay all taxes properly levied by law (including Federal, Provincial and Municipal)

2. The Harmonized Sales Tax (HST) is NOT to be considered an applicable tax for the purposes of this bid. The bidder shall therefore include separately any amount in his bid price for the said HST. In the event the HST does apply, the successful Contractor will indicate on each application for payment as a separate amount the appropriate HST the Owner is legally obliged to pay. The Contractor's HST registration number must be shown on all invoices. This amount will be paid to the Contractor in addition to the amount certified for payment under the contract and will therefore not affect the contract price.

34. SIGNS – ADVERTISING

1. No advertising and/or posting of company signs shall be permitted.

2. Provide common-use signs as related to traffic control, information, instruction, health and safety, use of equipment, public safety devices, in both official languages or by the use of commonly understood graphic symbols to the Departmental Representative approval.

35. BUILDING SMOKING ENVIRONMENT

1. Smoking is prohibited in the building and on the roofs. Obey smoking restrictions on building property as directed by the Departmental Representative.

36. TRAINING AND DEMONSTRATION

1. Upon completion of the all installations, provide qualified personnel to train and demonstrate all the installations to the site's operations and maintenance personnel. Contractor to review newly installed equipment and demonstrate the start/stop and control functions of the installed equipment. Training and demonstration to be for a duration of four (4) hours or, as indicated in the equipment specification section. Training date and time to be coordinated with and approved by the Departmental Representative.

37. OPERATIONS and MAINTENANCE MANUALS

1. Provide two (2) sets of operations and maintenance manuals with data indexed in vinyl hard covered "D" ring binders. Data to include detailed technical information, documents and records describing operation and maintenance of individual components, copies of all final approved shop drawings, inspection and testing reports, warranties, and all other data specifically requested within the specifications.

2. Each binder shall have a cover sheet listing title, location and project number. Names, addresses and telephone numbers of the Contractor, Sub-Contractors and all suppliers.

3. Each binder shall list all maintenance materials, special tools, and spare parts. This will also include a signed transmittal of receipt by the owner's representatives or the Departmental Representative.

4. Provide two copies on digital media in .pdf format and of the entire Operations and Maintenance manual. Vendor literature available from the vendor in native .pdf format shall be included. If vendor literature is not available in .pdf is shall be scanned. All other information shall be scanned into .pdf. An electronic index shall be created which allows for easy navigation through the files.

38. Shipping and Receiving

1 **Contractor must be on site to receive all shipments.**

2. **Contractor is responsible to unload all shipments.**

3. **Deliveries maybe turned away if the contractor is not on site.**

4. **Contractor materials are not to be left on site without the authorization of the Facility.**

END OF SECTION

PART 1 – GENERAL

1.1 PRECEDENCE

.1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.2 REFERENCES

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

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

.3 Province of Ontario
.1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. [1990 June 2002].

1.3 SUBMITTALS

.1 Make submittals to Departmental Representativefor review.

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
.1 Results of site specific safety hazard assessment.
.2 Results of safety and health risk or hazard analysis for site tasks and operation.

.3 Submit 5 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative weekly.

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

.5 Submit copies of incident and accident report.

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

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

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

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

1.4 FILING OF NOTICE

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

1.5 SAFETY ASSESSMENT

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

1.6 MEETINGS

.1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of project and prior to each outage.

1.7 REGULATORY REQUIREMENTS

.1 The Contractor shall comply with the specified standards and regulations to ensure safe operations. The latest editions are applicable.

.1 Canada Labour Code Part II.

.2 Canada Occupational Safety and Health Regulations.

.3 National Building Code Part 8 – Safety Measures at Construction & Demolition Sites.

.4 National Fire Code Part 4 – Flammable and Combustible Liquids.

.5 National Fire Code Part 5 – Hazardous Processes and Operations.

.6 Ontario Occupational Health and Safety Act and Regulations including;

.1 Construction Projects (O.Reg.213/91).
.2 Occupational Health and Safety Act.
.3 Workplace Hazardous Materials Information System (WHMIS).
.4 Ontario Trades Qualification and Apprenticeship Act.
.5 Ontario Electrical Safety Code (Reg.10/91).

1.8 GENERAL REQUIREMENTS

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

.2 Departmental Representative may respond in wr5iting, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.9 RESPONSIBILITY

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

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

1.10 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Health and Safety Act and Regulations for Construction Projects, R.S.O..

1.11 UNFORSEEN HAZARDS

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

1.12 POSTING OF DOCUMENTS	.1	Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of the Province of Ontario, and in consultation with Departmental Representative.
1.13 CORRECTION OF NON-COMPLIANCE	.1	The Contractor shall immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
	.2	Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
	.3	Departmental Representative may stop Work if work is deemed to be life threating and non-compliance of health and safety regulations is not corrected.
1.14 DISCIPLINARY ACTION	.1	The Contractor's disregard and/or lack of compliance to health and safety measures, procedures and policies may lead to disciplinary action by the Departmental Representative.
1.15 BLASTING	.1	Blasting or other use of explosives is not permitted without prior receipt of written instruction by Departmental Representative.
1.16 CONTRACTOR ACCIDENT AND INCIDENT REPORT	.1	The Contractor shall advise the Departmental Representative of any accident, injury, near-miss incident, fire, explosion or chemical spill occurring at the Work site and any visit to the site by a governmental enforcement official.
1.17 WORK STOPPAGE	.1	Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations of Work.

1.18 SITE HEALTH AND SAFETY POLICIES AND DIRECTIVES

.1 Where applicable the Contractor shall comply and follow all prescribed site Health and Safety Policies and Directives including but not limited to the following;

.1 Worker Profile Sheet: The Contractor shall submit to the Departmental Representative a completed Worker Profile Sheet c/w all attachments including copies of licenses, certificates and permits for supporting qualifications to perform required work for a given project for each individual worker requiring access to the site. The completed Worker Profile Sheets are required for each individual worker prior to working on site. Live work is not permitted.

.2 2nd Floor Mechanical Space – Mandatory Safe Working Practices: The Contractor shall obtain training from the Departmental Representative on safe working practices and procedures for the 2nd floor mechanical space for each worker requiring access to the 2nd floor mechanical space. The Contractor shall sign-off individual training forms prior to individual workers being authorized access to the 2nd floor mechanical space.

.3 Emergency and Fire Evacuation Route: The Contractor shall obtain training on procedures of evacuating the site under emergency and/or fire situations. Contractor training and sign-off is required prior to initiating site work.

.4 Ontario Trades Qualifications and Apprenticeship Act: The Contractor shall sign-off confirming that the Trades Qualifications and Apprenticeship Act shall be observed and followed. Contractor sign-off is required prior to initiating site work.

5. Lab safety training sessions for all individuals requiring access into the specific lab areas with limited access restrictions.

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1.19 WORKPLACE SAFETY AND INSURANCE BOARD

.1 Prior to commencing the work, throughout the total performance of the work when requesting payments and prior to receiving final payment, the Contractor shall provide evidence of

good standing with Workplace Safety and Insurance Board of Ontario.

1.20 CONSTRUCTION SAFETY MEASURES

.1 Observe and enforce construction safety measures required by Ontario Occupational Health and Safety Acts and Regulations for Construction Projects, Canada Labour Code Part II, Occupational Health and Safety, Workers' Compensation Board and municipal statutes and authorities and site specific Health and Safety Policies and Directives.

.2 In the event of conflict between any provisions of above authorities, the most stringent will apply.

.3 Provide and maintain guardrails, fences, barricades, lights, signs and other devices required for protection of workmen and public in accordance with the requirements of the Canada Labour Code Part II, Occupational Health and Safety, Ontario Occupational Health and Safety Act and Regulations for Construction Projects and Local by-laws. All signs shall be bilingual or CSA universal pictograms.

.4 Ensure the safety of building personnel at all times when performing work.

PART 2 – PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 – EXECUTION

3.1 NOT USED

.1 Not Used.

CUTTING AND PATCHING 01 45 00

1 General

1.1 Schedule and co-ordinate work to minimize cutting and patching.

1.2 Cut, patch and make good to accommodate Work and to leave Work in finished condition. Cutting in this sense shall mean actual cutting of components to allow new components to pass through or to provide new openings. Cutting shall not mean mere drilling of holes to accommodate screws, anchors, bolts or other fasteners as such. Such drilling is part of Section's installation function.

1.3 Use tradesmen qualified in work being cut and patched to ensure that it is correctly done.

1.4 Do not cut, drill or sleeve load-bearing members without obtaining written approval for each condition.

1.5 Cut holes carefully, leaving clean holes no larger than required, after they are located by Sections requiring them.

1.6 Make cuts with clean, true, smooth edges to tolerances required and in conformance with industry practice for applicable class of work. Make patches undetectable in finished work.

2 Responsibility for Cutting and Patching

2.1 Responsibility for various categories of cutting and patching shall be as follows:

2.1.1 Cutting and patching of architectural and structural work required for installation of work of Divisions 15 and 16:

.1 Holes and openings up to 200 mm (8") in diameter and related patching by applicable Sections of Divisions 15 and 16;

.2 Holes and openings larger than 200 mm (8") in diameter, chases, removal of existing bulkheads and furring (if any) and related patching by Contractor.

2.2 Cutting and patching of architectural and structural work required by Sections other than those of Divisions 15 and 16 is responsibility of Section whose work is to be cut or patched.

*****END****

CONSTRUCTION FACILITIES 01 51 00

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1 Maintenance

1.1 Use all means necessary to maintain construction facilities and controls in proper and safe condition throughout progress of the Work.

1.2 In the event of loss or damage, immediately make all repairs and replacements necessary to Designated Representative approval and at no additional cost.

2 Parking

2.1 Parking spaces are available on site. Spaces shall be used at the discretion and as directed by the Facility.

2.2 Do not be nuisance to public traffic any time. Manage construction traffic by using designated roads and by providing trained flag persons to direct public traffic as appropriate

3 Contractor's Storage

3.3 Provide in approved locations as required, lockable weather tight storage sheds with floors raised above ground, for storage of materials, tools, equipment, which may be damaged by weather. Provide separate shed located where directed for paints and volatile materials. Provide fire extinguisher in each location and do not store combustible or hazardous materials in Building.

4 Dust Tight Screens

4.1 Provide dust tight screens or partitions to localize dust generating activities, and for the continuing operation of the Wye Marsh Wildlife Centre, protection of workers, finished areas of work and the public and all wildlife that is on display to approved methods of the facility. Separate areas of work from occupied portions of building with dust-tight screens. Screens shall consist of plywood min 6mm (1/4") thick on wood stud supports, or equivalent. Seal edges and joints to achieve positive protection. Provide lockable door(s) in screen(s) as may be required to provide security to area of work on Drawings and extra key to the Facility. Remove screens promptly when no longer required and make good adjacent surfaces

4.2 Maintain and relocate protection until such work is complete.

5 Hoarding, Guard Rails and Barricades

5.1 Provide secure, rigid guard railings and barricades around deep excavations, open shafts, open edges of floors and roofs.

5.2 Provide hoarding to secure areas of work complete with lockable pedestrian door(s) to ensure security of facility. Equip door(s) with locks and keys. Copies of keys must be given to Building Occupants and is the responsibility of the General Contractor.

5.3 Provide as required by governing authorities.

6 Scaffolding

6.1 Erect scaffolding independent of walls. Use scaffolding in such a manner as to interfere as little as possible with work of other trades. When not in use, move scaffolding as necessary to permit installation of other work. Construct and maintain scaffolding in a rigid, secure and safe manner. Remove it promptly when no longer required.

7 Hoisting

7.1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.

7.2 Hoists and cranes shall be operated by qualified operator.

8 Site Storage/Loading

8.1 Provide and maintain storage sheds and workshops if required by the work throughout the construction period. Remove temporary buildings upon completion of the Work.

8.2 Confine the Work and the operations of employees to limits indicated by the Contract Documents. Do not unreasonably encumber the premises with products.

8.3 Do not load or permit to be loaded any part of the Work with a weight or force that will endanger the Work.

9 Sanitary Facilities

9.1 Existing toilet facilities where available and approved by the Facility may be used provided they are kept in clean condition.

10 Water Supply

10.1 The Facility shall provide a continuous supply of potable water for construction use.

11 Temporary Heating

11.1 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress, unless indicated otherwise in specifications. Maintain temperatures in occupied areas of the building to ensure comfort of the building occupants.

11.2 Ensure that in all areas of work where finishes are being installed that the minimum temperatures are established as required for the proper installation of Work. Be responsible for damage to the Work due to failure in providing adequate heat and protection during construction.

12 Temporary Power and Light

12.1 The Facility will pay for temporary power required during construction for temporary lighting and the operating of power tools.

13 Protection for Off-Site & Public Property

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

13.2 Be responsible for damage incurred.

13.3 Be responsible for damage incurred by Work Force where property has been damaged from vehicular traffic or parking on private or Facility's Property.

14 Fire Protection

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

14.2 Open fires and burning of rubbish are not permitted on the site.

15 Protection of Building Finishes & Equipment

15.1 Provide adequate protection of the existing building to prevent migration of dust and other contaminants.

15.2 Provide protection for finished and partially finished building finishes and equipment during performance of Work from damage and staining and protect adjacent materials and/or work to prevent damage whether they have been or have not yet been installed. The responsible party shall make good any and/or all damage to the satisfaction of the Facility. Contractors shall be responsible for all work and materials pertaining to their work.

15.3 Provide necessary screens, covers, hoardings as required to protect new and existing work.

15.4 Be responsible for damage incurred and cleaning due to lack of or improper protection.

15.5 Should the work be suspended for any cause, the Contractor must assume all responsibility for the protection during the period of suspension.

16 Project Cleanliness

16.1 Maintain the Work in tidy condition, free from the accumulation of waste products and debris, other than that caused by the Facility or other Contractors.

16.2 Remove waste material and debris from the site at the end of each working day.

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

16.4 Clean adjacent rooms and corridors to the satisfaction of the Designated Representative where dust and other contaminants have infiltrated due to improper protection.

17 First Aid

17.1 Provide, at the work site, such equipment and medical facilities as required by Workmen's Compensation Act, to supply first-aid service to anyone who may be injured on the work site. In case of serious injury or death, report the accident immediately, to the proper authorities and to the Designated Representative.

18 Removal of Construction Facilities

18.1 Remove all temporary facilities from site when directed by Designated Representative.

**********END**********

MATERIAL AND EQUIPMENT 01 60 00

1 Requirements Included

.1 Reference standards.
.2 Product quality, availability, storage, handling, protection, transportation.
.3 Manufacturer's instructions.
.4 Workmanship, co-ordination, cutting, fastenings.
.5 Existing facilities.

2 Reference Standards

2.1 Within the text of the specifications, reference may be made to the following standards:

ACI - American Concrete Institute
AISC - American Institute of Steel Construction
ANSI - American National Standards Institute
ASTM - American Society of Testing and Materials
CEC - Canadian Electrical Code (published by CSA)
CEMA - Canadian Electrical Manufacturer's Association
CGSB - Canadian General Standards Board
CISC - Canadian Institute of Steel Construction
CLA - Canadian Lumberman's Association
CPCA - Canadian Painting Contractors' Association
CPCI - Canadian Prestressed Concrete Institute
CRCA - Canadian Roofing Construction Association
CSA - Canadian Standards Association
FM - Factory Mutual Engineering Corporation
IEEE - Institute of Electrical and Electronic Engineers
IPCEA - Insulated Power Cable Engineers Association
NAAMM - National Association of Architectural Metal Manufacturers
NBC - National Building Code
NEMA - National Electrical Manufacturers' Association
TTMAC - Terrazzo, Tile and Marble Association of Canada
ULC - Underwriters' Laboratories of Canada

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

2.2 Conform to latest date of issue of reference standards and amendments effect on date of submission of bids except where a specific date or issue is specifically noted.

2.3 Where Drawings and/or specifications exceed code or standard requirements, provide such additional requirements.

2.4 Where codes or standards or this specification does not provide all information

necessary for complete installation of an item, then strictly comply with the manufacturer's instructions for first quality workmanship. In cases of discrepancies consult the Departmental Representative for clarification.

2.5 In the event of conflict between any provisions of relevant codes and standards, the requirement of authority having jurisdiction shall apply.

3 Products and Materials

3.1 Quality

3.1.1 Products, materials, equipment and articles (referred to as Products throughout the specifications) incorporated in the Work shall be new, not damaged or defective, and of the best quality (compatible with specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.

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

3.1.3 Should any dispute arise as to the quality or fitness of Products, the decision rests strictly with the Designated Representative based upon the requirements of the Contract Documents.

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

3.1.5 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.

3.2 Availability

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

3.2.2 In the event of failure to notify the Designated Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Designated Representative reserves the right to substitute more

readily available products of similar character, at no increase in Contract Price.

3.2.3 Storage, Handling and Protection

.1 Handle and store products in a 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 seals and labels intact. Do not remove from packaging or bundling until required in the Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

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

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

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

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

.8 Remove and replace damaged Products at own expense and to the satisfaction of the Designated Representative.

4 Manufacturer's Instructions

4.1 Unless otherwise indicated in the 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.

4.2 Notify the Designated Representative, in writing, of conflicts between the specifications and manufacturer's instructions, so that the Designated Representative may establish the course of action.

4.3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes the Designated Representative to require removal and re-installation at no increase in Contract Price.

5 Workmanship

5.1 General

5.1.1 Workmanship shall be the best quality, executed by workers experienced and skilled in the respective duties for which they are employed. Immediately notify the Designated Representative if required Work is such as to make it impractical to produce required results.

5.1.2 Do not employ any unfit person or anyone unskilled in their required duties. Where required by code or other by-laws and regulations, trades people shall be licensed in their trade. The Designated Representative reserves the right to require the dismissal from the site, workers deemed incompetent, careless, insubordinate or otherwise objectionable.

5.1.3 Any work not acceptable to the Designated Representative or local authorities shall be removed and replaced when and as directed by them. The cost of re-executing such work shall be borne by the Contractor.

5.1.4 Where not otherwise specified or shown, all work must conform to the local governing codes and by-laws and to the Ontario and National Building Codes. All codes, standards, regulations and by-laws shall be of the latest date or amendment prior to tender issue.

5.2 Co-ordination

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

5.2.2 Be responsible for co-ordination and placement of openings, sleeves and accessories.

5.3 Concealment

5.3.1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

5.3.2 Before installation, if any doubt arises as to means of concealment, or the intention of the Contract Documents in this regard, inform the Designated Representative before proceeding with the portion of work in question.

5.3.3 Make arrangements to have mechanical and electrical work and all structural components laid out well in advance of concrete placement and furring installation so that provision may be made for proper concealment. All such work shall be tested, inspected, pipe and duct covering applied where applicable, and

approved before being concealed.

5.3.4 The Contractor takes full responsibility for informing the Designated Representative in advance of concealment, and shall notify the Designated Representative and arrange with the Designated Representative a time when a site review can take place prior to concealment. Failure to do so and any consequent opening up of finishes and structure is the sole responsibility of the Contractor.

5.4 Cutting and Remedial Work

5.4.1 Perform cutting and remedial work required to make the parts of the Work come together. Co-ordinate the Work to ensure this requirement is maintained.

5.4.2 Should work performed outside this contract necessitate cutting and/or remedial work to be performed, the cost of such work will be valued by the Designated Representative.

5.4.3 Perform cutting and remedial work by specialists familiar with the materials affected. Perform in a manner to neither damage nor endanger any portion of Work.

5.5 Location of Equipment & Fixtures

5.5.1 Obtain manufacturer's literature for roughing-in and hook-up of equipment, fixtures and appliances.

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

5.6 Fastenings

5.6.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

5.6.2 Prevent electrolytic action between dissimilar metals and materials.

5.6.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in the affected specification Section.

5.6.4 Space anchors within their load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

5.6.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

5.6.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

5.7 Protection of Work in Progress

5.7.1 Adequately protect Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Designated Representative, at no increase in Contract Price.

5.7.2 Adequately protect troweled concrete floors and finished flooring from damage. Take special measures when moving heavy loads or equipment on them.

5.7.3 Prevent overloading of any part of the building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Designated Representative.

6 Protection of Existing Utilities and Services

6.1 Where work involves breaking into or connecting to existing utilities and services, carry out work at times directed by the Designated Representative, with minimum of disturbance to occupants.

6.2 Before commencing work, and during work, establish location and extent of existing utilities and service lines in area of Work and notify Designated Representative of findings. In particular take care and hand dig around existing utilities and service lines to establish levels affected by new work and relocation.

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

**********END**********

SELECTIVE DEMOLITION 02 41 00

1 GENERAL

1.1 Conform to Sections of Division 1 as applicable.

1.2 References

CSA S350-M80(1998)	Code of Practice for Safety in Demolition of Structures
EPA, O.Reg 102/94	Environmental Protection Act, Ontario Regulation O.REG 102/94
CEPA, 1988	Canadian Environmental Protection Act
CEAA, 1995	Canadian Environmental Assessment Act
OPSS 510, Nov 2006	Construction Specification for Removal

1.3 Definitions

Hand Demolition: systematic demolition of structures by workers using hand-held tools.

Mechanical Demolition: systematic demolition of structures using powered equipment.

Systematic Demolition: methodical dismantling of structure piece by piece, usually carried out in reverse order of construction.

Rapid Progressive Failure: method of demolition where key elements of structure are removed causing rapid and complete collapse of whole or part of structure.

1.4 Quality Assurance

1.4.1 Requirements:

Conform to The Occupational Health and Safety Act, Ontario Regulation 213/91, Amended to O.Reg. 85/04: Construction Projects.

Conform to Occupational Health and Safety Act Revised Regulation of Ontario, Regulation 838, Amended to O.Reg 104/04, Designated Substance - Asbestos on Construction Projects and in Building and Repair Operations;

Conform to OBC, especially Article 2.3.2.3 as applicable.

Conform to Fire Code, Regulation under the Fire Marshals Act especially Part 8.

Conform to requirements of the EPA, Environmental Protection Act, Ontario Regulation O.Reg. 102/94

1.4.2 Qualifications:

Employ for this work demolition company having 5 years Canadian experience in this type of work. If requested, submit proof of experience and list of projects.

1.5 Project Conditions

1.5.1 Existing Conditions:

1.5.1.1 Remove all wooden slat ceiling, lighting, exterior soffits, and other mechanical & electrical devices as identified, etc. the extent of which is noted on drawings, as may be required, to implement the new work. Remove all existing ceiling tile in areas where the existing ceiling to remain. All mechanical equipment must be safely supported to the structure and all life safety devices shall be temporarily reconnected until the finished ceiling is installed and in place.

1.5.1.2 Remove all plumbing fixtures, washroom partitions, flooring, finishes, ceiling, and sections of walls and floor slab, terrazzo wall base and ceilings as may be required to perform the work etc. refer to drawings. Prepare area of work for the installation of the new work.

1.5.1.3 Remove material and equipment designated for salvage where directed by Facility representative. All other material shall be removed from the site.

1.5.1.4 Protect the public and staff in the area of work during the removals and upon completion of components of work at end of each work day.

1.5.1.5 **Contractor is responsible for scanning and x-raying existing slabs to ensure no lines and services are running below the slab before undertaking any slab cutting.**

1.5.1.6 If work is being performed during regular business hours, protect the public and staff in the area of work during the removals and upon completion of components of work at end of each work day.

1.5.2 Maintaining Traffic:

1.5.2.1 Do not close or obstruct streets, sidewalks, alleys, passageways without permits. Do not place or store materials in streets, alleys or passageways.

1.5.2.2 Conduct operations with minimum interference with roads, streets, driveways, alleys, passageways.

2 PRODUCTS

2.1 MATERIALS

2.1.1 Except as indicated on Drawings, materials being demolished shall become property of this Section. Remove from Site. Where materials are being salvaged ensure that they are in safe lockable area as directed by Facility Manager.

3 EXECUTION

3.1 Preparation

3.1.1 Preliminary Survey:

3.1.1.1 Before commencing demolition operations, examine Site to determine type of construction, condition of structure and Site conditions.

3.1.1.2 Assess potential effect of removal of any part or parts on the remainder of structure before such part(s) are removed.

3.1.1.3 Assess effects of removals on existing structure and consider need for underpinning, shoring and/or bracing.

3.1.1.4 Contact municipal authorities or utility companies for assistance in locating and marking services passing under, through, overhead or adjacent to structure to be cut and removed. Costs for all locates are under this contract and shall be paid for by the General Contractor. Such services include:

- electrical power lines
- gas mains
- oil pipelines
- communication cables
- water mains
- drainage piping (storm and sanitary)

3.1.1.5 After determining demolition methods, determine area of possible vibration. Carefully inspect beyond those adjacent areas. List potential damage areas and photograph each for record purposes before starting work.

3.1.2 Protection:

3.1.2.1 Provide flagmen where necessary or appropriate to provide effective and safe access to Site to vehicular traffic and protection to pedestrian traffic.

3.1.2.2 Ensure scaffolds, ladders, equipment and other such equipments are not accessible to public.

3.1.2.3 Do not interfere with use and activities of adjacent buildings. Maintain free and safe passage to and from buildings.

3.1.2.4 Protect existing adjacent work against damages which might occur from falling debris or other causes due to work of this Section.

3.1.2.5 Where necessary to seal fire exits of adjoining or adjacent buildings, provide other exits in compliance with applicable fire safety and building regulations.

3.1.2.6 Maintain existing fire routes on Site.

3.1.3 Existing Services:

3.1.3.1 Provide and maintain temporary services required during demolition to satisfaction of authorities having jurisdiction, fire departments and utility companies.

3.1.3.2 Before commencing removals and demolition, notify Facility Manager for any interruption of service. Disconnect electrical power lines and communications cables as may be required.

3.1.3.3 Disconnect and cap mechanical services in accordance with requirements of local authority having jurisdiction.

3.1.3.4 Remove electrical equipment scheduled for removal on Drawings and as required by Work.

3.2 Performance

3.2.1 General:

3.2.1.1 Ensure demolition work is supervised by competent foreman at all times.

3.2.1.2 Materials and debris shall not be stacked in building to extent that overloading of any part of structure will occur.

3.2.1.3 At end of each day's work leave work in safe condition ensuring that no parts of structure are in danger of collapsing.

3.2.1.4 At end of each day's work leave work in safe condition such that the facility can operate the next day.

3.2.1.5 Carry out demolition in accordance with requirements of CSA S350-M. Demolish structure and remove materials from Site.

3.2.1.6 Demolish and remove perimeter radiator units, doors & frames, finishes down to substrate, except those specified and/or indicated to remain.

3.2.1.7 Demolish and remove ceilings and soffits as indicated, except those specified and/or indicated to remain.

3.2.1.8 <u>Remove materials designated for salvage carefully and store on site where directed by Facility Owner. Contractor is responsible for ensuring safe storage in designated area. No extras will be considered for failure to protect material from theft of damage or failure to take satisfactory measures when removing and dismantling material for salvage.</u>

3.2.1.9 Until acceptance, maintain and preserve active utilities traversing premises.

3.2.1.10 Keep work wetted down to minimize dust.

3.2.1.11 Minimize noise. Avoid use of noisy machinery outside working hours.

3.2.1.12 Protect from weather parts of adjoining structures not previously exposed.

3.2.1.13 **Firestopping and Smoke Seal:** In event that work of this Section impacts on integrity of fire separations, ensure that trade performing firestopping is notified.

3.2.2 Demolition:

3.2.2.1 Demolish components of existing structure as identified on drawings, and remove materials from Site.

3.2.2.3 Remove all mechanical and electrical items indicated to be removed. If items are to be reinstalled, safeguard all items until reinstallation can take place.

3.2.3 Methods:

3.2.3.1 Hand and mechanical demolition shall be acceptable methods for work of this Section. Verify with Designated Representative whether proposed methods of demolition are acceptable.

3.4 Disposal Of Waste Materials

3.4.1 Selling or burning of materials on Site is not permitted.

3.4.2 Conform to requirements of municipality's Works Department regarding disposal of waste materials.

3.4.2.1 Materials prohibited from municipality waste management facilities shall be removed from Site and dispose of at recycling companies specializing in recyclable materials.

END OF SECTION

1 GENERAL

1.1 General Requirements

1.1.1 Conform to Sections of Division 1 as applicable.

1.2 Related Work Specified Elsewhere

1.2.1 Installation of Services: As noted on Mechanical Drawings

1.3 Source Quality Control

1.3.1 Conform to CSA/CAN-A23.2-M90 for testing methods and procedures.

1.4 Reference Standards

1.4.1 Do cast-in-place concrete work in accordance with CSA-A23.1-M90, and testing in accordance with CAN3-A23.2-M90, except where specified otherwise.

1.5 Product Delivery, Storage & Handling

1.5.1 Handle and store reinforcement and accessories to ensure that contamination by bond reducing or foreign matter, and damage to its fabricated form does not occur.

1.6 Environmental Requirements

1.6.1 Place concrete in cold and hot weather as specified in CSA/CAN-A23.1-M90

2 PRODUCTS

2.1 Materials

2.1.1 Concrete materials as specified in CSA/CAN-A23.1, A23.3-M90, A23.3-M84
.1 Cement: Type 10, normal.

2.1.2 Formwork lumber: plywood and wood formwork materials to CSA-0121-M1978 CAN3-086-M84, CAN3-086S1-87 CAN3-086.1-M89, CAN3-086.1S1-87 CSA-0153-M1980.

2.1.3 Reinforcing Steel: deformed steel conforming to CSA G30 Series, and to material specification:
.1 15M, grade 400, deformed bars to CAN/CSA G30.18
.2 tie wires: #16 USSG or heavier annealed wire or approved proprietary

system.

.3 welded wire mesh: to CSA G30.5-1983.

2.1.4 Concrete Mix for slab repair for trenching of interior services: CPD Rapidcrete, ready to use, fast setting, high strength patching material, compressive strength ASTM C109-77 at 21˚C (70˚F), 2 hours- 25.6 MPa, 4 hours-28.5 MPa, 24 hours – 46.2 MPa, 3 days – 54.5 MPa, 28 days – 62.1 MPa. Extend mix with 10 mm pea gravel.

2.2 **Concrete Mix for Slab Repair**

2.2.1 Extend ready to use, CPD Rapidcrete with equal weight (or loose volume) of clean 10 mm (3/8") pea gravel for patching. Use only enough water to achieve the desired consistency. Do not exceed 5 L (1.32 US gal) of water per 25 kg (55 lb.) bag.

2.2.2 Follow manufacturer's written instructions for use, surface preparation, application, limitations and curing of concrete mix.

3 **EXECUTION**

3.1 **Examination**

3.1.1 Verify lines, and levels and column centres before proceeding with formwork and ensure dimensions agree with drawings.

3.1.2 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

3.1.3 Examine formwork to ensure that it has been completed and adequately braced in place before commencing to place reinforcement.

3.1.4 Ensure that no water is present and no flooding water is permitted on foundation beds and skim coats where footings and other concrete work are to be placed. Place concrete only on frost-free ground. Remove previously frozen bearing surfaces.

3.1.5 Ensure that compacted fill has been placed to meet specified requirements; and that under-slab services have been installed, inspected, tested and approved.

3.2 **Formwork**

3.2.1 Construct forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA/CAN-A23.1-

M90.

3.3 **Reinforcement**

3.3.1 Place reinforcement as specified in accordance with requirements in CSA/CAN-A23.1-M90 and of sizes, at spacing, and in locations as shown on Drawings.

3.3.2 Support reinforcement by positive means which ensures cover for steel in accordance with CSA/CAN-A23.1-M90, or as otherwise shown on Drawings. Install non-marring and approved supports at exposed concrete surfaces.

3.3.3 Do not cut reinforcement, either before or after concrete is placed, to permit incorporation of other Work.

3.3.4 **For Concrete Slab Repair**: cut slab on either side of trench to insert 15M bars every 24" o.c. centre of existing slab to bridge trench to provide reinforcement.

3.3.5 Welded wire fabric:

.1 Provide 152 x 152 x MW18.7 x MW18.7 welded wire fabric at mid-depth in slabs on grade.

.2 Lap ends and sides of fabric in accordance with requirements of CSA A23.3 but in any event, not less than 150 mm.

3.4 **Placing Concrete**

3.4.1 Place concrete as specified in CSA/CAN-A23.1-M90.

3.4.2 Inform Departmental Representative least 48 hours before each concrete placing operation.

3.4.3 Do not permit vertical free fall of concrete mix to exceed 1500 mm.

3.4.4 Do not use concrete mixed more than 1 hour after introduction of mixing water during hot weather conditions or 1-1/2 hours during other periods or concrete contaminated by foreign materials.

3.4.5 Thoroughly compact concrete during and after depositing by spacing and vibration to work the concrete around reinforcement and inserts so that finished concrete is dense, uniform and free of air holes or honeycombs.

3.5 **Defective Materials and Workmanship**

3.5.1 Materials or workmanship which fail to meet specified requirements may be rejected by Departmental Representative whenever found at any time prior to

final acceptance of the work, regardless of previous inspection. If rejected, defective materials or work incorporating defective materials or workmanship shall be removed and replaced or repaired to satisfaction of Departmental Representative promptly, at no expense.

END OF SECTION

1 GENERAL:

1.1 General Requirements:

1.1.1 Conform to Sections of Division 1 as applicable.

1.1.2 This section is intended for work associated with the installation of a new opening in an existing masonry wall.

1.2 Related Work

1.2.1	Cast-In-Place Concrete:	Section 03 30 00
1.2.2	Loose steel lintels:	Section 05 50 00
1.2.3	Sealant:	Section 07 92 00

1.3 Quality Assurance

1.3.1 Unless otherwise specified, do masonry work in accordance with CSA S304.1-94(R2001), Masonry Design and Construction for Buildings; CSA A370-94(R1999), Connectors for Masonry; and to CSA A371-94 (R1999), Masonry Construction for Buildings, and to publication "Recommended Practices & Guide Specifications for Cold Weather Masonry Construction issued by the Canada Masonry Centre.

1.3.2 Do masonry mortar work to CSA A179-94(R1999), except where specified otherwise.

1.3.3 Build mock-up to demonstrate masonry repair where mechanical convectors are being removed to ensure wall assembly is integrated into existing adjacent assembly

1.4 References

.1 CSA S304.1-94(R2001), Masonry Design and Construction for Buildings
.2 CSA A370-94(R1999), Connectors for Masonry
.3 CSA A371-94 (R1999), Masonry Construction for Buildings
.4 CSA A165 Series-94 (R2000) CSA Standard on Concrete Masonry Units
.5 CSA A179-94 (R1999) Mortar and Grout for Unit Masonry
.6 CAN/CSA A3000-98 Cementitious Materials Compendium

1.4 Product Delivery, Storage, and Handling

1.4.1 Deliver materials dry, in sequence to meet construction schedule.

1.4.2 Do not use materials which have been damaged by exposure to moisture or by any other cause.

1.4.3 Store sand on platforms to avoid inclusion of foreign materials.

1.4.4 Store masonry units on pallets or plank platforms held off above ground and protect with waterproof covers.

1.4.5 Protect stored sand and masonry units with weatherproof covers.

1.5 Cold Weather Requirements

1.5.1 Supplement Clause 5.16.2 of CSA A371 with following requirements:

1.5.2 Maintain temperature of mortar between 5°C and 50°C until used.

1.6 Hot Weather Requirements

1.6.1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

1.7 Protection

1.7.1 Keep masonry dry using waterproof, non- staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.

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

1.7.3 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

2 PRODUCTS

2.1 Materials

2.1.2 Concrete Block:

.1 Concrete block shall be autoclaved, modular size with uniform medium texture. Provide headers, jambs, bull nosed corners, lintels, bond beams, halves, piano, sash block and other special units as may be required to complete the work. Block in the various thicknesses and sizes shall have a solids content in all cases to provide the fire rating required where fire rated walls are indicated. **Use square edge block where tile finish is specified for installation of edging at outside corner tiled locations.**

.2 Hollow load bearing and non-load bearing concrete block masonry units: Type H/7.5/A/M and, Type H/7.5/C/M autoclaved to CSA A165 Series.

.3 Light Weight Concrete Units; Hollow in modular sizes shown, Type H/7.5/A/M and, non-load bearing, autoclaved to CSA A165 Series.

.5 Solid load bearing and non-load bearing concrete block masonry units: to CSA A165 Series, Type S/12.5/A/M and Type S/12.5/C/M.

2.2 Mortar and Grout Materials:

.1 General: CSA A179.

.2 Aggregate: to CSA A82 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.

.3 Water: potable, to CSA A179

.4 Masonry cement: Type H to CAN/CSA A3000, Federal White.

2.3 Mortar Types

2.3.1 Use same brands of materials and source of aggregate for entire project.

2.3.2 Mortar for exterior masonry above grade:
.1 Structural Loadbearing: Type S
.2 Non-loadbearing, Partitions and Veneer: Type N

2.3.3 Following applies regardless of mortar types and uses specified above:

.1 Mortar for grouted reinforced masonry: Type S

.2 Mortar for pointing: pre-hydrated Type N

.3 Grout shall be of pourable consistency and shall be fine grout on the basis of proportion specifications, in accordance with Table 3 of CSA A179.

2.4 Mixes:

2.4.1 Mix mortar ingredients thoroughly in quantities needed for immediate use.

2.4.2 Mix mortar in mechanical mixer, operated until materials are homogeneously blended, but not less than 3 minutes after all materials are in mixer.

2.4.3 Clean mixer after each batch.

2.4.4 Mix mortar in proportions specified in CSA A179.

3 EXECUTION

3.1 Workmanship

3.1.1 Build masonry work true-to-line, plumb, square and level, with vertical joints in proper alignment. Lay work from face of coursing to maximum plumb tolerance of 6 mm in 2.4 m and to maximum tolerance of 3 mm in 2.4 m in the plane.

3.1.2 Assume complete responsibility for dimensions, plumb and levels of this work and constantly check same with graduated rod.

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

3.1.4 Construct masonry work so that both vertical and horizontal joints are of equal and uniform thickness.

3.1.5 Maintain a 25 mm deflection space between underside of structure above and top of non-load bearing walls. Other than at fire separations, fill deflection space with glass fibre board compressed to 50% of its original thickness or with foam filler strips. Leave space for caulking deflection space on both sides of wall.

3.1.6 Buttering corners of units, throwing mortar into joints, deep or excessive furrowing of bed joints not permitted. Do not shift nor tap units after mortar

has taken initial set. Where adjustments must be made after mortar has started to set, remove mortar and replace with fresh supply.

3.1.7 Beam fill to top of beams, joists, around items passing through masonry walls after items have been installed.

3.1.8 Where new masonry abuts old or fully set masonry, clean existing surfaces and dampen if necessary to obtain bond.

3.1.9 Keep exposed faces free from stains, chips and cracks. Chipped or blemished units may be used where they are concealed; defective and broken units will be rejected.

3.1.10 Where masonry is generally the finish in the building, bond must not be broken and patching of areas will not be acceptable.

3.1.11 Where necessary to temporarily stop horizontal runs of masonry, and building corners, step back masonry diagonally to lowest course previously laid. Do not "tooth" new masonry. Fill in adjacent courses before heights of stepped masonry reach 1200 mm.

3.1.12 No efflorescence will be allowed on masonry work.

3.2 Tolerances

3.2.1 Tolerances in notes to Clause 5.3 of CSA A371 apply.

3.3 Installation

3.3.1 Lay specially-shaped masonry units required or shown on drawings. The corners of concrete masonry units projecting into habitable areas and exposed or painted in the finished work shall be single or double bull nosed as required to suit the particular location. Tooth-in new masonry units at new openings and lay corner/finished specially-shaped units at exposed edges.

3.3.2 Lay joints 10 mm thick unless otherwise specified or indicated on Drawings. All joints shall be full of mortar except where specifically designated to be left open.

3.3.3 Reinforce masonry as indicated. Verify loads to be supported and the arrangement and type of fastenings and reinforcement with the appropriate conditions and locations as per the drawings.

3.3.4 Bond:

Block: Running

3.3.5 Minimize cutting block. Cut out neatly for electrical switches, outlet boxes, and other recessed or built-in objects accurately using carborundum saw. Make cuts straight, clean, and free from uneven edges, leaving 3 mm maximum clearance.

3.3.6 Do not wet concrete masonry before or during laying in wall.

3.3.7 Locate corners accurately.

3.3.8 Use full bed of mortar for first course. For remaining courses bed face shells and cross and end webs and vertical end joints fully in mortar. Compress end joint mortar.

3.3.9 Stagger end joints in every course. Align joints plumb over each other in every other course.

3.3.10 Fully support existing masonry load bearing walls by means of shoring and pinning prior to any demolition of openings required for renovation.

3.3.11 Where infilling new block into existing block walls, tooth in new block into existing block courses. Ensure that new block is the same width as existing.

3.3.12 Install masonry veneer anchors, at not more than the maximum recommended spacing of 800 mm Horizontal and 600 mm vertical spacing, refer to Structural drawings for specific location requirements.

3.3.13 Install cell vents on top of flashing course and weep holes below shelf angles, spacing at 600 mm.

3.3.14 Install mortar deflection by placing the strips horizontally at all flashing locations. Place diagonally on top of the flashing to ensure that the mortar droppings are broken up and deflected away from the weep holes Mechanical attachment is not required. Install to manufacturer's instructions

3.4 Provisions for Other Trades

3.4.1 Provide openings in masonry walls where required or indicated for work of other trades.

3.4.2 Co-operate with other trades and accurately locate chases and openings and neatly finish to required sizes.

3.4.3 Where masonry encloses conduit or piping, bring to proper level as directed. Do not cover any pipe or conduit chases or enclosures until advised that work has been inspected, tested and approved.

3.4.4 Cut out neatly for electrical switches, outlet boxes, and other recessed or built-in objects.

3.4.5 Make cuts straight, clean, and free from uneven edges.

3.5 Mortar and Pointing:

3.5.1 Make all joints uniform in thickness, straight, in line, with mortar tooled to a smooth dense finish to form concave joints, except where specified otherwise. Use a non-staining jointing tool, which shall be clean and free of rust, salts and any other harmful materials.

3.5.2 On face of walls to which rigid insulation, resilient base, gypsum wallboard and other similar finishes will be applied directly, strike joint faces flush.

3.5.3 Rake out joint at juncture of intersecting masonry walls, control joints and elsewhere indicated where caulking is required.

3.5.4 Take particular care in preventing mortar splashes. Where they occur carefully remove them after mortar has hardened.

3.5.5 For sections of concrete block walls, as at door frames, and including short nibs which are less than 600 mm wide, fill cores of block units with mortar. Consolidate mortar with proper sized vibrators.

3.5.6 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, compressed, uniformly concave joints where concave joints are indicated.

3.5.7 Allow joints to set just enough to remove excess water, then rake joints uniformly to 6 mm depth and compress with square tool to provide smooth, compressed, raked joints of uniform depth where raked joints are indicated.

3.5.8 Strike flush all joints concealed in walls and joints in walls to receive gypsum board, tile, insulation, or other applied material except paint or similar thin finish coating.

3.6 Grouting

3.6.1 Mix grout to pourable consistency.

3.6.2 Pre-hydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 h nor more than 2 h then remix with sufficient water to produce mortar of proper consistency for pointing.

3.6.3 Grout under all steel bearing plates bearing on masonry as required for structural members with non-shrink grout, in accordance with manufacturer's printed instructions.

3.6.4 Ensure complete filling of voids between top of masonry and underside of plates.

3.7 Building-In

3.7.1 Build in items required to be built into masonry.

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

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

3.7.5 Where required, fill cores of concrete block units with mortar for anchoring built-in items.

3.10 Cleaning

3.10.1 Allow mortar droppings on concrete masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing.

3.10.2 Point or replace defective mortar as required or directed.

3.10.3 Scrub surfaces to be cleaned using a non-acid cleaning solution of type which will not harm constructed masonry. Check with masonry unit manufacturer for acceptable solution. Clean a trial test area and obtain approval to proceed.

3.11 Provision for Movement

3.11.1 Leave 3 mm space below shelf angles.

3.11.2 Leave 6 mm minimum or L/240 space where L is span of structural elements between top of partitions and structural elements. Do not use wedges.

3.12 Loose Steel Lintels

3.12.1 Install loose steel lintels. Centre over opening width.

**********END**********

1. **GENERAL**

1.1. Conform to Sections of Division 1 as applicable.

1.2. **RELATED SECTIONS**

1.2.1. Finish painting: Section 09 91 00, Painting.

1.3. **REFERENCES**

ASTM A53/A53M-02-	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A123/A123M-02	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M-02	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A269-02a	Standard Specification For Seamless and Welded Austenitic Stainless steel Tubing For General Service
ASTM A307-02	Specification for Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength
ASTM A325M-00	Specification for High-Strength Bolts for Structural Steel Joints [Metric]
ASTM A325-02	Specification for Structural Bolts, Steel, Heat-treated 120/105ksi Minimum Tensile Strength.
A1008/A1008M-02e1	Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
A1011/A1011M-02	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy and High-Strength Low Alloy with Improved Formability
ASTM A 653/A653M-02a	Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
CAN/CGSB-1.40-97	Anticorrosive Structural Steel Alkyd Primer
CAN/CGSB-1.81-M90	Air Drying and Baking Alkyd Primer for Vehicles and Equipment
CAN/CGSB-1.181-99	Ready Mixed Organic Zinc Rich Coating
CAN/CSA-G40.20/G40.21-98	General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels
CAN/CSA-G164-M92(R1998)	Hot Dip Galvanizing of Irregularly Shaped Articles
CAN/CSA-S16.01	Limit States Design of Steel Structures
CSA W47.01	Certification of Companies For Fusion Welding of Steel Structures
CSA W48.01	Filler Materials and Allied Materials for Metal Arc Welding

CSA W59-M1989(R2001)	Welded Steel Construction (Metal Arc Welding)
CAN/CSA-W117.2-01	Safety in Welding, Cutting and Allied Processes
SSPC	Steel Structures Painting Council, "Steel Structures Painting Manual Vol. 2"

2. PRODUCTS

2.1. MATERIALS

2.1.1. **Steel, Structural Quality, WWF, W-Shapes, HSS Sections and Structural Tees**: CAN/CSA-G40.20/G40.21, Grade 350W.

2.1.2. **Steel, Structural Quality, Plates, Angles and C-channels**: CAN/CSA-G40.20/G40.21, Grade 300W.

2.1.3. **Sheet Steel**:ASTM A 653/A653M,

2.1.4. **Sheet Steel**: Commercial Quality ASTM A1008, stretcher levelled or temper rolled.

2.1.5. **Galvanized Sheet Steel**: Galvanizing as specified ASTM A 653/A653M, structural and commercial quality sheets. Must be specially treated by phosphate conversion process if steel is to be exposed and finish painted.

2.1.6. **Fasteners (Concrete Anchors, Toggle Bolts, and Hammer Driver Bolts**) to ASTM A307, Star Expansion, Hilti (Canada) Ltd. or Ucan Fastening Products.

2.1.7. **Metal Filler**: Polyester based, White 'Lightning' by Marson Canada Inc. or Combo or First choice by Dura Chemicals Ltd.

2.1.8. Conform to following requirements: CAN/CGSB-1.40-M.

2.2. FABRICATION

2.2.1. Fit and assemble work in shop where possible. Execute work according to details and reviewed shop drawings. Where full shop assembly is not possible, make trial assembly in shop.

2.2.2. Do welding to CSA W59-M. File or grind welds smooth and flush where exposed to view and where specifically indicated on Drawings.

2.2.3. Fit joints and intersecting members accurately. Make work in true planes with adequate fastening.

2.2.4. Supply fastenings, anchors, accessories required for fabrication of work of this Section. Such items occurring on or in exterior wall or slab shall be hot dip galvanized.

2.2.5. Fastenings include without being limited to anchor bolts, machine bolts, toggle bolts, self drilling anchor, lag screws, expansion shields, sleeves, brackets, washers and nuts.

2.2.6. Provide bolts with all washers and nuts required for complete installation. Provide lock washers where vibrations may occur.

2.2.7. Make exposed metal fastenings and accessories of same material, texture, colour and finish as base metal on which they occur unless otherwise indicated or specified.

2.2.8. Keep exposed fastenings to an absolute minimum evenly spaced and neatly laid out.

2.2.9. Make fastenings of permanent type unless otherwise indicated.

3. EXECUTION

3.1. INSTALLATION

3.1.1. Build and erect work plumb, true, square, straight, level and accurate to sizes detailed, to reviewed shop drawings, free from distortion or defects detrimental to appearance and performance.

3.1.2. Insulate metals where necessary to prevent corrosion due to contact between dissimilar metals and between metals and masonry, concrete or plaster. Use bituminous paint, butyl tape, building paper or other approved means.

3.1.3. Supply instructions, templates, and, if necessary, supervise installation of fastenings or accessories requiring to be built-in by other Sections of Work.

3.1.4. After erection and installation, clean work and apply field touch of same formula as shop coat primer to damaged or unpainted surface of shop primed material. Work primer into joints, crevices, interstices and open spaces.

3.2. CONNECTIONS

3.2.1. Main member connections shall be welded or bolted with high tensile strength bolts and double angle connections as listed in CISC Code of Standard Practice for Structural Steel.

3.2.2. **Bolted Connections**

3.2.3. High strength bolted connections shall be bearing type using M20 (3/4") bolts conforming to ASTM A325M. Secondary members may be bolted with machine bolts.

3.2.4. Perform high tensile bolted connections in accordance with CAN/CSA-S16.1-M and be field tested.

3.2.5. Accurately space holes of size 1.6 mm (1/16") larger than nominal diameter of bolt. High tensile bolt connections shall be bearing (friction) type unless noted otherwise.

3.2.6. Provide compressor or electrical equipment capable of supplying and maintaining required pressure at wrench.

3.2.7. Make connections without use of erection bolts, some high tensile bolts will serve that purpose.

3.2.8. Nuts or bolts, except high tensile bolts, shall be prevented from becoming loose by burring bolt thread, by welding or by lock washers or lock nuts.

3.3. Fasteners

3.3.1. Supply fasteners, anchors and accessories required for erection of work of this Section. Ensure items occurring on or in exterior wall or slab are hot dipped galvanized.

3.3.2. In concrete and masonry, use epoxy injection anchor for vibration and heavy loads, and where anchors may be close to edge or close to adjacent anchors.

3.3.3. Use sleeve anchors in hollow block and brick for light static loads.

3.3.4. Use ULC approved drop-in anchors for pipe and sprinkler systems suspended from concrete ceiling.

3.3.5. Use wedge anchors for light to medium static loads in concrete.

3.3.6. Use concrete screws for light static loads in concrete, block and masonry.

3.3.7. Use heavy load expansion anchors for heavy static, vibratory or impact loading in concrete.

3.4. **SCHEDULES**

3.4.1. **General**: Provide miscellaneous metal work indicated on Drawings and not included in work of other Sections in addition to items listed below.

3.4.2. Where items are required to be built into masonry, concrete or other work provide such items to respective Sections with all anchors and accessories for building in.

3.4.3. **Itemized List**: Provide following metal work unless specifically designated to be supplied only. List supplied herein is not necessarily complete and shall be augmented by thorough inspection of Drawings and all other requirements to complete Work. Each item shall be as indicated on Drawings and as detailed on reviewed shop drawings:

3.4.4. **Support Framing Systems**: Provide steel support for ceiling supported fixtures and fittings other framing systems indicated, complete with anchors, brackets, sleeves, screws and incidentals required to complete installations.

- Secure to structure above as may be required.

3.4.5. Provide steel sections which are:

3.4.6. Not indicated to be supplied by another Section of Specifications.
OR

Not noted on Drawings to be supplied by another Section of Specifications.
OR

Not specified under another Section of Specifications.

3.4.7. Provide such items complete with anchors, brackets, bearing plates and other accessories required for installation.

3.4.8. Where steel sections are required to be built into masonry or concrete, supply such members to respective trades for building in.

3.4.9. Work shall include, without being limited to:

3.4.10. Miscellaneous Items: Provide items complete with anchors, brackets, sleeves, screws and other incidentals required and as detailed.

- Where steel items or supports are required to be built into masonry or concrete, supply such members to respective trades.

End of Section

ROUGH CARPENTRY 06 10 00

1 **GENERAL**

1.1 Conform to Sections of Division 1 as applicable.

1.2 **REFERENCES**

ASTM E84-10b	Standard Test Method for Surface Burning Characteristics of Building Materials
CAN/CSA G164-M92 (R2003)	Hot Dip Galvanizing of Irregularly Shaped Articles
CAN/CSA O80 Series-08	Wood Preservation
CSA O86-09	Engineering Design in Wood
CSA O121-08	Douglas Fir Plywood
CSA O151-09	Canadian Softwood Plywood
CAN/ULC-S102-10	Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
NLGA	National Lumber Grades Authority, Standard Grading Rules for Canadian Lumber, 2003
ULC	Underwriters' Laboratories of Canada

2 **PRODUCTS**

2.1 **MATERIALS**

2.1.1 **Framing Lumber**: Lumber for each type of structural component shall be of same species and grade, equally seasoned and shall be processed and stamped at same mill. Lumber identification shall conform to requirements of Standard Grading Rules for Canadian Lumber of National Lumber Grades Authority (NLGA).

2.1.2 **Grading**: 120, National Grading Rule for Dimension Lumber.

2.1.3 **Studs**: Spruce, 122b "Construction" light framing.

2.1.4 **Joists and Other Framing Members**: Spruce 124b. "No. 1" Structural Joists and Planks, except as otherwise specified.

2.1.5 **Members Other Than Studs and Less Than 89 mm (4") Wide**: Spruce, 122c. "Standard" light framing, except as otherwise specified.

2.1.6 **Nailing Strips, Blocking, Furring and Strapping**: Spruce, 122c. "Standard" light framing.

2.1.7 **Pressure Treated Lumber & Timber:** to comply with WPC -04-2012

2.1.8 **Exterior Sheathing shall be Softwood Plywood or Douglas Fir, CSA O121-M of Following Grades**:

2.1.8.1 Douglas fir plywood (DFP): to CSA 0121, standard construction.

2.1.8.2 Canadian Softwood Plywood: CSA O151, standard construction.

2.1.9 **Wood Preservative**

2.1.9.1 For painted surfaces use Pentox Conservat'r (clear) by Osmose-Pentox Inc. or Super Solignum-10-10 Paintable Penta by Solignum Inc.

2.1.9.2 For concealed surfaces use Pentox Green by Osmose-Pentox Inc. or Preserv-Green 1-42 by Solignum Inc.

2.1.10 **Rough Hardware**: Nails, screws, bolts, lag screws, anchors, special fastening devices and supports required for erection of carpentry components. Use galvanized components if exposed to exterior atmosphere. Galvanize in accordance with requirements of CAN/CSA-G164.

3 EXECUTION

3.1 INSTALLATION

3.1.1 Construct and install work as indicated on Drawings. **Contractor to provide support for fixtures and fittings as may be required for the support of exterior light fixtures located in the soffit.**

3.1.2 Machine dressed work shall be slow fed using sharp cutters and finished members shall be free from drag, feathers, slivers or roughness of any kind.

3.1.3 Frame materials with tight joints rigidly held in place.

3.1.4 Design construction methods for expansion and contraction of materials.

3.1.5 Erect work plumb, level, square and to required lines.

3.1.6 Be responsible for methods of construction and for ensuring that materials are rigidly and securely attached and will not be loosened by work of other trades.

3.1.7 Fasten wood nailers, blocking, framing and strapping solidly to adjacent materials in true planes.

3.1.8 **Furring, Bearing Plates and Rough Framing**: Provide and install where indicated on Drawings or required.

3.1.9 **Strips and Blocking**

3.1.9.1 Provide and install wood strips required for attaching work of other Sections.

3.1.9.2 Provide and install all wood blocking required.

3.1.10 **Wood Preservative Treatment**

3.1.10.1 Treat all surfaces of exterior blocking, curbs, cants and other concealed exterior woodwork, with wood preservative; apply in accordance with manufacturer's directions.

3.1.11 **Rough Hardware**

3.1.11.1 Supply and install all rough hardware.

3.1.11.2 Fasten to hollow units with toggle bolts and to solid masonry or concrete with lead expansion shields and lag screws. No organic fibre or wood plugs shall be used.

3.1.12 **Miscellaneous Carpentry Work**: Supply and install all other carpentry indicated on Drawings or as required for completion of work. Co-operate with other trades in installing items supplied by other Sections, cut openings in woodwork when so required and make good disturbed surfaces.

End of Section

1. GENERAL:

1.1 General Requirements

1.1.1 Conform to Sections of Division 1, as applicable.

1.2 Related Work Specified Elsewhere:

1.2.1	Finish Hardware:	Section 08 71 00
1.2.2	Painting:	Section 09 91 00
1.2.3	Rubber bases to casework:	Section 09 65 00
1.2.4	Solid Surfacing Countertops:	Section 12 36 61
1.2.5	Mechanical and electrical work:	Refer to drawings and specifications

1.3 Warranty:

1.3.1 Warrant work of this Section against delamination of plastic laminate work and warpage of millwork for a period of two (2) years from date Work is certified as substantially performed. Promptly make good defects and deficiencies which become apparent within warranty period including making good any work damaged by this work satisfactory to Designated Representative and at no expense. Defects shall include but shall not be limited to delamination of plastic laminate work and warpage of millwork.

1.4 Reference Standards

1.4.1 Do finish carpentry to Millwork Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC) latest edition, except where specified otherwise.

1.5 Qualifications of Fabricator

1.5.1 Casework shall be fabricated by skilled craftsmen employed by a firm having not less than five years of experience in the manufacturing of quality casework.

1.5.2 Assign a full time qualified supervisor or foreman during work of this Section. Such person shall have minimum three years experience in this particular field.

1.6 Submittals

1.6.1 Shop Drawings:

1.6.1.1 Submit shop drawings in accordance with General Conditions.

1.6.1.2 Shop drawings shall clearly indicate the material being supplied and shall show connections, thicknesses, finishes, hardware, attachments, reinforcing, anchorage and location of exposed fastenings. Indicate details of construction, profiles, jointing and other related details.

1.6.1.3 Clearly indicate method of installation.

1.6.2 Samples:

1.6.2.1 Submit three (3) 300 mm x 300 mm (12"x 12") samples of plastic laminates laminated to substrate and melamine as specified for review as specified in Section 01 33 00: Submittals, before proceeding with work. Samples shall show colours and details of edging forming and construction.

1.7 Product Delivery, Storage and Handling:

1.7.1 Provide protective coverings of suitable material for plastic laminated surfaces, take special precautions at corners.

1.7.2 Deliver millwork items when area is ready to receive work.

1.7.3 Protect materials against dampness during and after delivery.

1.7.4 Store materials in ventilated areas, protected from extreme changes of temperature or humidity. Do not store or install materials in areas where relative humidity is less than 25% or greater than 60% at 22 deg C.

1.8 Co-operation

1.8.1 Co-operate with Mechanical and Electrical Divisions for connection of services to casework from in-room rough-in points to final termination point.

2 PRODUCTS

2.1 Materials:

2.1.1 All wood shall be kiln dried.

2.1.2 Miscellaneous lumber for concealed framing of casework and finish carpentry items: Comply with NLGA, requirements, with maximum moisture content of 7% for interior work. Pine, spruce or fir species, to AWMAC economy grade.

2.1.3 Core: Plywood to CSA O115-M (G/SO) or CSA O121-M Grade "B" or Core material must be low VOC, low formaldehyde particleboard, Skyblend as manufactured by Roseburg Forest Products, Novopan Industrial-Grade particleboard or equal. Particleboard for use with laminated plastic, fine, smooth faces, to CAN3-0188.1-M78 Particleboard to CAN3-O188.1-M, Grade R.

2.1.4 Plywood for casework, cabinet doors, countertops and elsewhere specified: same as 2.1.3

2.1.5 Cabinet doors & boxes, exposed ends and faces exposed to view, gables: thermo-fused laminate, Colour: Inspiration 744 as manufactured by Uniboard, edging to match.

2.1.5 Edgeband of all cabinets, shelving and doors/drawers: 3 mm edgeband made of ABS or PVC plastic as manufactured to match the laminate or melamine colours

2.1.6 Countertops: refer to Section 12 36 61 for solid surfacing

2.1.7 Laminated plastic for flatwork: to CSA A172Type 1b, 0.062" (1.6 mm) thick;
Manufacturer: Arborite, Nevamar, Pionite, or Wilsonart
Colour: as specified or to be select by Designated Representative
Finish: Suede

2.1.8 Adhesive for use with laminated plastic sheets: of types recommended by laminated plastic manufacturer.

2.1.9 Sealer: water resistant sealer or glue acceptable to laminated plastic manufacturer.

2.1.10 Fasteners:

Nails, spikes and staples: to CSA B111; galvanized for decking Table 22, galvanized finish; sizes as recommended in CSA 086-1976. Supply 200 mm spiral spikes for lateral nailing, galvanized for interior highly humid areas and for treated lumber; plain finish elsewhere.

2.1.11 Box Drawer Slide:

2.1.12 Cabinet Hinges: Blum Clip Top, 170˚ opening angle, all metal hinge, nickel plated for 19 mm cabinet sides, type best suited for location and intended purpose

2.1.14 Drawers: full box plywood construction. Front shall be 19 mm (3/4") thick; sides and back shall be 12.7 mm (1/2") thick. Fit sides to front and back with dovetailed joints. Provide 6.4 mm (1/4") thick plywood bottom, grooved into sides and front and nailed to underside of drawer back. Install box drawer slides to manufacturer's instructions.

2.1.15 Steel Pilaster shelf standards and Supports: No. 255 Pilaster Standard with 256 ZC Steel shelf supports, surface mounted by Knape & Vogt Canada Inc., or equal. House all intersecting gables, sides, bottoms and fixed shelves. Set adjustable shelves on clips on metal pilaster strips housed into gables and sides. Offset pilaster strips where they occur on both sides of a gable.

2.1.16 Cabinet/Drawer Pulls: D door pull, brushed nickel finish, 33204195 by Richelieu or equal. Provide one drawer Pull for each drawer and cabinet door.

2.1.17 Hardwood lumber: to National Hardwood Lumber Association (NHLA) requirements, moisture content of maximum 7% for interior. Unless otherwise specified, Maple as detailed, to AWMAC premium grade and selected for matching colour and texture.

2.2 Fabrication and Manufacture:

2.2.1 General Workmanship

2.2.1.1 Fabricate and install work in accordance with the best practice by skilled craftsmen of companies specializing in the work specified and to the requirements of other trades. Each item shall be as shown on Drawings and as detailed on Shop Drawings.

2.2.1.2 Lay out work carefully and to accommodate work of other trades. Accurately cut and fit. Join work only over solid backing.

2.2.1.3 Dress all exposed surfaces of casework and finished carpentry members.

2.2.1.4 Make running members in longest lengths obtainable.

2.2.1.5 Properly frame members with tight joints. Use glue blocks where necessary.

2.2.1.6 As far as practicable shop assemble work in size easily handled and to ensure passage through building openings. Deliver to site ready for installation. Leave adequate allowance for fitting and scribing on site.

2.2.1.7 Conceal joints and connections where ever possible. Locate prominent joints where directed by Departmental Representative. Intermediate joints between supports will not be permitted. Glue and pin mortise and tenon joints. Construct joints made on site for equal quality and workmanship as joints made in shop.

2.2.1.8 Unless otherwise specified, glue work and blind screw or nail. Set nail heads occurring in exposed work. Countersink all screw and bolt heads below finished surfaces. Do not drive screws and bolts. Fill all fastening depressions in exposed work with wood filler.

2.2.1.9 Accurately scribe, cope and mitre members where required.

2.2.1.10 Ensure that finished woodwork is free from bruises, mineral marks, knots, shakes and other defects. Select materials to ensure acceptance for colour, grain and texture.

2.2.1.11 Provide a sandpaper fine finish to remove machine marks, scratches and other marks from exposed or partially exposed wood surfaces. Finish to an even, smooth surface and leave work ready for an applied finish.

2.2.1.12 Provide 9.5 mm (3/8") thick solid, matching hardwood strip by thickness of plywood, less face veneers, on all plywood edges, exposed in the final assembly. Ensure face veneers completely overlap wood strips. Secure strips to edges with bonding adhesive. No exposed fasteners permitted. Apply strips to edges of adjustable shelves.

2.3 Fabrication - Cabinet Work

2.3.1 Unit bodies shall be 19 mm (3/4") thick plywood, plastic laminate where indicated. All bodies shall have backs.

2.3.2 Unless otherwise indicated or specified, fabricate all casework in accordance with AWMAC standards for diversified construction, custom grade.

2.3.3 Provide all counters, cabinets, closets, shelving units, and all other units.

2.3.4 Refer to drawings for locations, details, number of units required and location of fittings.

2.3.5 Where indicated, provide thermo-fused melamine or plastic laminate finish.

2.3.6 Where indicated, provide splash backs and unless otherwise noted, make splash backs 100 mm (4") high. Return splash backs on side walls.

2.3.7 Obtain all miscellaneous metal items from Section 05 50 00 which are required to be installed by this Section for the construction and completion of wood casework.

2.3.8 Mechanical and electrical items are specified under work of Mechanical and Electrical Divisions. Co-ordinate work of those trades; make provisions to accommodate their work. Provide cut-outs required. Provide wood bearers for support, particularly at sink openings.

2.4 Laminated Plastic

2.4.1 Apply laminate backing sheet to reverse side of core of all plastic laminate work.

2.4.2 Ensure adjacent parts of continuous laminate work match in colour and pattern.

2.4.3 Apply laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface.

2.4.4 Form shaped profiles and bends as indicated, using post-forming grade and cold bending laminate to laminate manufacturer's instructions.

2.4.5 Form shaped profiles and bends as indicated, using post-forming grade and cold bending laminate to laminate manufacturer's instructions.

2.4.6 Use straight self-edging laminate strip for flatwork to cover exposed edges uniformly at approximately 20 deg. Do not mitre laminate edges.

2.4.7 Use full size sheets. Make joints only where approved and make such joints to hairline.

2.4.8 Make allowances around perimeter where items pass through or project into laminated plastic work to permit movement without restriction.

2.4.9 Provide cut-outs for grilles, fixtures, services and other similar items. Keep free of chips; round and file smooth all internal corners and edges and seal exposed core. Provide sufficient clearances to avoid stress in laminated plastic.

3 EXECUTION

3.1 Installation

3.1.1 Construct and install Work as shown on Drawings. Take measurements at site for finish carpentry work and casework to be built-in or attached to building structure, before commencing work of this Section.

3.2 Casework

3.2.1 Unless otherwise indicated or specified, fabricate casework units using the following materials and sizes. Factory assemble units carefully machined. Securely glue joints with bonding adhesive.

.1 Frame for floor mounted units: Thermo-fused melamine on particleboard core, not less than 1-1/2" x 3/4" full frame assembly.

.2 Countertops: 3/4" thick plywood. Fabricate countertops of both post-formed and square-edge construction as indicated. Provide drip grooves at underside of overhang on countertops with built-in sinks. Provide sealer at underside of countertop where sink or lavatory is specified.

.3 Sides, gables, tops, bottoms, shelves: unless otherwise indicated, 3/4" thick thermo-fused melamine on particleboard core.

.4 House intersecting gables, sides, bottoms and fixed shelves. Set adjustable shelves on clips on metal pilaster strips housed into gables and sides. Offset pilaster strips where they occur on both sides of a gable.

3.1.3 Unless otherwise indicated, block up bottom of floor mounted units to form a 100 mm high x 75 mm (4" x 3") deep toe space.

3.1.4 Where indicated, provide laminated plastic finish.

3.1.5 Where indicated, provide splash backs and unless otherwise noted, make splash backs 100 mm (4") high. Return splash backs on side walls.

3.1.6 Provide fillers of same material as casework, where necessary to fill voids between casework and between casework and walls or ceilings.

3.2 Storage Cabinets and shelving

3.2.1 Construct cabinets and shelving as noted.

3.2.2 Round corners, edges and ends. House all intersecting gables, sides, bottoms and fixed shelves. Set adjustable shelves on clips on metal pilaster strips housed into gables and sides. Offset pilaster strips where they occur on both sides of a gable.

3.3 Finish Hardware

3.3.1 Take delivery of finish hardware and install, except hardware specified as part of work of another Section or specified under this Section. Check each item as received.

3.3.2 Set, fit and adjust hardware according to manufacturer's directions at heights later directed by Designated Representative. Hardware shall operate freely. Protect installed hardware from damage and paint spotting.

3.3.3 Install hardware for steel doors except hinges.

3.3.4 Prepare wood doors for installation with required bevels, clearances and mortises for hardware. Install wood doors, grilles and applicable hardware, including hinges.

3.3.5 Fit, hang and trim wood doors. Leave 2 mm (1/16") clearance at head and jambs and 10 mm (3/8") bottom rails in areas to be carpeted. Install doors so that face on opening side is kept 2 mm (1/16") shy (recessed) from rebate even after bumpers installed. After trimming door have painter seal top and bottom edges of door and transom under Section 09 91 00, Painting and Finishing.

3.3.6 Pre-drill kick plates and doors before attachment of plates. Apply with water resistant adhesive and countersunk stainless steel screws.

3.4 Adjusting and Cleaning - Hardware

3.4.1 Check and adjust each operating hardware item to ensure proper operation and function of unit.

3.4.2 Lubricate moving parts as recommended by hardware manufacturer. Use graphite type lubricant if no other is recommended.

3.4.3 Repair or replace defective materials and units which cannot be adjusted and lubricated to operate freely and smoothly. Re-install items found improperly installed.

3.5 Hardware Mounting Heights

3.5.1 Mortise lock strike: 990 mm (39") from centre of knob to finished floor.

3.5.2 Deadlock strike: 1270 mm (50") from centre of cylinder to finished floor.

3.5.3 Mortised night latches: 1270 mm (50") from centre of cross bar to finished floor.

3.5.4 Panic sets: 1020 mm (40") from centre to finished floor.

3.5.5 Door pulls: 1020 mm (40") from centre to finished floor.

3.5.6 Push plates: 1120 mm (44") from centre to finished floor.

3.5.7 Blank strikes: 1270 mm (50") from centre to finished floor.

3.5.8 Blank fronts: 1270 mm (50") from centre to finished floor.

3.5.9 Door closer arms: to allow maximum degree of swing.

3.5.10 Floor stops: to allow maximum degree of swing.

3.6 Door Seals, Weather-stripping and Thresholds

3.6.1 Obtain door seals, weather-stripping and thresholds from Finish Hardware Sections.

3.6.2 Install door seal to doors to tightly seal entire perimeter of doors leading into where indicated. Secure in place with non-ferrous screws, in accurate alignment.

3.6.3 Adapt door seals as required to achieve specified performance and provide any necessary accessories.

**********END**********

1 GENERAL

1.1 General Requirements

1.1.1 Conform to Sections of Division 1 as applicable.

1.2 Related Work Specified Elsewhere:

1.2.1 Rough Carpentry: Section 06 10 00

2 PRODUCTS

2.1 Materials

2.1.1 Preformed Metal Soffit

.1 Profile:
- .1 Prefinished Aluminum Vented Soffit – perforated venting with holes, pre-cut to required length. as manufactured by Agway Metals Inc., Vic-West or equal.
- .2 Surface aspects - Colour: Dark Bronze
- .3 Maximum lengths: from 915 mm to 3656 mm horizontal
- .4 Thickness: 24 ga
- .5 Centre to centre distances: 300 mm
- .6 Profile depth: 12.7 mm
- .7 Trim pieces as required to suit site conditions.

3 EXECUTION

3.1 Preparation

3.1.1 Protect metal surfaces in contact with concrete, masonry mortar, plaster or other cementitious surface with isolation coating.

3.2 Installation - (Field Assembled)

3.2.1 Ensure trim pieces are securely fastened to structure.

3.2.2 Install soffit and support on trim pieces and in accordance with the manufacturer’s instructions and in accordance with the best practice.

3.2.3 Provide notched and formed end closures, sealed to arrest direct weather penetration at vertical profiles for soffit. Ensure continuity of rain screen principle. Install continuous starter strips, outside corners, edgings, soffit, drip, cap flashings.

3.2.5 Install fillers and closure strips with carefully formed and profiled work.

3.2.6 Install soffit as indicated.

3.2.7 Maintain joints in metal soffit, true to line, tight fitting, hairline joints.

3.2.8 Attach components in manner not restricting thermal movement.

3.3 Cleaning

3.3.1 Wash down exposed exterior surfaces using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths. Wipe clean as part of final clean-up.

END OF SECTION

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1 GENERAL

1.1 Conform to Sections of Division 1 as applicable.

1.2 **RELATED SECTIONS**

1.2.1 Cutting and patching: Section 01 45 00 Cutting and Patching.

1.2.2 Masonry partitions including mortaring in of fire dampers: Section 04 20 00 Masonry Procedures.

1.2.3 Sealants and caulking: Section 07 92 00, Sealants.

1.2.4 Gypsum board partitions: Section 09 29 00, Gypsum Board.

1.2.5 Mechanical: Division 15, Mechanical.

1.2.6 Electrical: Division 16, Electrical.

1.3 **REFERENCES**

CAN/ULC S101-07	Standard Methods of Fire Endurance Tests of Building Construction and Materials
CAN/ULC -S102-07	Standard Method of Tests For Surface Burning Characteristics, Building Materials and Assemblies,
CAN/ULC-S115-05	Standard Method of Fire Tests of Firestop Systems
ULC Guide No. 40 U19.13	FireStop Systems
ULC Guide No. 40 U19.15	FireStop Systems Components

1.4 **DESCRIPTION OF WORK**

1.4.1 Work of this Section is inclusive of all firestopping specified herein and indicated on Drawings except for firestopping and smoke seal within mechanical assemblies (i.e. inside ducts, dampers) and electrical assemblies (i.e. inside bus ducts) shall be provided as part of work of Divisions 15 and 16 respectively. Firestopping and smoke seals around outside of such mechanical and electrical assemblies, where they penetrate fire rated separations, shall be part of work of this Section.

1.4.2 Section include fire stopping materials and/or systems intended to act as firestop and smoke seal for any through-penetrating items, termination devices, receptacles or any unpenetrated openings or joints, including openings and spaces at perimeter edge conditions, with wall and floor assemblies having fire-resistance rating.

1.4.3 Fire stop and seal (draft-tight) gaps, expansion joints and penetrations in fire separations and fire walls against passage of fire, smoke, gasses, firefighter's hose stream and, where designated, passage of liquids. Smoke seal at angle support at fire dampers.

1.5 **QUALITY ASSURANCE**

1.5.1 Provide work of this Section using competent installers experienced trained and approved by material or system manufacturer for application of materials and systems being used. Installers shall have minimum 5 years experience in installation of firestopping materials as systems for multiple trade project.

1.5.2 Work of this Section shall be by 1 Sub-Contractor responsible for firestopping materials and systems for all of the Work except as outlined above.

1.6 **COORDINATION**

1.6.1 Coordinate with trades involved (and advise dates) where work will take place throughout various areas of Work.

1.7 **DELIVERY, STORAGE AND HANDLING**

1.7.1 Deliver materials to Site in manufacturer's sealed and labelled containers. Materials shall be subject to Designated Representative inspection.

1.7.2 Store materials inside building for 24 hours prior to use; store in area designated by Designated Representative; protect from damage and environmental conditions detrimental to material.

1.8 **ENVIRONMENTAL CONDITIONS**

1.8.1 Maintain minimum temperature of 5 deg C (40 deg F) for minimum period of 1 week before application, during application and until application is fully cured.

1.8.2 Conform to manufacturer's recommended temperatures, relative humidity and substrate moisture content for storage, mixing, application and curing of firestopping materials.

1.8.3 Ventilate areas in which firestopping is being applied. Protect water-soluble material from wetting until fully cured.

1.8.4 Use products that are environmentally responsible

1.9 **SUBMITTALS**

1.9.1 **Product Data**

1.9.1.1 Submit up-to-date manufacturer's product data for each material proposed for use under this Section. Include manufacture printed instructions for installation.

1.9.2 **Certification**: Submit (if requested) current ULC listings and certified copies of test reports and/or smoke seals indicating that firestopping material/systems conforms to or exceeds specified requirements.

2 **PRODUCTS**

2.1 **General**

2.1.1 Supply materials and systems capable of providing effective barrier against passage of fire, smoke, gasses in compliance with ULC S115 and where specifically indicated passage of liquids.

2.1.2 Ensure firestopping system provides fire-resistance rating (flame and temperature) not less than fire resistance rating of surrounding floor, wall or assembly, in accordance with requirements of OBC.

2.1.3 **Firestop system rating**: to ULC S115.

2.1.4 Firestopping seals except for wall joints in visible areas must be of easily identifiable colour, such as red or yellow to be clearly distinguished from other building materials.

2.1.5 Supply asbestos and PCB-free materials and systems tested in accordance with ULC-S115, be ULC listed, or be certified by Building Code officials in locality in which building is situated.

2.1.6 Ensure suitability of products for application and compatibility of materials with surfaces to which it will be applied.

2.1.7 Site system assembly shall be in accordance with ULC or UL listed system design limitations, unless proposed assembly is approved by authorities having jurisdiction and meets Designated Representative approval.

2.2 **Materials**

2.2.1 **Primers**: As recommended for specific substrate and use.

2.2.2 **Damming and Backup Materials, Support and Anchoring Devices**: Non-combustible, in accordance with tested assembly installed as acceptable to authorities having jurisdiction and as recommended by manufacturer. Combustible material for damming purpose may be permitted only if they are removed after permanent firestop materials are cured. Sheet steel covers over temporarily unused sleeves shall be minimum 0.9 mm (1/32") thick galvanized steel sheet and shall be supplied by Section 05999, Miscellaneous Metals. .

2.2.3 **Pipe and Duct Insulation and Wrappings:** Compatible with firestopping material; as recommended by manufacturer.

2.2.4 Fire stopping and smoke seals at opening intended for ease of re-entry such as cable: elastomeric seal. Do not use cementitious or rigid seal at such locations.

2.2.5 Fire stopping and smoke seals at opening around penetrations for ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

2.2.6 Do not use cementitious or rigid seal at such locations.

2.2.7 Sealants at vertical surfaces: non-sagging.

2.2.8 Sealants on floor surfaces requiring level finish: self-levelling.

3 EXECUTION

3.1 PREPARATION

3.1.1 Remove combustible material and loose material detrimental to bond from edges of penetration. Clean, prime or otherwise prepare substrate material to manufacturer's recommendation.

3.1.2 Do not apply firestop material to surfaces previously painted or treated with sealer, curing compound, water repellent to other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

3.1.3 Verify openings, dimensions and surfaces conform to fire and smoke seal assembly.

3.1.4 Comply with manufacturer's recommended requirements for temperature, relative humidity, moisture content and presence of any sealer or release agents on substrate during application and curing of materials. Surfaces shall be dry and frost free.

3.1.5 Fully protect walls, windows, floors and other surfaces around areas to be firestopped from marring or damage.

3.1.6 Prime surfaces in accordance with manufacturer's directions. Mask where necessary to avoid spillage on to adjoining surfaces. Remove stains on adjacent surfaces as required.

3.1.7 Remove insulation from area of insulated pipe and duct where such pipes or ducts penetrate fire separation unless ULC certified assembly permits such insulation to remain within assembly.

3.1.8 Provide temporary forming, packing and bracing materials necessary to contain firestopping. Upon completion, remove forming and damming materials not required to remain as part of system.

3.1.9 Install damming and firestopping materials as per manufacturer's instructions.

3.2 INSTALLATION

3.2.1 Seal penetrations through and gaps in fire rated separations. Fill gap in accordance with ULC details for tested system selected.

3.2.2 Mix and apply firestopping materials in strict accordance with manufacturer's written instructions and tested designs to provide required temperature and flame rated seal. Apply with sufficient pressure to properly fill and seal openings to ensure continuity and integrity of fire separation. Tool or trowel exposed surfaces as required.

3.2.3 Remove excess compound promptly as work progresses and upon completion.

3.2.4 Examine sizes, anticipated movement and conditions of opening and penetration to

establish correct system and depth of backup materials and of firestopping material required. Use firestopping and smoke seals best suited for specific application as required, indicated or specified. Use only components specified in fire test of system. Do not eliminate any component for firestop system that was present in fire tests.

3.2.5 Do not cover materials until full cure has taken place.

3.2.6 Provide firestop systems at following locations, without being limited to:

3.2.6.1 At all openings, voids and penetrations through fire rated masonry, concrete and gypsum board walls, partitions and shaft walls.

3.2.6.2 At all openings, voids and penetrations installed for future use through fire rated masonry, concrete and gypsum board walls, partitions and shaft walls.

3.2.6.3 Around mechanical and electrical assemblies penetrating fire assemblies.

3.2.6.4 Between tops of all fire rated walls and partitions and underside of floor or roof slabs as detailed

3.2.6.5 At all expansion joints in walls, floors and assemblies as detailed

3.2.7 Refer to all other sections of Specifications and the Drawings to ascertain where firestops are to be used and, if noted, type of firestop required.

3.2.8 Request inspection by Designated Representative of completed systems before they are covered.

3.2.9 **Curing**: Cure materials in accordance with manufacturer's directions.

3.3 CLEANING

3.3.1 Remove excess materials and debris and clean adjacent surfaces immediately after application to satisfaction of Designated Representative. Remove and/or correct staining and discolouring of adjacent surfaces as directed.

3.3.2 Remove temporary combustible damming materials after initial set of firestopping materials. Such dams may be required to remain in place if flame spread rating is below 25, in accordance with CAN/ULC -S102.

End of Section

1 GENERAL

1.1 Conform to Sections of Division 1 as applicable.

1.2 RELATED SECTIONS

1.2.1 Firestopping and smoke seals: Section 07 84 00, Penetration Fire-stopping.

1.2.2 Read other Sections of Specifications for extent of sealing specified in those Sections. Do all other sealing indicated, specified or required.

1.3 REFERENCES

CAN/CGSB-19.13-M87	Sealing Compound, One-Component, Elastomeric, Chemical Curing
CAN/CGSB-19.17-M90	One-Component Acrylic Emulsion Base Sealing Compound
CAN/CGSB-19.24-M90	Multicomponent, Chemical-Curing Sealing Compound

1.4 QUALITY ASSURANCE

1.4.1 **Qualifications**: Perform work of this Section by recognized and established sealant applicator having experience using skilled mechanics trained in use of sealing equipment and specified materials.

1.4.2 Submit proof of experience upon Designated Representative request.

1.5 DELIVERY, STORAGE AND HANDLING

1.5.1 Deliver caulking and sealing materials to Site in original, unopened containers with manufacturer’s labels and seals intact. Labels shall identify manufacturer's name, brand name of product, grade and type, application directions and shelf life or expiry date of product.

1.5.2 Handle and store materials in accordance with manufacturer's printed directions. Store flammable materials in safe, approved containers to eliminate fire hazards.

1.5.3 Do not use caulking and sealing materials that has been stored for period of time exceeding maximum recommended shelf life of materials

1.6 PROJECT CONDITIONS

1.6.1 **Environmental Requirements:** Do not apply any sealant under adverse weather conditions, when joints to be sealed are damp, wet or frozen or when at ambient temperatures below 5 deg C (40 deg F). Maintain minimum temperature of application during application and for 8 hours after application. Consult manufacturer for specific instructions before proceeding and obtain

Designated Representative approval.

1.7 **WARRANTY**

1.7.1 Warrant work of this Section against defects and deficiencies in accordance with General Conditions of the Contract. Promptly correct to satisfaction of Designated Representative and at no expense to Owner, any defects or deficiencies which become apparent within warranty period. Defects include, but are not limited to cracking, crumbling, melting, shrinkage, sag, failure in adhesion, cohesion or reversion, air and moisture leakage, marbling or streaking due to improper mixing, discolouration due to dirt pick-up during curing and staining of adjacent materials.

2 **PRODUCTS**

2.1 **MATERIALS**

2.1.1 **Colours**: Selected by Designated Representative from manufacturer's standard range to match colour of predominant materials to which sealant is applied.

2.1.2 **Formulation:** non-bleeding, non-migrating, and capable of supporting their own weight. Use self levelling type for horizontal surfaces and non-sag type at vertical and soffit applications. Use 1 manufacturer's product for each Type specified

2.1.3 **Sealant Type A**

2.1.3.1 One component modified urethane base chemical curing conforming to CAN/CGSB-19.13-M, Class MCG-2-25-B-N,

OR

Multi-component modified urethane base chemical curing conforming CAN/CGSB-19.24-M, Type 2, Class B.

2.1.4 **Sealant Type B**

2.1.4.1 One component, chemical curing, mildew resistant silicone conforming to CGSB-19GO22M,, containing non-toxic fungicidal agents,

2.1.5 **Sealant Type C**

2.1.5.1 One component, acrylic latex emulsion base, Interior Latex conforming to CAN/CGSB-19.17-M,
OR

One component urethane conforming to CAN/CGSB-19.13-M, Class MC-2-25-B-N,

OR

Multi-component modified urethane base chemical curing conforming CAN/CGSB-19.24-M, Type 2, Class B.

2.1.6 **Sealant Type D**

2.1.6.1 One component urethane conforming to CAN/CGSB-19.13-M, Class MC-2-25-B-N,

OR

Multi-component chemical curing polyurethane base conforming to CAN/CGSB-19.24-M, Type 1, Class B,

2.1.7 **Joint Backing**: preformed, compressible, resilient, non-waxing, non-extruding, non-staining strips of closed cell polyethylene or urethane foam. Sizes and shapes to suit various conditions, diameter 25% greater than joint width. Backing shall be compatible with sealant, primer and substrate.

2.1.8 **Bond Breaker Tape:** as recommended by sealant manufacturer.

2.1.9 **Joint Primer**: non-staining, suitable for substrate surfaces, compatible with joint forming materials and as recommended by sealant manufacturer.

2.1.10 **Cleaning material**: non-corrosive, non-staining, solvent type, xylol, methyl-ethyl-ketone (MEK), toluol, isopropyl alcohol (IPA) or as recommended by sealant manufacturer and acceptable to material or finish manufacturers for surfaces adjacent to sealed areas.

3 EXECUTION

3.1 EXAMINATION

3.1.1 Ensure joints are suitable to accept and receive sealants. Commencement of work implies acceptance of surfaces and conditions.

3.1.2 Do not apply sealant to masonry until mortar has cured.

3.1.3 Before any sealing work is commenced, test materials for indications of staining or poor adhesion.

3.2 PREPARATION

3.2.1 Ensure that all joint interfaces are clean.

3.2.2 Clean joints and spaces which are to be sealed and ensure they are dry and free of dust, loose mortar, oil, grease, oxidation, coatings, form release agents, sealers and other foreign material.

3.2.3 Clean porous surfaces such as concrete, masonry or stone by wire brushing, grinding or sandblasting as required to obtain clean and sound surfaces.

3.2.3.1 Remove laitance by grinding or mechanical abrading.

3.2.3.2 Remove oils by sandblast cleaning.

3.2.3.3 Remove loose particles present or resulting from grinding, abrading or sandblast cleaning by thorough brushing.

3.2.4 Clean ferrous metals of rust, mill scale and foreign materials by wire brushing, grinding or sanding.

3.2.5 Wipe non-porous surfaces such as metal and glass to be sealed, except pre-coated metals, with cellulose sponges or clean rags soaked with ethyl alcohol, ketone solvent, xylol or toluol and wipe dry with clean cloth. Where joints are to be sealed with silicone based sealants clean joint with methyl-ethyl-ketone (MEK) or xylol. Do not allow solvent to air-dry without wiping. Clean pre-coated metals with solutions or compounds which will not injure finish and which are compatible with joint primer and sealant. Check ferrous metal surfaces are painted before applying sealant.

3.2.6 Examine joint sizes and where depth of joint exceed required depth of sealant correct to achieve proper following width/depth ratio:

3.2.6.1 Maintain 2:1 width/depth ratio: minimum joint size shall be 6 mm (1/4") x 6 mm (1/4"), maximum depth of sealant to be 13 mm (1/2").

3.2.7 Install joint backing material to achieve correct and uniform joint profile.

3.2.8 Where joint design or depth of joint prevents use of joint backing material, apply bond breaker tape to prevent three-sided adhesion.

3.2.9 Do not stretch, twist, puncture or tear joint backing. Butt joint backing at intersections. Install bond breaker tape at back of joint where joint backing is not required or cannot be installed.

3.2.10 Where surfaces adjacent to joints are likely to become coated with sealant during application, mask them prior to priming and sealing.

3.2.11 Do not exceed shelf life and pot life of materials, and installation times, as stated by manufacturers.

3.2.12 Be familiar with work life of sealant to be used. Do not mix multiple component materials until required for use.

3.2.13 Use materials as received from manufacturer, without additions, deletions and adulterations of materials.

3.2.14 Mix multiple component sealants and bulks sealants using mechanical mixer

capable of mixing without mixing air into material, strictly in accordance with manufacturer's directions and recommendations. Continue mixing until material is homogeneously blended, uniform in colour and free from streaks of unmixed material. Install compound prior to start of hardening or curing cycle.

3.2.15 Seal joints in surfaces to be painted before surfaces are painted. Where surfaces to be sealed are prime painted in shop before sealing check to make sure prime paint is compatible with primer and sealant. If they are incompatible, inform Designated Representative and change primer and sealant to compatible types approved by Designated Representative

3.2.16 Where irregular surface or sensitive joint border exists, apply masking tape at edge of joint to ensure joint neatness and protection.

3.2.17 Prime all exterior horizontal joints. Prime sides of joints for type of surface being sealed prior to application of joint backing, bond breaker or sealant as recommended by sealant manufacturer

3.3 **APPLICATION**

3.3.1 Apply sealant using hand operated guns or pressure equipment fitted with suitable nozzle size and equipment approved by sealant manufacturer. Apply in accordance with manufacturer's directions and recommendations.

3.3.2 Force sealant into joint and against sides of joints to obtain uniform adhesion. Use sufficient pressure to completely fill all voids in joint regardless of variation in joint widths and to proper joint depth as prepared. Ensure full firm contact with interfaces of joint. Superficial pointing with skin bead shall not be acceptable.

3.3.3 Finish face of compound to form smooth, uniform beads. At recesses in angular surfaces, finish compound with flat face, flush with face of materials at each side. At recesses in flush surfaces, finish compound with concave face flush with face of materials at each side.

3.3.4 Compound may be tooled, provided that such tooling does not damage seal or tear compound. Avoid pulling of sealant from sides.

3.3.5 Tool surfaces as soon as possible after sealant application or before any skin formation has occurred, particularly when using silicone sealants.

3.3.6 Joint surfaces shall be straight, neatly finished, free from ridges, wrinkles, sags, dirt, stains, air pockets and embedded foreign matter or other defacement and be uniform in colour, free from marbling and/or colour streaking due to improper mixing or use of out of shelf life products.

3.3.7 Solvent curing sealants shall not be used indoors.

3.3.8 Use 1 of sealants specified for each type in following locations. Ensure sealant chosen (from several specified under each type under "MATERIALS") for each

location is recommended by manufacturer for use for conditions encountered.

3.3.8.1 Type A (non-traffic bearing): Joints between metal frames and adjacent masonry and/or concrete construction in exterior walls, exterior and interior; control and expansion joints in exterior and interior surfaces of poured-in-place concrete walls, precast architectural wall panels and unit masonry walls; sealing of joints between underside of pre-stressed precast concrete floor slabs and masonry; and all other locations where sealing is required or noted on Drawings except in locations designated for Type B, C and D and except where sealing specified in other Sections.

3.3.8.2 Type B: Joints between urinals and walls, around washrooms accessories, at corners of walls, between splash backs and walls, in shower, damp or wet areas, at ceramic tiles.

3.3.8.3 Type C: Joints between interior metal frames and adjacent construction in interior partitions.

3.3.8.4 Type D (traffic bearing): Joints in horizontal surfaces between concrete slabs, pavers and precast concrete panels.

3.3.9 Joint designation in preceding paragraphs and fact that Drawings do not show all locations to be sealed, does not limit responsibility of this Section to seal all locations except those indicated in other Sections of Work, required to create and ensure continuous enclosure.

3.3.10 Fire-stopping and smoke seal

3.3.10.1 Sealants part of firestopping systems and smoke seals provided within fire rated assemblies shall be part of work of Section 07 84 00, Penetration Fire-stopping and shall be carried out under supervision of this Section.

3.4 REPAIR

3.4.1 Remove any compounds not complying with requirements specified herein. Exercise care in removal operations not to mar or damage finishes adjacent to joints. Repeat preparation, priming and installation of new material as specified to provide finished work complying with specified requirements, and acceptable to Designated Representative. Do such repair work at no extra cost to Owner.

3.5 CLEANING

3.5.1 Immediately clean adjacent surfaces which have been soiled and leave Work in neat, clean condition. Remove excess materials, compounds smears or other soiling resulting from application of sealants. Use recommended cleaners and solvents.

3.6 PROTECTION OF COMPLETED WORK

3.6.1 Provide approved, non-staining means of protection for completed joint sealant installations where required to protect work from mechanical, thermal, chemical and other damage by construction operations and traffic.

3.6.2 Maintain protection securely in place until completion of Work. Remove protection when so directed by Designated Representative.

End of Section

1. GENERAL

1.1. Conform to Sections of Division 1 as applicable.

1.2. RELATED SECTIONS

1.2.1. Installation of steel door frames in masonry: Setting in place by Section 06 20 00, Finish Carpentry and Millwork, building in by Section 04 20 00, Masonry Procedures.

1.2.2. Caulking of door frames: Section 07 92 00, Joint Sealants.

1.2.3. Hardware supplied by Section 08 71 00, Finish Hardware, installed by Section 06 20 00, Finish Carpentry.

1.2.4. Finish painting: Section 09 91 00, Painting and Finishing.

1.3. REFERENCES

ASTM A 653/A653M-09	Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
ASTM A568M-09	Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold Rolled, General Requirements for
CSA W59-03	Welded Steel Construction (Metal Arc Welding)
CAN4-S104-M80 (R1985)	Fire Tests of Door Assemblies
CAN4-S105-M85 (R1992)	Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104
NFPA 80-90	Fire Doors and Windows

1.4. SUBMITTALS

1.4.1. Submit shop drawings in accordance with General Requirements

1.4.2. Indicate each type of frame, door, core, metal thicknesses and finishes, openings, glazed, fire ratings, location of exposed fasteners, hardware blanking, reinforcing, tapping and drilling arrangements. Show large scale frame sections and anchoring details. Submit door and frame schedule identifying each unit. Ensure each unit bears legible identifying mark corresponding to that listed in door and frame schedule.

1.4.3. Submit for Designated Representative approval, sample of frame corner showing construction, workmanship and finish.

1.4.4. Submit in addition to fire label, certificate to substantiate design and construction of fire-rated screen assemblies, if required by Designated Representative or authorities having jurisdiction.

1.5. DELIVERY, STORAGE AND HANDLING

1.5.1. Protect doors and frames during shipping and storage.

1.5.2. Note damage incurred during shipping.

1.5.3. Make good immediately any damage done. Clean scratches and touch up with rust-inhibitive primer. Replace damaged work which cannot be repaired, restored or cleaned.

1.5.4. Store materials on wood sleepers in dry area and cover to protect from damage. Coordinate this requirement with Section 06 41 00, Finish Carpentry and Millwork installing doors.

1.5.5. Remove wrappings or coverings from doors upon delivery at Site. Store doors in vertical position, spaced by blocking to permit air circulation between them.

2. PRODUCTS

2.1. **MATERIALS**

2.1.1. Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

2.1.2. **Sheet Steel:** Commercial grade steel to ASTM A568M, Class 1, hot-dip galvanized to ASTM A 653/A653M-96-Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, ZF 75 (A25).

2.4. STEEL CORE THICKNESS (MINIMUM)

		Metric Thickness	Gauge
2.4.1.	**Door Frames (and Transom Frames):**	1.519 mm	16
2.4.2.	**Side Light and Window Frame Assemblies:**	1.519 mm	16

2.4.3. Doors (and Transom Panels):

2.4.3.1. Hollow Steel Construction

-	Face Sheets	1.214 mm	18

	- Laminated Vertical Stiffeners	0.912 mm	20
2.4.4.	**Accessories (Doors and Frames)**		
2.4.4.1.	Reinforcements		
	- Lock and Strike Reinforcements	1.519 mm	16
	- Hinge Reinforcements	3.416 mm	10
	- Flush Bolt Reinforcement	1.519 mm	16
	- Reinforcement for Surface Applied Hardware	1.214 mm	18
	- Concealed Door Closer or Holder Reinforcements	2.657 mm	12
	- Top and Bottom End Channels	1.214 mm	18
2.4.5.	Steel Top Caps:	0.912 mm	20
2.4.6.	Mortar Guard Boxes:	0.759 mm	22
2.4.7.	Glass Trim (Screw Fixed or Snap-In Types):	0.912 mm	20
2.4.8.	Floor Anchors:	1.519 mm	16
2.4.9.	Jamb Spreaders:	0.912 mm	20
2.4.10.	Wall Anchors:		
	- Masonry T-strap Type	1.214 mm	18
	- Existing Masonry/Concrete Wall Type	0.912 mm	20
	- Masonry Wire Type	4.0 mm dia.	-
	- Masonry Stirrup-strap Type 50 mm x 250 mm (2" x 10" min.)	1.519 mm	16
	- Steel/Wood Stud Type	0.912 mm	20
	- Steel/Wood Stud Tension and Associated Wall Type	0.912 mm	20
2.4.11.	**Door Cores**		

2.4.11.1. Glass Fibre for Hollow Steel Doors With Stiffeners: Mineral wool insulation, minimum density 24 kg/m3 (1.5 pcf) minimum consisting of durable fibrous material processed from rock, slag or glass, bound with deterioration resistant binders, CSA A101-M, Type 1A.

2.4.12. **Primer:** Rust inhibitive touch-up only.

2.4.13. Fire Rated Door and Frame Assemblies: Conform to CAN4-S104-M,CAN4-S105-M and NFPA 80

2.4.14. **Adhesives**

2.4.14.1. Polyurethane Cores: Heat resistant, epoxy resin based, low viscosity, contact cement.

2.4.14.2. Lock-Seam Doors: Fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4.15. **Door Silencers:** Single stud rubber/neoprene type.

2.4.16. **Fasteners for Stops:** Cadmium plated steel, counter sunk flat or oval head sheet metal Phillips screws.

2.5. **FABRICATION**

2.5.1. Permit access by an approved inspection and testing company for purpose of inspecting at random doors under fabrication.

2.5.2. **Welding:** CSA W59-M.

2.5.2.1. Grind exposed welds smooth and flush. Fill open joints, seams and depressions with filler or by continuous brazing or welding. Grind smooth to true sharp arises and profiles, and sand down to smooth, true, uniform finish.

2.5.3. **Hardware Requirements:** Blank, mortise, reinforce, drill and tap doors and frames to receive mortised templated hardware. Check hardware list for requirements.

2.5.4. **Frames-General**

2.5.4.1. Fabricate frames for doors, screens and borrowed lights to profiles indicated.

2.5.4.2. Interior frames shall be 1.519 mm (16 ga) welded type construction.

2.5.4.3. Reinforce frame as required for surface mounted hardware. For door frames wider than 1.5 mm (5'), reinforce door frame head and jamb and mullions at junction of head.

2.5.4.4. Where frames occur in masonry provide strip strap, T-strap or wire type anchors. Where frames occur in gypsum board provide stud type anchors.

2.5.4.5. Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb. Provide 2 anchors for rebate opening heights up to and including 1.5 mm (5') and 1 additional anchor for each additional 760 mm (30") of height or fraction thereof, except as indicated below. For frames in previously placed concrete, masonry or structural steel provide anchors located not more than 150 mm (6") from top and bottom of each jamb and intermediate anchors at 660 mm (26") on centre maximum.

2.5.4.6. Where floor finishes allow, fabricate frames to extend 38 mm (1-1/2") below finished floor level. Where frames are to terminate at finished floor level, provide plates for anchorage to slabs.

2.5.4.7. Prepare each door opening for single stud door silencers: 3 for single door openings placed opposite hinges: 2 for double door openings approximately 150 mm (6") each side of centreline of head stop.

2.5.4.8. Supply removable portion of stop and frame where required for overhead concealed door closers and properly connect to frame and prepare for attachment to closer prior to shipment.

2.5.4.9. Install door anchor clips to gypsum board installers' directions for steel door frames in solid gypsum board partitions. Ensure clips are supplied by Section 09250, Gypsum Board.

2.5.4.10. Factory apply touch-up primer to areas where zinc coating has been removed during fabrication.

2.5.4.11. Construct door frames of labelled fire doors as detailed in Follow-up Service Procedures/Factory Inspection Manuals issued by nationally recognized listing agency to individual manufacturers and tested in conformance with CAN4-S104-M. Ensure ratings for frames match doors as minimum requirement. Locate label on frame jamb on hinge side, so it is concealed when door is closed.

2.5.4.12. Undercut 19 mm (3/4") for air intake at washrooms and other doors indicated on Door Schedule.

2.5.5. **Welded Type Frames**

2.5.5.1. Mitre corners of frames. Cut frame mitres accurately and weld continuously on inside of frame.

2.5.5.2. Protect mortise cut outs with mortar guard boxes. Omit for gypsum board applications.

2.5.5.3. When required due to large size of frame product, fabricate and ship to Site in sections. Indicate joints for field assembly on shop drawings.

2.5.5.4. Cope and weld butt joints of mullions, transom bars, centre rails and sills. Grind welded joints to smooth uniform finish.

2.5.5.5. Attach floor anchors to inside of each jamb profile.

2.5.5.6. Weld in 2 temporary jamb spreaders at each frame to maintain alignment during shipment.

2.5.5.7. Form glazing stops into channels, minimum 16 mm (5/8") height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

2.5.6. **Doors-General**

2.5.6.1. Fabricate doors to be swing type flush with 1 continuous face free from joints, tool markings and abrasions and with provisions for glass and/or louvre openings as indicated on Door Schedule and Drawings.

2.5.6.2. Fabricate interior doors to be hollow steel construction with polyurethane core.

2.5.6.3. For interior doors longitudinal edges shall have mechanically interlocked, tack welded 150 mm o.c. (6”), filled and sanded flush.

2.5.6.4. Fabricate doors with top and bottom inverted recessed spot welded channels.

2.5.6.5. Insulate exterior doors and frames with thermal breaks where possible.

2.5.6.6. Reinforce, blank, drill and tap doors for mortised, templated hardware.

2.5.6.7. Reinforce doors for surface mounted hardware.

2.5.6.8. Factory prepare holes 13 mm (1/2") diameter and larger. Factory prepare holes less than 13 mm (1/2") when required for function of device for knob, lever, cylinder, turnpieces or when these holes overlap function holes.

2.5.6.9. Fabricate fire rated door assemblies as detailed in Follow-up Service Procedures/Factory Inspection Manuals issued by nationally recognized listing agency to individual manufacturer and tested in conformance with CAN4-S104-M. Provide labels for fire rated doors.

2.5.6.10. Fabricate fire rated doors where indicated in Door Schedule or Drawings, to meet required maximum temperature rise on unexposed side of door in accordance with OBC and ULC requirements.

2.5.6.11. Construct rail and stile doors in same manner as flush doors.

2.5.6.12. Construct panels to match doors.

2.5.6.13. Reinforce panels to prevent oil canning. Install panels with concealed fasteners and reinforce to accommodate hardware as required. Provide door top and rebated matching panel where no transom mullion occurs.

2.5.7. Doors: Hollow Steel Construction

2.5.7.1. For interior doors fabricate door faces in single sheet of 1.519 mm (16 ga) for cell area doors and 1.219 mm (18 ga) steel thickness for common area doors.

2.5.7.2. Reinforce hollow steel doors with vertical stiffeners spaced 150 mm (6") o.c. maximum. Laminate stiffeners at common area and weld stiffeners to internal face of doors at top and bottom at cell area doors.

2.5.7.3. Fill voids between stiffeners with polyurethane core for interior doors.

2.5.8. **Prime Painting:** Apply factory touch up primer at areas where zinc coating has been damaged during fabrication.

3. EXECUTION

3.1. Installation

3.2. Supply steel doors and frames to Section 06 20 00, Finish Carpentry and Millwork for installation.

End of Section

FINISH HARDWARE 08 71 00

1 GENERAL

1.1 Conform to Sections of Division 1 as applicable

1.2 RELATED SECTIONS

1.2.1 Refer to Drawings, Specifications and Schedules for project scope.

1.3 REFERENCES

BHMA	Builder's Hardware Manufacturing Association
CAN/CGSB-69.34-93	Materials and Finishes
ULC	Underwriters Laboratories of Canada

1.4 SYSTEM DESCRIPTION

1.4.1 Keying System

1.4.1.1 To match existing facility.
1.4.1.2 Provide construction cores.
1.4.1.3 Provide all permanent cores and duplicate keys to Facility Representative.

1.5 SUBMITTALS

1.5.1 Shop Drawings & Samples

1.5.1.1 Submit samples of complete line of hardware and finishes to Designated Representative for approval, if and when requested, to accompany any proposal for substitution.

1.5.1.2 Submit shop drawings as per the schedule and as per the requirements of this section for approval by the Designated Representative.

1.5.1.3 Hardware shall not be ordered from manufacturer until shop drawings and samples have been approved by Designated Representative and Ministry Designee and hardware and finishes supplied shall be identical with approved samples.

1.6 DELIVERY, STORAGE AND HANDLING

1.6.1 Pack hardware in suitable wrappings and containers to protect it from injury during shipping and storage. Accessories, fastening devices and other loose items shall be enclosed with each applicable item of hardware. Mark packages for easy identification as indicated on approved delivery schedule.

1.6.2 Deliver to building finish hardware for door listed in Door Schedule. Hand hardware over to trades which are designated to install it.

1.7 **WARRANTY**

1.7.1 Warrant work of this Section against defects and deficiencies for period of 5 years for door closers, and 2 years for other hardware, in accordance with General Conditions of the Contract. Promptly correct defects and deficiencies which become apparent within warranty period, to satisfaction to Designated Representative and at no expense.

2 PRODUCTS

2.1 **MATERIALS**

2.1.1 The hardware to be supplied under this Section. Refer to Hardware Schedule.

2.1.2 **Hinges:**

2.1.2.1 Butts and hinges: to ANSI-A156.1, concealed bearing for use on heavy weight doors or High frequency usage, size, 114 mm x 102 mm and finish – satin chromium plated.

2.1.3 **Electric Strike:**

2.1.3.1 ANSI/BHMA A156.31, Grade 1; suitable for metal or wood frame;.24 Amps at 12 VDC/VAC, .12 Amps at 24 VDC/VAC, DC continuous duty/AC intermittent duty only; tamper resistant, static strength 1,500 lbs.; dynamic strength 70 ft-lbs.; Endurance 500,000 cycles; fail safe; dual voltage 12 or 24 VDC/VAC; non-handed; internally mounted solenoid; accommodates 5/8" – ¾" latchbolt (3/4" with 1/8" door gap); strike body depth 1-1/16"; plug-in connector.

2.1.4 **Locks:**

2.1.4.1 Heavy Duty Lever handle, satin chromium plated door hardware in compliance with ANSI A117.1 section 404.2.6; Listed by FHMA for A156.2, Series 4000, Grade 1; Listed bu UL for use on 3 Hr. A label for single or double swing doors,

2.1.4.2 Details: Backset – 2-3/4"; Core Housing – 7 pin housing; Function D Storeroom for BF Washroom – Function R for Classroom; contour angle return compatible with barrier-free requirements; 3-1/2" convex rose style;

2.1.5 **Barrier Free Door Operator:**

2.1.5.1 Heavy duty door closer, complete with actuators, control boxes, switches are rated 15 amps@ 30 VDC; Voltage 12/24 V AC/DC.

2.1.5.2 Switch Type: Momentary

2.1.5.3 Contact Type: SPDT Form 'C'

2.1.5.4 Mount operators on either push or pull sides of doors as required to place them inside rooms;

2.1.5.5 Electrical box and actuator: Hardwired low voltage actuator with stainless steel 114 mm x 114 mm x 32 mm square plate, engraved blue filled with handicap symbol. Box 51 mm wide x 102 mm high x 50 mm deep single gang electrical box, flush mounted in wall, locations indicated.

2.1.6 **Door Operator:**

2.1.6.1 Compliant with UL 325 and meets the provisions of ANSI A156.19, electrically powered low-energy operator designed primarily for automatic opening applications that occasionally require manual opening. Ship with motor gearbox, control box, mounting plate, standard arm, metal cover, standard track, wood and machine screws.

2.1.7 **Power Supply:**

2.1.7.1 Input voltage: 120/240 VAC, 50/60 Hz, universal input

2.1.7.2 Output voltage: 2A @ 12/24 VDC output, field selectable with jumper

2.1.7.3 Certifications: UL 294, Class 2, RoHS; FCC Part 15

2.1.7.4 AC Primary Fuse Size: 3.15A, 250v, 5 x 20 mm SLOW-BLOW

2.1.7.5 Battery Fuse Size: 7.5A 32v ATO blade style.

2.1.7.6 Low voltage DC, regulated and filtered

2.1.7.7 Single polarized connector for distribution board

2.1.7.8 Fused primary input

2.1.7.9 AC input and DC input output monitoring circuit w/LED indicators

2.1.7.10 Enclosure: Grey/Baked Enamel, 14” H x 12” w x 4” D, 8-1/2” x ¾” knockouts, NEMA 1 enclosure, Hinged cover w/lockdown screws, with High voltage protective cover.

2.1.8 **Emergency Call System:**

2.1.8.1 A complete equipment package specifically designed to meet the requirements of Ontario Reg. 368/13 amendment to 2012 OBC for Barrier Free & Universal Washrooms.

2.1.8.2 Audible and visual annunciation within restroom designed to confirm a request for assistance without disturbing occupant. Annunciation is activated until mushroom button is pulled ‘off’.

2.1.8.3 Single gang LED annunciator with sounder, and outside the restroom by single gang dome light with sounder.

2.1.8.4 ‘In the Event of an Emergency’ sign with 25 mm lettering.

2.1.9 **Restroom Control Kit:**

2.1.9.1 Surface Mount, illuminated push plate switch system including advanced logic control; 113 mm illuminated push plate switch (Push to Lock) with sign and 113 mm illuminated push plate (wheelchair symbol & Push to Open) with sign.

2.1.10 **Surface Mounting Enclosure:**

2.1.10.1 113 mm x 113 mm x 50 mm deep, surface box, standard depth, provision for wireless. Double wall, flame/impact resistant black polymer (ABS)

2.1.11 **Floor Mount Door Stops:**

2.1.11.1 Dome Door Stop, 47.625 dia. X 33.34 high x 12.7 rise; 1 piece zinc die casst construction; 0.856 kg; supplied with screws and shields standard finishes.

2.1.12 **Kick and Bumper Plates**

2.1.12.1 Door protection plates: Kick plate type, 1.27 mm thick stainless steel.

2.2 **FABRICATION**

2.2.1 **Strikes:**

2.2.1.1 Lock strikes as per Hardware Schedule

2.2.1.2 Blank standardized template strikes for hollow metal door frames shall be supplied for all doors without locks.

2.2.2 Kick and Bumper Plates

2.2.2.1 Kick and bumper plates shall be detailed and finished to match base building standard.

2.2.2.2 Stainless Steel kick plates shall be 1.27 mm (0.05") minimum thickness, finish to match base building standard

2.2.3 **Fasteners**

2.2.3.1 Supply hardware complete with screws, bolts, expansion shields and other fastening devices as required for satisfactory installation and operating of the hardware.

2.2.3.2 Supply fastening devices of same finish as hardware which is to be fastened.

2.2.3.3 Where pull is scheduled on one side of door, and push plate on other side, issue installation directions to trade responsible for fixing, so that the pull shall be secured through door from reverse side and push plate installed to cover screws. Flush pulls shall be supplied with machine screws for attaching as specified above.

2.2.4 **Finishes**

2.2.4.1 Type and finish of hardware shall be equal in all respects to samples of hardware and finishes approved by Designated Representative.

2.2.4.2 Metal finishes shall be free from defects, clean and unstained, and of uniform colour.

2.2.5 Finish hardware for fire rated doors shall meet requirements of ULC as part of fire rated door assembly and shall carry ULC or WH label.

3 EXECUTION

3.1 **EXAMINATION**

3.1.1 Before furnishing any hardware, carefully check all architectural Drawings of work requiring hardware, verify door swings, door and frame material and operating conditions, and assure that hardware will fit work to which it is to be attached.

3.1.2 Check shop drawings and frame and door lists affecting hardware type and installation, and certify to correctness thereof, or advise Designated Representative in writing of required revisions.

3.1.3 **Templates:** Check Hardware Schedule, Drawings and Specifications, and furnish promptly to applicable trades any templates, template information and manufacturer's literature, required for proper preparation for and application of hardware, in ample time to facilitate progress of work.

3.2 **LOCATION OF HARDWARE**

3.2.1 **Hinge Locations**

3.2.1.1 Doors 2311 mm (7'-7") and over in height and requiring 4 or more hinges.
- Top Hinge: 298 mm (11-3/4") maximum from centreline of hinge to frame head of rabbet.
- Centre Hinges: symmetrically spaced between top and bottom hinge.
- Bottom Hinge: 330 mm (13") maximum from centreline of hinge to bottom of frame.

3.2.2 **Lock Location**: 1024 mm (40-5/16") from centreline of lock to bottom of frame.

3.2.3 **Deadlock Strike Location**: 1219 mm (48") from centreline of strike to bottom of frame.

3.2.4 **Door Pulls**

3.2.4.1 1067 mm (42") from centreline of grip or push bar to bottom of frame.

3.2.5 **Push Plates**: 1143 mm (45") from centreline of plate to bottom of frame.

3.2.6 **Kick Plate**: Within 6 mm (1/4") of door bottom.

- Single Door Width: Push side; less 50 mm (2") of door width.
  Pull side; less 25 mm (1") of door width.

End of Section.

DOOR HARDWARE

Section 08710

PROJECT: Wye Marsh Wildlife Centre Proposed Washroom
16160 Highway 12 East
Midland, Ontario,

CONTRACTOR:

, ,

Tel:
Fax:

ARCHITECT: Formworks Architect
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Date: February 5, 2016

Manufacturer List

Code	Name
BE	Best Access Systems
CAMD	Camden(Hardware)
CHS	HES
CIV	Ives
CLC	LCN
CSM	Standard Metal
CVO	Von Duprin
GESC	G. E. SALLOWS CORP.

Finish List

Code	Description
26D	Satin Chrome
32D	Satin Stainless Steel
626	Satin Chromium Plated
630	Satin Stainless Steel
652	Satin Chromium Plated
689	Aluminum Painted
BLACK	Black

Hardware Schedule

HEADING #1

Opening Description: 3' 2" x 7' 0" Type HM F Type HM A

1	Single Door #103	corridor to b.f. washroom		90°	RH
3	Hinges	3CB1HW 4 1/2 x 4	652		CIV
1	Lockset	9K3-7D15D PATD	626		BE
1	Electric Strike	5200C	630		CHS
1	Restroom Control Kits	CX-WC13SM SURFACE MOUNT			CAMD
1	Emergency Call System	CX-WEC10 KIT			CAMD
1	Door Operator	9131 STD MC	689		CLC
1	Labor	OPERATOR INSTALLATION LABOR 1			GESC
1	Kick Plate	K10A 8" x 36" 3MT	32D		CSM
1	Dome Stop	S102	26D		CSM
1	Power Supply	PS902			CVO
1	Switch	CM-45/4 HANDICAP/PUSH TO OPEN - BLUE 4 1/2" square	32D		CAMD
1	Surface mounting enclosure	CM-43CBL	BLACK		CAMD
1	Labor	ELECTRONICS INSTALLATION LABOR			GESC

Note: Balance of hardware by door supplier. All electrified hardware shown to be installed and terminated by the hardware supplier. Division 16 to supply & terminate 120 VAC, supply back boxes, conduit & 18-2 low voltage wire as required. Contractor to supply wood blocking for secure mounting.

HEADING #2

Opening Description: 3' 2" x 7' 0" Type HM F Type HM A

1	Single Door #104	corridor to classroom		90°	LH
3	Hinges	3CB1HW 4 1/2 x 4	652		CIV
1	Lockset	9K3-7R15D PATD	626		BE
1	Kick Plate	K10A 8" x 36" 3MT	32D		CSM
1	Dome Stop	S102	26D		CSM

GLASS AND GLAZING 08 80 00

1 **GENERAL**

1.1 Conform to Sections of Division 1 as applicable.

1.2 **REFERENCES**

CAN/ CGSB-12.3-M91	Flat, Clear Float Glass
CAN/CGSB-12.5-M86	Mirrors, Silvered
CAN/CGSB-19.13-M87	Sealing Compound, One-Component, Elastomeric, Chemical Curing
CAN/CGSB-19.18-M87	Sealing Compound, One-Component, Silicone Base, Solvent Curing (WITHDRAWN)
CAN/CGSB-19.24-M90	Multi-component, Chemical-Curing Sealing Compound

1.3 **SUBMITTALS**

1.3.1 **Maintenance Data** : Provide maintenance data indicating cleaning instructions for inclusion into Maintenance Manual

1.4 **WARRANTY**

1.4.1 Warrant mirror's silvering from deteriorating for period of 10 years in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period to satisfaction of Owner and at no expense to Owner.

2 **PRODUCTS**

2.1 **MATERIALS**

2.1.1 **Mirrors, Silvered, Glass:** CAN/CGSB-12.5-M, clear or tinted, size(s) as indicated on Drawings, minimum 6 mm (1/4") thick float glass with process deposit of silver coats, copper coats and final protective seal, warranted for 10 years against deterioration of silvering.

2.1.1.1 Frameless Mirror Clips: for 6 mm Mirror by C. R. Laurence of Canada.

2.1.1.2 Back: Galvanized metal back, minimum 0.49 mm (26 ga) overall thickness, zinc coating designation Z275 for mirrors up to 406 mm x 610 mm (16" x 24"), and minimum 0.64 mm (24 ga) overall thickness zinc coating designation Z275 for mirrors over 406 mm x 610 mm (16" x 24"). Provide with hidden mounting device for vertical or horizontal setting as required.

2.2 **FABRICATION**

2.2.1 Label each light of glass and/or plastic glazing with registered name of product and weight and quality of glass and/or plastic glazing.

2.2.2 Check dimensions on Job Site before cutting materials.

2.2.3 Install openings in mirror for electrical wiring for glass mounted light fixtures. Confirm exact locations.

2.2.4 Grind and chamfer edges of unframed glass and mirrors.

2.2.5 Ensure minimum bite or lap of glass and/or plastic glazing on stops and rabbets as recommended by glass and/or plastic glazing manufacturer.

3 EXECUTION

3.1 INSTALLATION

3.1.1 Conform to recommendation of Glazing Manual 1990, Flat Glass Marketing Association, except as specified herein.

3.1.2 Check compatibility of glazing materials and framing sealants with each other.

3.2 WORKMANSHIP

3.2.1 Remove protective coatings. Clean glass surface to receive sealant with clean cloth dampened with Xylol or 50-50 mixture of Acetone and Xylol. Wipe dry with clean, dry cloth.

3.3 Mirrors

3.3.1 Install mirrors where indicated on Drawings. Ensure location of lighting sconces prior to cutting glass.

3.3.2 Mount plumb and level and accurately in position and secure rigidly in position.

3.3.3 Ensure back-up wall surface is thoroughly dry, smooth and firm and is primed or painted.

3.3.4 Provide space for air circulation and elimination of condensation between back of mirror and wall.

3.3.5 Install tamper proof mirrors according to manufacturer's directions.

3.3.6 Install mirrors without frames as follows with clips located uniformly
3.3.7 Place felt or plastic pad between mirror and each clip.

3.3.8 Install mirrors with frames according to manufacturer's direction. Use concealed tamper proof fasteners.

End of Section

GYPSUM BOARD 09 29 00

1 **GENERAL**

1.1 Conform to Sections of Division 1 as applicable.

1.1.1 **Definitions**: Drywall - Gypsum Board.

1.2 **RELATED SECTIONS**

1.2.1 Installation of steel frames and frame anchor in gypsum board partitions: Section 06 20 00 Finish Carpentry.

1.2.2 Finish painting: Section 09 91 00 Painting and finishing.

1.2.3 Mechanical installations: Mechanical Division

1.2.4 Electrical installations: Electrical Division.

1.3 **REFERENCES**

ASTM C11-04	Standard Terminology Relating to Gypsum and Related building Materials and Systems
ASTM C36/C36M-03	*Standard Specification for Gypsum Wallboard*
ASTM C79/C79M-04	*Standard Specification for Treated Core and Non-Treated Core Gypsum Sheathing Board*
ASTM C475-02	Standard Specification for Joint compound and Joint Tape for Finishing Gypsum Board.
ASTM C645-04a	Specification for Non-structural Steel Framing Members
ASTM A653/A653M-04a	Standard Specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C754-04	Standard Specification for installation of Steel Framing Members to receive Screw Attached Gypsum Panel Board
ASTM C840-04a	Standard Specification for the Application, and Finishing of Gypsum Board.
ASTM C919-02	Standard Practise for Use of Sealants in Acoustical Application
ASTM C954-04	Standard specification for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in (0.84mm) to 0.112 in (2.84mm) in Thickness.
ASTM C1002-04	Standard Specification for Steel Self-Piercing, Tapping screws for The Application of Gypsum Panel Products or Metal Plaster Base to Wood Studs or Steel Studs
ASTM C1047-04	Standard Specification for Accessories for Gypsum Wallboard and Veneer Base.
ASTM C1177/C1177M-04e1	Standard Specification for Glass Mat Gypsum

	Substrate for Use as Sheathing.
ASTM C1178/C1178M-04e1	Standard Specification for Glass Mat Water-resistant Gypsum Backing Panel
ASTM C1280-04	Standard Specification for the Application of Gypsum Sheathing.
ASTM C1396/C1396M-04	**Standard Specification for Gypsum Board (incorporates ASTM C36; C37, C79, C442, C630,C931, C960, C1395)**
ASTM D 3273-00	Standard Tests Method for The Resistance to Growth of Mould on the Surface of Interior Coatings in The Environment Chamber
ASTM E84-05	Standard Test Method for Surface Burning Characteristics of Building Materials.
ASTM E90-04	Standard Tests Methods for Laboratory Measurement of Airborne Sound Transmission Loss of Buildings, Partitions and Elements.
ASTM E413 –04	Classification for Rating Sound Insulation
CAN/ULC-S101-M89	Standard Methods of Fire Endurance Tests of Building Construction and Materials
CAN/ULC-S102-M88	Surface Burning Characteristics of Building Materials and Assemblies
CAN/ULC-S702-97	Thermal Insulation, Mineral Fibre, for Buildings
ULC	Underwriters' Laboratories of Canada

1.4 **DELIVERY, STORAGE AND HANDLING**

1.4.1 Deliver materials to Site with manufacturers original labels intact. Do not remove wrappings until ready for use.

1.4.2 No outside storage permitted. Store in clean, dry area, off ground.

1.4.3 Stack gypsum board flat on level and dry surface without overhanging boards. Prevent sagging and damage to edges, ends and surfaces. Protect bagged products from excessive moisture or wetting.

1.5 **PROJECT CONDITIONS**

1.5.1 After installation, do not leave fibre-reinforced gypsum sheathing board exposed to weather conditions longer than 60 days.

2 **PRODUCTS**

2.1 **MATERIALS**

2.1.1 **Gypsum Board**: ASTM C36/C36M, paper faced; edges tapered or square rounded, to suit specific application, 1200 mm (48") wide sheets of maximum practical lengths to minimize end joints, regular, 12.7 mm (½") thick unless indicated otherwise on Drawings.

2.1.2 **Metal Studs For Gypsum Board:** ASTM C645, Galvanized sheet steel, minimum 0.59 mm thickness, zinc coating G90 (Z275); (25 gsg) (0.0247"), screwable with crimped web and returned flange, of depth shown.

2.1.3 **Floor and Ceiling Partition Track for Gypsum Board**: Galvanized sheet steel, minimum 0.59 mm overall thickness zinc coating G90 (Z275); (25 gsg) (0.0247"), prepunched with square holes along Centre line and with minimum 30 mm (1-3/16") legs, top track having longer legs where required to compensate for deflection of structure above. Width to suit metal studs.

2.1.4 **Furring Channels**: Galvanized sheet steel, minimum 0.59 mm overall thickness zinc coating G90 (Z275), (25 gsg) (0.0247") screw channels, 66.7 mm wide x 22.2 mm deep, (2-5/8" x 7/8").

2.1.5 **Runner Channels**: Galvanized sheet steel, minimum 1.64 mm overall thickness zinc coating G90 (Z275) (16 gsg) (0.0635"), 38.1 mm (1-1/2") high with 19 mm (3/4") flanges, for primary furring member in suspended ceilings and as horizontal stiffeners or bracing in metal stud systems.

2.1.6 **Hangers**: 4.8 mm (3/16") nominal diameter mild steel rod.

2.1.7 **Tie Wire**: 1.60 mm nominal diameter (16 IW ga.) galvanized, soft annealed steel.

2.1.8 **Corner Bead**: Galvanized steel sheet, minimum 0.59 mm overall thickness zinc coating G90 (Z275) [(25 gsg) (0.0247")], ASTM A653/653M, minimum width of flanges 28.6 mm (1-1/8") for 12.7 mm (½") thick board and 31.8 mm (1-1/2") for 15.9 mm (5/8") thick board.

2.1.9 **Casing Bead**: Galvanized steel sheet, minimum 0.59 mm overall thickness zinc coating G90 (Z275) (25 gsg) (0.0247"), ASTM A653/653M, designed for finishing with joint compound.

2.1.10 **Gypsum Board Screws**: to ASTM C1002***;*** Self-drilling, self-tapping gypsum board screws, 25.4 mm (1") long #6 for single layer application, 41.3 mm (1-5/8") long #7 for double layer application**.**

2.1.11 **Laminating Compound**: asbestos-free, as recommended by manufacturer.

2.1.12 **Joint Cement, Tape, Topping & Compound to ASTM C475, Accessories to ASTM C1047**: As recommended by gypsum board manufacturer.

2.1.13 **Sponge Tape**: Self-sticking adhesive on 1 side, closed cell neoprene sponge tape.

2.1.14 **Adhesive**: Manufacturer's standard, multi-purpose construction adhesive.

2.1.15 **Sound Attenuation Blankets**: of sufficient thickness to meet required STC rating for sound-proofed partitions.

2.1.16 **Acoustic Sealant**: Non-hardening,

2.1.17 **Elastomeric Sealant**: as recommended by manufacturer of fibre-reinforced gypsum sheathing board.

3 EXECUTION

3.1 EXAMINATION

3.1.1 Temporary heat is provided under Section 01500, Temporary Facilities and Controls. Carry out work of this Section only when temperature is maintained and controlled in range of 13 deg C to 21 deg C (55 deg F to 70 deg F), for at least 24 hrs before installing gypsum board and is so maintained until joint cement and adhesives are cured.

3.1.2 Provide adequate ventilation to eliminate excessive moisture before commencing and during work to ensure proper drying of joint filler and adhesive. Do not force dry adhesive and joint treatment.

3.1.3 Examine substrate for compliance with applicable requirements, installation tolerances and other conditions affecting installation of fibre-reinforced gypsum board or sheathing. Do not proceed until unsatisfactory conditions have been corrected. Beginning of installation shall indicate acceptance of substrate conditions.

3.2 INSTALLATION

3.2.1 Conform to ASTM C840 for the application of interior gypsum board, except as specified otherwise herein.

3.2.2 Cooperate with mechanical, electrical and other trades to accommodate fixtures, fittings and other items in gypsum board areas.

3.2.3 Install casing bead and sponge tape where gypsum board abuts materials other than itself and acoustic tile ceilings including at exterior door and window frames, where juncture is not concealed with trim; or elsewhere where indicated on Drawings. Unless indicated otherwise, use tape 3 mm (1/8") narrower than casing bead to provide recess at exposed side. Compress tape by 25%.

3.2.4 If gypsum board abuts another gypsum board surface and joint is shown not to be taped and filled or otherwise covered, make juncture same as above.

3.2.5 Install sponge tape between gypsum board partition or furring framing, where such framing abuts exterior door or window frame.

3.2.6 Install sponge tape between floor and gypsum board partition track. Tape shall be either full width or 1 strip 9.5 mm (3/8") wide on each side of framing member.

3.2.7 Erect casing beads plumb or level with minimum number of joints. Do not use scrap pieces.

3.2.8 Where additional supports are not installed on electrical fixtures located in ceiling, provide written confirmation to Division 16 Electrical, when requested by Designated Representative, that suspended ceiling is capable of supporting weight of lighting fixtures, and other electrical fixtures required by Division 16, Electrical.

3.2.9 Allow for deflection at top of partitions to avoid transmission of structural loads to framing system.

3.2.10 Provide adequate reinforcing for framing to receive wall mounted fixtures and vanities.

3.2.11 Firmly fasten panel to framing members without cutting surface paper or fracturing core. Ensure panel joints are aligned. Lay out panels with maximum spacing between panels not to exceed 6 mm (1/4").

3.3 **Wall Furring**

3.3.1 Apply metal furring members vertically to masonry and concrete walls at 600 mm (24") o.c. or less as required to suit insulation sizes. Fasten members 600 mm (24") o.c. through flanges.

3.3.2 Shim furring members as required to present true, plumb line for application of gypsum board.

3.3.3 Locate furring members not more than 50 mm (2") away from openings, interior corners, intersections, frames, control joints and similar items.

3.3.4 Use 20 ga. metal furring where abuse resistant board is specified at masonry and concrete walls.

3.4 **Stud Partitions**

3.4.1 Install steel studs in accordance with ASTM C754 unless specified otherwise in this specification.

3.4.2 Provide accurately aligned partition tracks at top and bottom of partitions. Secure at 600 mm (24") o.c.

3.4.3 Erect studs vertically in partition tracks at 400 mm (16") o.c. and not more than 50 mm (2") abutting walls, openings and each side of corners.

3.4.4 Place attachment clip over main/cross tee from top. Line up pre-drilled hole on clip with hole on main/cross tee and screw clip to main/cross tee with 12 mm (½") wafer screw.

3.4.5 Screw through pre-drilled holes in attachment clip into top track of stud partition or glazed partition. Do not screw through ceiling grid.

3.4.6 Coordinate installation of attachment clip with Section 09510, Acoustic Ceilings. Do not damage ceiling grid system during installation of these clips.

3.4.7 Extend studs on each side of openings from floor to ceiling or structure above, whichever is indicated.

3.4.8 Locate 2 framing members on each side of framed openings. Frame over and below openings and runner sections at least 150 mm longer than rough openings. Cut ends to fit bend wed up and screw anchor to adjacent studs. Install cut to length intermediate vertical studs in same manner and spacing as wall studs over such framed openings. Securely anchor studs to head and jamb anchor clips of door frames by blot or screw attachment. Insert intermediate studs above and below channels to support gypsum board.

3.4.9 Install horizontal runner at top and bottom of rough opening in glazed partitions.

3.4.10 Install cut to length intermediate vertical studs, in same manner and spacing as wall studs, over door frames, above, and below other openings.

3.4.11 Where studs extend over 3600 mm (12'-0") in height provide horizontal bracing spaced approximately 2400 mm (8'-0") o.c. vertically and provide double studs at each side of door frames.

3.4.12 Size, brace and reinforce studs as necessary to provide sturdy, rigid partitions to heights and lengths required.

3.4.13 Securely anchor partition track to building structure and make 12 mm (½") allowance in partition studs for deflection of structure above to avoid transmission of structural loads on partitions. Do not secure studs or gypsum board to top track.

3.4.14 Where horizontal runs of service lines are to be installed, arrange with applicable trades to have lines installed prior to gypsum board application.

3.5 **Ceiling Furring**

3.5.1 **Hangers:**

3.5.1.1 Hangers for suspended gypsum board ceilings, bulkheads and duct furring shall support grillage independent of walls, columns, pipes, ducts, conduit and similar components. Erect hangers plumb and securely anchor to structure.

3.5.1.2 Where hangers are suspended from unfilled steel deck make holes through both sides of deck troughs and pass hanger through and down both sides of troughs. Ensure that ends of hangers are wrapped around vertical portion of hanger rod at insert.

3.5.1.3 Alternatively, in both composite and unfilled steel deck, hangers may be dropped through punched holes in bottom of deck troughs before deck is filled or covered, provided they are suitably and securely anchored at top.

3.5.1.4 Space hangers at maximum 1200 mm (4'-0") o.c. along runner channels and not more than 150 mm (6") from ends to support weight of ceiling and superimposed loads such as lighting fixtures, diffusers and grilles.

3.5.1.5 Where ducts are large or where combination of ducts, or combination of ducts and other items interfere so that hanger spacing exceeds 1200 mm (4'-0"), increase size of main runner channels and hangers accordingly to sustain increased loading and span.

3.5.2 **Runner Channels:**

3.5.2.1 Space runner channels at maximum 1200 mm (4'-0") o.c. and not more than 150 mm (6") from boundary walls, interruptions of continuity and changes in direction.

3.5.2.2 Run channels at right angles to structural framing members.

3.5.2.3 Where splices are necessary, lap members at least 200 mm (8") and wire each end with minimum double strand of tie wire. Avoid clustering or lining up splices. Provide hanger with in 150 mm (6") of splice.

3.5.2.4 Attach channels to rod hangers by bending hanger sharply under bottom flange of runner and securely wire in place with saddle tie.

3.5.3 Cross Furring

3.5.3.1 Erect furring channels at right angles to runner channels.

3.5.3.2 Space furring channels at 600 mm (24") o.c. and not more than 150 mm (6") from boundary walls, interruptions in ceiling continuity and change in direction.

3.5.3.3 Secure furring channels to each support with double strand of tie wire or with clip approved by manufacturer of furring components. Splice joints by nesting and tying channels together.

3.5.3.4 Furring channels shall be level to maximum tolerance of 3 mm (1/8") over 3600 mm (12').

3.6 **Ceiling Bulkhead**

3.6.1 Fur for gypsum board faced vertical bulkheads within and at termination of ceilings.

3.6.2 Fur above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as shown.

3.6.3 Install studs vertically at 450mm (18") o.c., aligning stud openings. Secure studs to tracks using pinching tool or screws. Brace stud framing to form a rigid system.

3.6.4 Construct corners using a minimum of three studs.

3.6.5 Provide extended leg ceiling runners as required to accommodate deflection.

3.7 **Gypsum Board - Single Layer**

3.7.1 **Ceilings**:

3.7.1.1 Apply gypsum board to metal furring with screws.

3.7.1.2 Erect board with long dimension parallel to supports. Locate end joints over supporting members.

3.7.1.3 Space screws at 200 mm (8") o.c.

3.7.2 **Partitions:**

3.7.2.1 Apply gypsum board to metal studs with screws.

3.7.2.2 Erect board with long dimension parallel to supports. Locate end joints over supporting members.

3.7.2.3 Locate vertical joints at least 300 mm (12") from jamb lines of openings.

3.7.2.4 Space screws at 200 mm (8") o.c. at board edges and 300 mm (12") o.c. on board field.

3.7.3 Ceiling and Partition Fasteners:

3.7.3.1 Perimeter screws shall be not less than 10 mm (3/8") or more than 13 mm (½") from edges and ends and shall be opposite screws on adjacent boards.

3.7.3.2 Drive screws with power screw gun and set with countersunk head slightly below surface of board.

3.7.4 **Joints:**

3.7.4.1 Finish all joints.

3.8 **Fire Rated Construction**

3.8.1 Provide fire rated enclosures, separations, and assemblies as indicated on the drawings conforming to requirements of Authorities Having Jurisdiction.

3.9 **Finishing**

3.9.1 **Level of Finishing to ASTM C840. Work of this project shall be Level 4.**

3.9.1.1 **Level 0**: no taping, finishing or corner beads are required.

3.9.1.2 **Level 1**: All joints and angles shall have tape embedded in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.

3.9.1.3 **Level 2**: All joints and angles shall have tape embedded in joint compound and have one separate coat or joint compound wiped with joint knife and leaving a thin coating over the tape and fastener heads. Accessories shall be covered by one coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges shall be acceptable.

3.9.1.4 **Level 3**: All joints and angles shall have tape embedded in joint compound and two separate applications of joint compound over all joints, angles and fastener heads. Accessories shall be covered with two separate coats of joint compound. Joint compounds shall be smooth and free of tool marks and ridges. The prepared surface shall be covered with a drywall primer prior to the application of the final decoration.

3.9.1.5 **Level 4**: All joints and angles shall have tape embedded in joint compound. and have three separate coats of joint compound over all joints, angles and fastener heads. Accessories shall be covered with three separate coats of joint compound. All joint compounds shall be free of tool marks and ridges. The prepared surface shall be covered with a drywall primer prior to the application of the final decoration.

3.9.1.6 **Level 5**: Equal to level 4 and in addition, a skim coat shall be applied. Excess material shall be immediately sheared off, leaving a film covering the paper. The prepared surface shall be covered with a drywall primer prior to the application of the final decoration.

3.9.2 Do filling either manually, using tools of trade, or by mechanical taping and filling machine of proven efficiency.

3.9.3 Apply joint filler, tape and topping cement according to manufacturer's directions.

3.9.4 Finished work shall be smooth, seamless, plumb, true and flush, having square, neat corners.

3.9.5 Drive home fasteners protruding above panel surface. Fill fastener depressions.

3.9.6 Apply continuous coat of joint compound to fill channel formed by tapered edges of panels. Center tape and lightly press to embed in compound. Apply thin coat over tape.

3.9.7 Apply joint compound over butt joints and embed tape in manner similar to tapered joint. Provide sufficient quantity of compound under the tape to ensure adequate bond.

3.9.8 Apply coat of joint compound to corner and casing beads.

3.9.9 Fold tape to form 90E angle. Apply joint compound to both sides of corner. Embed in taping compound.

3.9.10 After joint compound has dried completely. Apply additional coats of finishing compound to obtain required level of finish. Provide recommended sanding between coats as recommended by manufacturer.

End of Section.

1. GENENERAL

1.1. Conform to Sections of Division 1 as applicable.

1.2. Contractor is responsible for all wall preparation to ensure level and proper installation of new finishes.

1.3. RELATED SECTIONS

1.3.1. Sealant at junction of lavatory splashback and urinals and ceramic wall tile: Section 07 92 00, Sealants.

1.3.2. Toilet and bath accessories: Section 10 80 00, Washroom Accessories.

1.4. REFERENCES

ANSI A108.4, ANSI A118.1	ANSI A118.3, ANSI A118.4, all part of
ANSI 108.1-1985	Installation of Ceramic Tile
ASTM C207-91 (1997)	Specification for Hydrated Lime for Masonry Purposes
CGSB 71-GP-22M-78	Adhesive, Organic, for Installation of Ceramic Wall Tile
CGSB 71-GP-30M-79	Adhesive, Epoxy and Modified Mortar Systems, for Installation of Quarry Tiles
CAN/CGSB-75.1-M88	Tile, Ceramic
CAN/CSA-A5-98	Portland Cement
CSA A179 –94(R1999)	Aggregate for Masonry Mortar
TTMAC	Terrazzo Tile & Marble Association of Canada

1.5. SUBMITTALS

1.5.1. Samples

1.5.1.1. Submit 4 samples of each colour, texture, size and pattern of tile.

1.5.2. **Maintenance Manual:** Submit 3 copies of maintenance manual issued by TTMAC in accordance with Schedule B.

1.5.3. **Test Area: Provide test area to ensure satisfaction of tile installation for approval of joint width and installation of large format tile, removal of grout from tile face (floor tile) and for insurance that installation of grout sealer has been applied as per manufacturer's recommendations.**

1.6. PROJECT CONDITIONS

1.6.1. **Environmental Requirements:** Maintain air and structural base temperatures

at ceramic tile installation area above 12 deg C (54 deg F) for 48 hrs before, during, and 45 hrs after installation.

2. PRODUCTS

2.1. General

2.1.1. Following abbreviations of manufacturer's or supplier's company names apply.

Abbreviations	Full Name of Company
Crest	Crest
Dymac	Dymac Chemical
Flextile	Flextile Ltd.
H.L. Blachford	H.L. Blachford Ltd.
Laticrete	Laticrete International Inc. - Canada
LePage	LePage Ltd.
Olympia	Olympia Floor and Wall Tile Company
Mapei (Chembond)	Mapei Inc.
Thoro	Thoro system Products of Canada Ltd.

2.1.2. **Ceramic Tile**

2.1.2.1. Ceramic Wall Tile (backsplash): Lifestyle Exagon, Grey tile as supplied by Ceratec or equal.

2.1.3. **Mortars and Adhesives:** Use of following mortars or adhesives is Contractor's choice, subject to restrictions stated and Site conditions, except where epoxy or acid resistant mortar and grout is required.

2.1.3.1. Thin Set Mortar: ANSI 118.1, or ANSI 118.4 (CGSB 71-GP-30M for Type 2) except where epoxy adhesive required:

- For glazed and unglazed wall and floor tile, water absorption class MR 2: Kerabond or Ultraflex II by Mapei or Multicure (Modified System) by C-Cure or No. 52 Versatile by Flextile.

- For vitreous (glazed) floor and wall tile, with less than 0.5% absorption; and size 300 mm x 300 mm or larger; water absorption class MR 1: Multicure (Modified System) by C-Cure or Kerabond/Keralastic by Mapei or No. 52 Versatile by Flextile.

- For high absorption glazed wall and ceiling tile, with water absorption class MR 4: C-Cure wall mix by C-Cure or Kerabond by Mapei.

OR

2.1.3.2. Latex Modified Thin Set Mortar: For conditions above use Multi-cure by C-Cure or other latex mortar conforming to ANSI A108.4, , except where epoxy

adhesive is required.

OR

- C-Crylic 200 with Permabond (Premium Mix over concrete substrate) and/or Multicure (Modified System) by C-Cure or Kerabond mixed with Keralastic by Mapei.

OR

2.1.3.3. Mortar Bed: Mixed on Site of following components:

- Cement: CAN/CSA-A5-M, Type 10 Portland.

- Sand: CSA A179.

- Hydrated Lime: To ASTM C207, Type S.

- Latex or Acrylic Additive: Formulated for use in Portland cement mortar, by Thoro, or C-Crylic 200 by C-Cure, or Acrylic Mortar Additive by Flextile or Planacrete 50 by Mapei or Laticrete 3701 by Laticrete or Acryli-crete 5000 by Crest or Permalast by Lepage.

- Water: Potable, free of minerals detrimental to mortar and grout mixes.

OR

2.1.3.4. Adhesives:

- Organic Adhesive: CGSB 71-GP-22M, Type 1 for intermittent wet areas, Duoflex #90, or #99 by Flextile or Ultramastic 1 by Mapei or TA-190 Double Duty Modular, or Perma II-2001 by LePage, or Dymac #68 by Dymac; Type 2 elsewhere, Econobond #93 by Flextile or Crest 3000 by Crest or Perma II-2002 by LePage, or Dyamc #64 by Dymac except where epoxy is required.

- Epoxy Adhesive: ANSI A118.3, CGSB 71-GP-30M Type 1 (100% solids epoxy), Chemset by Master Builders or Epoxy 100 by C-Cure, Latapoxy SP-100 by Laticrete, Kerapoxy by Mapei or Flex-Epoxy 100 by Flextile.

- Epoxy Adhesive: ANSI A118.3, Chemset by Master Builders or Flexi-Bond by Crest, or Permaplus 3030 by LePage.

- Epoxy Adhesive: ANSI A118.3, Chemset by Master Builders or Epoxy 100, 200 by C-Cure, Flex-Epoxy, Flex-Epoxy 100 by Flextile, or Kerapoxy by Mapei, or Latapoxy 210, Latapoxy SP-100 by Laticrete, or Crest Epoxy 200, Epoxy 100 by Crest.

- #90 Duoflex by Flextile, or Ultramastic I by Mapei, or Perma I-2001 by

LePage, or Dymac #68 by Dymac.

2.1.4. **Grouts:** Use of following grouts is Contractor's choice subject to restrictions stated. Colour for wall tile grout-white, unless otherwise specified.

2.1.4.1. Grout cleaner: Deterdek descaler cleaner, Fila Surface Care Products, as supplied by Olympia Tile.

2.2. **MIXES**

2.2.1. **Mortar Bed**

2.2.1.1. Scratch Coat: 1 part cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand, 1 part water. Adjust water volume depending on water content of sand. Use as little water as possible to obtain a stiff mix.

2.2.1.2. Slurry Bond Coat: Cement and water mixed to creamy paste. Latex additive may be included.

2.2.1.3. Levelling Coat: 1 part cement, 4 parts sand, 1 part water, including minimum 1/10 part latex additive (as per manufacturer's instructions) such as Level-Cure by C-Cure.

2.2.1.4. Bond or Setting Coat: 1 part cement, 1/3 part hydrated lime, 1 part water.

2.2.1.5. Measure mortar ingredients by volume.

2.2.2. **Thin Set Mortar:** Mix to manufacturer's instructions.

2.2.3. **Organic Adhesive:** Pre-mixed.

3. **EXECUTION**

3.1. **INSTALLATION**

3.1.1. Wipe back side of tile with slightly damp towel or sponge to remove dust, dirt and/or residue. Apply back-buttered thin coat of fresh mortar or adhesive approximately 2 mm (1/16") thick to back side of each tile immediately before laying into freshly applied wet notch trowel applied mortar bond coat. Provide 100% mortar coverage at perimeter edges and corners.

3.1.2. Apply tile and backing materials to clean and sound surfaces and in accordance with setting system specified.

3.1.3. Remove paper facing after setting and adjust tiles where applicable.

3.1.4. Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Make cut edges smooth and even.

3.1.5. Maximum Surface Tolerance: 1:800.

3.1.6. Make joints between tiles uniform and approximately 1.5 mm (1/16") wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.

3.1.7. Lay out tiles so perimeter tiles are minimum 1/2 size.

3.1.8. Sound tiles after setting and replace hollow sounding units to obtain full bond.

3.1.9. Make internal angles square and external angles (rounded).

3.1.10. Use round trim at termination of wall tile panels, except where panel abuts projecting or right angle surface or flush adjacent surface.

3.1.11. Allow minimum 24 hours after installation of tiles before grouting. Prepare and apply grout to manufacturer's instructions.

3.1.12. Clean installed tile surfaces after grouting cured.

3.1.13. **Setting System**

3.1.13.1. Wall Tile: Install in accordance with TTMAC detail 303W-2002, 304W-2002

3.2. **Grouting**

3.3.1 Apply grout in strict accordance with manufacturer's printed instructions.

3.3.2 Force grout into joints for full depth, level with surface of tile. Scrape surplus grout from surface of tile thoroughly and quickly. After grout has attained slight initial set, completely clean-up and polish surface of tile.

3.5. **CLEANING & PROTECTION**

3.5.1. Apply descaler as may be required. Install as directed by product manufacturer.

3.5.2. Prohibit all traffic in work areas during installation and for 72 hour after installation of tile.

End of Section

TERRAZZO 09 40 00

1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Conform to Sections of Division 1, as required.

1.2 WORK INCLUDED:

1.2.1 Work of this section includes restoration, and repair and cleaning of all existing terrazzo flooring in area of work where terrazzo flooring to remain, patching and filling of terrazzo flooring and terrazzo base in areas affected by removals or slab cutting is required for installation of services or where new doors, or partitions and where existing openings are infilled.. Work shall include final washing and sealing of terrazzo flooring in area of work. Work shall include all required cutting of slab to install flooring level to existing terrazzo as may be required. Underbed in areas of new work is to be included.

1.3 REFERENCE STANDARDS

1.3.1 Do terrazzo restoration in accordance to Maintenance Guide latest revision, produced by Terrazzo Tile and Marble Association of Canada (TTMAC).

1.4 SUBMITTALS

1.4.1 Submit proposed terrazzo mix and colour to match existing for approval by Designated Representative.

2 PRODUCTS

2.1 Wax Stripper: as recommended by floor restoration company.

2.2 Cleaning Products: neutral type pH detergent.

2.3 Cleaning products containing acid or tri-sodium phosphate (TSP) should not be used on the tile.

2.4. Sealer: as recommended by floor restoration company.

2.5 Cement: Portland cement to CAN 3-A5-M77, Type 10

2.6 Sand: Sharp, screened sand: CAN 3-A23.1-M77.

2.7 Water: Clean, drinkable water, free from oil, acids, alkali or organic matter.

2.8 Marble, granite chips: clean and sound, colour to match existing

2.9 Colour pigments: Non fading mineral pigments to British standard 1014, colour to match existing

2.10 Reinforcing mesh: 50 mm x 50 mm, No. 16 x No. 16, steel mesh, electrical welded, galvanized after fabrication, conforming to CSA G30.5, as may be required.

2.11 Divider Strips: 32 mm deep except where existing conditions do not permit, adjust depth to suit site conditions.

2.12 Cleaners, sealers and floor finish: Terrazzo, Tile and Marble Association of Canada Types 1001, 1002, 1003, 1004, 2001, 2002 and 3001 as applicable.

2.2 MIXES/PROPORTIONS

2.1.1 Underbed: one part of cement to four parts sand by volume. Wet and mix thoroughly. Generally use no more than 18 litres of water per bag of cement for underbed mix.

2.1.2 Terrazzo Topping, must match existing: Use mix appropriate to type of terrazzo used, using cement mix and chip size in proportions and colour to match existing.

3 EXECUTION

3.1 TERRAZZO FLOOR CLEANING AND RESTORATION

3.1.1 Clean terrazzo according to latest edition of Manual #200 prepared by Terrazzo, Tile and Marble Association of Canada.

3.1.2 Prior to cleaning the floor surface and during the cleaning process, it is imperative that the wash mop or scrubbing pad, pail and water be thoroughly clean. Water must be changed frequently.

3.1.3 Remove existing wax or polymer floor finishes with heavy-duty stripper and cleaner. Use 1 to 3 parts cleaner to 40 parts warm or cold water as per manufacturer's recommendations. Apply with a clean mop or sponge depending on size of are. Agitate with a brush or scrubbing pad. Remove dirty solution with wet vacuum. Wet mop or sponge dry. Follow with wet cleaning, rinsing and finishing.

3.1.3 Refinishing terrazzo floor where only a light grinding is required is to start with an 80 to 120 grit stone to remove surface sealers and dirt. Further grind the terrazzo to improve the overall appearance and desired surface texture.

3.1.4 Where the floor is in need of in-depth restoration use a terrazzo floor grinding machine, wet grind a thin layer of terrazzo to remove surface sealers and dirt as above starting with a coarser grit. In the case of badly pitted surfaces it may be necessary to grind with coarser grit, such as 24 grit stone, diamond plugs or discs. Further grind the terrazzo with progressively finer grits to obtain a new-like appearance. Grinding with a finer stone higher than 80 grit may affect the slip-resistance.

3.1.5 Grout in areas where there are exposed pits after the grinding process. Wash the floor with clean water and rinse, remove excess water. If the existing terrazzo is two components epoxy resin, the surface must be fully dry before applying the apoxy grout. Apply grout by machine or by hand with a trowel, using a cement acrylic or epoxy mix, with or without pigment to match existing floor making sure to fill all voids. Allow the grout to cure 24 hours before grinding. Grind floor with an 8- or finer grit stone until all grout has been removed from the surface, leave the surface free from any deep scratches. Pick up all grained residue, flush floor with clean water, remove excess water and rinse using a clean mop. Allow the floor to thoroughly dry.

3.1.6 Apply two coats of sealer.

3.1.7 The same procedure applies to refinishing stairs, using grinding machines and appropriate grinding stones or sanding discs.

3.1.8 Sealers must have a slip resistance factor of 0.5 or higher.

3.2 Installation of New Terrazzo floor & base, Repairs affected by Removals and areas where existing floor has been cut, trenched and removed.

3.2.1 Cut areas of slab carefully in areas where indicated on drawings to achieve required depths for installation of new flooring. Cuts shall be square and true such that divider strips can be installed to separate the new and existing terrazzo.

3.2.2 Underbed: Apply over prepared substrate and screed level making allowances for applicable terrazzo toping. Permit underbed to cure minimum 24 hours prior to receiving terrazzo topping.

3.2.3 Divider Strips: Install divider strips in underbed while it is still in plastic state. Set strips true and level where new and existing terrazzo meet.

3.2.4 Standard Terrazzo Topping: After a minimum of 24 hours following installation of underbed, soak underbed, remove excess water and place a slurry consisting of cement and colour using same proportion as used in the existing terrazzo or in close approximation to make a close colour match. Wet topping mixture, mix thoroughly and apply to underbed while slurry is still wet. Sprinkle topping with wetted marble chips to match existing. Roll topping with heavy rollers to compact topping and remove excess water and cement. Hand trowel to level terrazzo toping flush with top of divider strips and cure. Surface and grout terrazzo when it has set sufficiently hard. Surface by machine rubbing with No. 24 grit or finer abrasive blocks. Use plenty of wter during grinding. Immediately following initial grinding, flush terrazzo surfaces thoroughly using water only and apply a grout to fill the voids. Mix grouts same proportions as used in topping. Allow grouted surface to cure for at least 48 hours and then re-surface by machine rubbing using No. 120 grit abrasive blocks and plenty of water. Following removal of grout, scrub terrazzo thoroughly using machine scrubbers and ample clean water. Rinse terrazzo with clean water and then dry thoroughly. Apply coat of sealer as soon after cleaning as possible.

3.2.5 Apply sealer in accordance with manufacturer’s written instructions. Wipe off excess water before it dries. Apply second coat of sealer in same matter as first, but not until all other work is

complete and terrazzo has been cleaned again as previously specified above. Apply two coats of surface finish.

3.2.6 Clean and seal as recommended by manufacturer.

3.3 Terrazzo Bases (if required to match existing, where installed)

3.3.1 Apply underbed with sufficient water to form a stiff mix. Install coved base dividers in line with every floor divider. For terrazzo topping, omit sprinkling of surface chips and rolling specified for standard terrazzo topping. Refer to details 5,6, 7, Portland Cement Terrazzo

3.2.7 Clean and seal as recommended by manufacturer.

********** END **********

ACOUSTIC TILE CEILING 09 51 00

1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Conform to Sections of Division 1 as applicable.

1.2 RELATED WORK

1.2.1 Mechanical Fixtures: Division 15

1.2.2 Electrical Fixtures: Division 16

1.3 SUBMITTALS

1.3.1 Submit samples of acoustical units for approval prior to ordering.

1.3.2 Obtain approval of Ontario Hydro and Authorities having Jurisdiction for the ceiling grid and supports as related to the support of the light fixtures. Adjust grid, fixing devices and support hangers as required to obtain approval.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

1.4 Ship grid members and mouldings in rigid crates and avoid damage. Bent or deformed materials will be rejected.

2 PRODUCTS

2.1 MATERIALS

2.1.1 Lay-in Panels: The panels shall meet the following requirements and classifications when tested in accordance with ASTM E1264. Asbestos free, water-felted mineral fibre,15 mm (5/8") thick, to suit grid dimensions, square edge, having a smooth, non-directional finish, scratch-resistant, impact-resistant, soil-resistant, **Flat Black finish**, and having a humidity-resistant treatment to prevent warp or sag and coating applied to face and back of panels to inhibit surface growth of mould/mildew.

-Flame resistant rating: Class A (UL)
-Noise reduction coefficient 0.55
-Ceiling attenuation class 35

'2415' Radar ClimaPlus by CGC; or Fine Fissured - 1729 by Armstrong World, Colour: Flat Black 205 or Tech Black

For ceiling replacement of all other areas, the ceiling tile shall be as above but white.

2.1.2 Suspension System: Heavy Duty exposed tee system, DX/DXL, 15/16" Tee System by CGC or 'Prelude 15/16' by Armstrong World Industries Canada Ltd., or other approved manufacture; Colour: Flat Black 205. Components of system shall be from one manufacturer; exposed tee system and panels shall be from one manufacturer. Interlocking tee system designed to support louvers as detailed, consisting of main tees and cross tees. The system shall provide lock joint intersections of cross and main tees.

.1 Exposed main tee: 24 mm (15/16") exposed face and 38 mm (1-1/2") high bulb tee design with double web and separate exposed cap piece. Splice shall be integral and reversible.
.2 Exposed cross tee: 24 mm (15/16") exposed face and 38 mm (1-1/2") high bulb tee design of same fabrication as main tee, with off-set ends to allow cross tee flange to sit on main tee flange providing flush exposed faces, and with positive interlock to main tee.
.3 Edge Moulding: formed angle to provide 25 mm (1") exposed face similar to exposed face of tee.

2.1.3 Hanger wire: 2.6 mm (12 gauge), galvanized soft annealed steel wire.

2.1.4 Hanger inserts: purpose made.

2.1.5 Carrying channels: 1-1/2" x 3/4" x 18 ga. steel

2.1.6 Accessories: splices, clips, wire ties, retainers and wall moulding, to complement suspension system components, as recommended by system manufacturer.

2.1.7 **Sound Attenuation Blankets (above ceiling at Barrier Free Washroom)**: non-combustible, lightweight, semi-rigid stone wool batt insulation to CAN/ULC-S702, Type 1, thickness 152 mm.

3 EXECUTION

3.1 INSTALLATION

3.1.1 Co-ordinate the work with all trades affected by the work of this Section. Provide a layout of hangers and framing suitable to accommodate fittings and units of equipment. Failure to follow this procedure will require that the hangers and channels be revised to suit as necessary without additional cost to the Owner.

3.1.2 Install suspension system in accordance with ASTM C636, and manufacturer's instructions, except where specified otherwise.

3.1.3 Where ducts or other equipment prevent the regular spacing of hanger, reinforce the nearest adjacent hangers and related carrying channels and furring as required to span the greater distance.

3.1.4 Lay out work in accordance with reflected ceiling plans. Provide a tolerance of 1/360 of span and 2 mm (1/16") maximum between adjacent edges of metal pans. Allowable tolerance of finished acoustical ceiling system: 4 mm in 3600 mm (1/8" in 12 ft.) and 0.4 mm (1/64") between adjacent metal members. Tolerances shall not be cumulative.

3.1.5 Supply hangers or inserts for installation to the respective Section in ample time and with clear instructions for their correct placement. Provide additional hangers and inserts as required.

3.1.6 Design and space hangers and carrying members to support the entire ceiling system including lighting fixtures, diffusers and grilles. Recessed objects shall replace or be centred on acoustical panels, except where indicated otherwise. Consult with mechanical and electrical trades to co-ordinate the work.

3.1.7 Hang suspension system securely from structure above with hanger wires at approximately 4'-0" (1.2 m) centres maximum, both ways. Crimping of hangers not permitted. Locate hangers to avoid interference with ductwork and piping. Secure hangers to main tees by looping end of hanger through hole in tees and tying end of hanger to its= vertical suspension with minimum two twists. Hang suspended ceilings independently of walls, columns, ducts, pipes and conduit. Where carrying members are spliced avoid visible displacement of the longitudinal axis or face plane of adjacent members.

3.1.8 Centre acoustical ceiling installation on room axis leaving equal border pieces. Provide a row of hangers adjacent to and parallel with the walls for the support of the ends of the main tee runners at not more than 6" (150 mm) from the ends of runners. Lay directionally patterned tile one way with pattern parallel to longest room axis unless otherwise directed.

3.1.9 Do not erect ceiling suspension system until work above ceiling has been inspected and accepted by Departmental Representative and Authorities having Jurisdiction.

3.1.10 Install finished work rigid, secure, square, level and plumb, framed and erected to maintain dimensions and contours indicated. Make allowance for thermal and structural movement.

3.1.11 Where ceiling suspension system is to be supported from steel deck construction above, support fixtures and other similar heavy items independently of suspended ceiling framing. Where this is not practical nor possible, provide framing members designed to carry superimposed loads and provide additional hangers to adequately support loads without sag.

3.1.12 Erect suspension systems at required heights and water tube, transit or laser beam level to tolerance of 1/8" over 12'-0".

3.1.13 Install exposed tee members to pattern indicated. Securely attach hangers to main tee members.

3.1.14 Space cross tee bars to suit ceiling panels and as detailed, and to accommodate lighting fixtures, diffusers, exhaust grilles and other built-in items properly fit into ceiling module and finish flush with rest of ceiling.

3.2 INSTALLATION - ACOUSTICAL BATTS

3.2.1 Lay acoustical batts in the new ceiling space onto new ceiling grid and tiles.

3.2.2 Lay batts over partitions and in close contact with adjoining batts.

3.2.3 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures and minimum 50 mm from sidewalls of chimneys and vents.

********** END **********

1 GENERAL

1.1 Conform to Sections of Division 1 as applicable.

1.1.1 Flooring Contractor is responsible to ensure that the existing surfaces are prepped with levelling compound as required for the new flooring to adhere to the existing terrazzo. Substrate must be level and smooth.

1.2 SAMPLES

1.2.1 Submit samples in accordance with General Requirements.

1.2.2 Submit duplicate 610 mm x 610 mm (24" x 24") full size samples of flooring and base material for Departmental Representative approval, before ordering.

1.3 MAINTENANCE DATA & INSTRUCTIONS

1.3.1 Provide 3 copies of detailed instructions for maintaining, preserving and keeping resilient flooring clean in accordance with General Requirements.

1.3.2 Include adequate warning of maintenance practices or materials detrimental to resilient flooring.

1.4 QUALITY ASSURANCE

1.4.1 Work shall be executed by company approved by manufacturer and experienced in this type of installation, having successful history of similar installations.

1.5 DELIVERY, STORAGE AND HANDLING

1.5.1 Deliver products in accordance with manufacturers' written recommendations. Label containers to clearly identify contents by product description, manufacturer, lot number, size, colour and pattern.

1.5.2 Protect materials from freezing.

1.5.3 Deliver products to area of work minimum 24 hours prior to installation. Remove them from containers to allow them to become fully acclimatized.

1.6 ENVIRONMENTAL REQUIREMENTS

1.6.1 Ensure temperature of room floor surface and materials is not less than 21 deg C (70 deg F) for 24 hours before, during and for 7 days minimum after installation.

1.6.2 Room temperature shall be between 65° & 85° F deg (18° & 30° C) at least 48 hours prior to, during and after installation.

1.6.3 Ensure humidity levels of spaces to receive tile are maintained at design levels for minimum 48 hours before installation.

1.6.4 Avoid high humidity, cold drafts and abrupt temperature change.

1.7 **WARRANTY**

1.7.1 Warrant work of this Section against defects and deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become evident during warranty period including, but not be limited to, buckling, opening of seams, bond failure and extensive colour fading, to satisfaction of Departmental Representative and Facility representative and at no expense

2 **PRODUCTS**

2.2 **MATERIALS**

2.2.1 **Heavy Duty Safety Flooring:** to ASTM F1303, Reaction to Fire ASTM E648, Class 1, Enhanced Slip EN 13845 E Sf, Abrasion Resistance EN13845 50,000 cycles; EN 649 Group T; Polysafe Modena Pur – as manufactured by Polyflor or equal. Welding rods shall match flooring.
Colour: to approval of Departmental Representative.

2.2.2 **Integral Cove Base**: ASTM F 1344, Class I A solid colour, 3 mm (1/8") thick x 100 mm (4" minimum) high, vulcanized, in coil lengths, [complete with pre-moulded corners], colour as indicated.
Colour: to be approved by Departmental Representative

2.2.3 **Rubber Base for application where noted**: as may be required at existing flooring locations and to new millwork.

2.2.4 **Thresholds, Adapters to existing flooring**: as may be required at existing flooring locations.

2.3 **Primers and Adhesives:** Adhesive for Resilient Flooring Apply adhesive as recommended by applicable flooring and base manufacturers which will produce good and permanent bond between substrate and flooring, and between wall surface and base. Flooring installer must use manufacturer's product for manufacturer's warranty to apply.

2.4 **Levelling Materials**: as recommended by flooring manufacturer, compatible to their product and adhesives.

2.5 **Neutral Cleaner:** Taski ' Profi' or Johnson Wax Professional 'Stride' oil and grease emulsifying neutral detergents (pH of 7-8)

3 EXECUTION

3.2 INSPECTION

3.2.1 Ensure that substrate is dry and smooth. Report to Departmental Representative any irregularities detrimental to flooring application.

3.3 PREPARATION

3.3.1 Clean and vacuum floor free of dirt, grease or other deleterious matter that will affect adhesion of flooring. All floors must be clean, smooth flat to within 1/8” x 10 ft. and dry. Dust, scale, and loose particles must be removed. The surface must be free of solvents, paint, grease, oil, was alkali, sealing/curing compounds, and any other foreign material, which could affect adhesive bonding.

3.3.2 Remove irregularities and fill depressions with non-shrinking latex compound.

3.2.1.1 **Completely remove all adhesives**.

3.3.3 Do not install flooring over expansion joints.

3.3.4 All concrete subfloors should be tested for moisture, pH (alkalinity) and proper bonding.

3.4 INSTALLATION

3.4.1 Levelling Coat

3.4.1.1 Fill joints in underlay with non-shrinking, latex cement filler. Force filler carefully into joints, nail heads and fill depressions, cracks, gouges and chipped edges with patching compound. Sand smooth when set.

3.4.1.2 Apply levelling coat over underlayment panels receiving new flooring where required. Prepare and prime existing surfaces, mix levelling compound, apply and finish levelling compound in strict accordance with manufacturer's printed instructions.

3.4.2 Adhesive and flooring

3.4.2.1 Apply adhesive uniformly with approved notch-tooth spreader at manufacturer's recommended rate.

3.4.2.2 Lay tile flooring with joints parallel to building lines to produce symmetrical tile pattern. Adjust starting lines to ensure border tiles are not less that tile width.

3.4.2.3 Lay flooring with joints flush, uniform, in moderate contact. Fit by freehand knifing, direct scribing. Do not double cut flooring material.

3.4.2.4 Install approved edging where floor tile terminates adjacent to dissimilar flooring material or at different finished floor height. Install thresholds at door ways.

3.4.2.5 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.

3.4.2.6 Apply welding rods as recommended by manufacturer.

3.4.3 **Bases**

3.4.3.1 Fill cracks and level irregularities of surface to which base is applied with filler approved by adhesive manufacturer to provide solid backing over entire area behind base.

3.4.3.2 Cement cove base to vertical surfaces so that gaps do not occur behind base, so that front lip of base cove bears firmly and uniformly on floor surfaces and so that good and permanent bond is produced between base and surface to which it is applied.

3.4.3.3 Set base in adhesive tightly against wall and floor surfaces. Use pieces of base minimum 18" (0.5 m) long.

3.4.3.4 Lay out base to keep number of joints at minimum. Uniformly space joints; butt to moderate contact.

3.4.3.5 Scribe and fit to door frames and other obstructions. Use pre-moulded end pieces at flush door frames.

3.4.3.6 Apply bases as shown complete with stops. Use premoulded external and internal corners; mitre internal corners.

3.4.3.7 Use full length pieces where practicable, accumulated short lengths not permitted.

3.4.3.8 Butt joints and keep flush without gaps.

3.5 **INITIAL CLEANING**

3.5.1 Remove surplus adhesive from face of flooring and base as work progresses.

3.5.2 As soon as possible after adhesive has set, clean flooring and base surfaces, thoroughly sweep or vacuum the flooring to remove all loose dirt and grit.

3.5.3 Use neutral cleaner in accordance with manufacturer's directions.

3.5.4 Important: Do not let cleaning solution dry

3.5.5 Scrub the flooring: use a 22 ga nylon bristle brush or low abrasive pad (tan or red) on a single disk rotary/scrubbing machine at low speed (150-200 RPM)

3.5.6 Wet vacuum or mop-up the cleaning solution.

3.5.7 Rinse with clean cold water, and then remove all water by vacuum or mop. Replace rinse water often.

3.5.8 Allow the flooring to dry thoroughly (approximately one hour, depending on temperature and humidity)

3.5.9 Protect floor from damage.

End of Section

1. GENERAL

1.1. Conform to Sections of Division 1 as applicable.

1.2. This section is intended for touch-ups to existing surfaces and for painting gypsum board ceilings and bulkheads where lighting and other life safety devices have been upgraded or salvaged and re-installed.

1.3. DEFINITIONS

1.3.1. "Exposed" means visible in completed Work. In case of closets, cabinets and drawers, it includes their interiors.

1.4. QUALITY ASSURANCE

1.4.1. Perform work of this Section by applicator with minimum 5 years of proven, satisfactory and successful painting experience on projects of similar size and nature. Submit proof of such experience with list of projects in Canada upon Departmental Representative request. Provide qualified crew of painters and full time review of work by qualified supervisor for duration of work.

1.4.2. As work progresses and upon completion of work, submit written reports and manufacturers' confirmation that materials and application methods conform to manufacturers' requirements.

1.5. DELIVERY, STORAGE AND HANDLING

1.5.1. Deliver materials in original containers with labels intact and store in area indicated in accordance with manufacturer's MSDS. Keep stored materials with lids securely covered.

1.5.2. Ventilate, heat and maintain storage area at minimum temperature of 10 deg C (50 deg F) and protected from direct rays of sun.

1.5.3. Take necessary precautions against fire and spontaneous combustion. Provide warning signs where toxic materials and explosive solvents are used. Provide $C0_2$ fire extinguisher of minimum 9 kg (20 lb) capacity in storage area while materials are stored within.

1.5.4. Leave storage areas clean and free from evidence of occupancy on completion.

1.6. PROJECT CONDITIONS

1.6.1. **Environmental Requirements:** Paint and finish in clean, dust-free, properly ventilated and adequately lit areas (minimum 100 lx (9.3 ft candles). Maintain

adequate ventilation at all times to control excessive humidity.

1.6.2. Maintain minimum interior temperature of 18 deg C (65 deg F) during application and drying of paint and maintain until building occupancy occurs.

2. PRODUCTS

2.1. MATERIALS

2.1.1. Painting and Finishing Materials

2.1.1.1. Paint and finishing materials for each procedure listed in Finish Schedule shall be products of single manufacturer.

2.1.1.2. Paint products shall meet or exceed requirements of ECP-07 Guidelines for water based paints. In addition, paint products shall meet or exceed applicable performance standards issued by CGSB or other such standards approved by accredited standards writing organizations.

2.1.1.3. Paint shall have excellent flowing and brushing properties. Paint shall cure free of sags, runs, wrinkles to yield desired finish specified.

3. EXECUTION

3.1. Verification of Surface Conditions

3.1.1. Do work only when surfaces and conditions are satisfactory for production of quality work. Report to Departmental Representative in writing any surfaces which are found to be unsatisfactory. Commencement of work shall imply acceptance of substrate surfaces.

3.1.2. Ensure temperature of surfaces to be finished is between 10 and 20 deg C (50 and 68 deg F) and surfaces are dry and free of dirt, grease or other contaminants that may affect applied finish.

3.1.3. Verify moisture content of surfaces with electronic moisture metre. Do not proceed without written directions if moisture reading is higher than 12-15%.

3.1.4 If substrate is gypsum board, inspect to ensure joints are completely filled and sanded smooth. Inspect surfaces for "nail popping", screw heads not recessed and taped, breaks in surface or other imperfections and have repaired as required.

3.2 PREPARATION

3.2.1 Protection

3.2.1.1 Provide scaffolding, staging, platforms and ladders, as required for execution of work. Erect scaffolding to avoid interference with work of other trades. Comply with Occupational Health and Safety Act.

3.2.1.2 Provide drop cloths or adequate plastic sheets to protect floors in areas assigned for storage and mixing of paints.

3.2.1.3 Remove finish hardware, electrical switch and outlet covers to protect from paint splatter. Mask items not removable. Use sufficient drop cloths and protective coverings for full protection of floors, furnishings, mechanical, electrical and special equipment, all other components of building which do not require painting or to be removed, from paint spotting and other soiling. Re-install items when paint is dry. Clean any components that are paint spotted or soiled.

3.2.1.4 Keep waste rags in covered metal drums containing water and remove from building at end of each day.

3.2.1.5 Prohibit traffic, where possible, from areas where painting is being carried out and until paint is cured. Post “wet paint” or other warning signage during and on completion of work.

3.2.1.6 When handling solvent coating materials, wear approved vapour/particulate respirator as protection from vapours. Dust respirators do not provide protection from vapours.

3.2.2 Surface Preparation

Remove dust, grease, rust and extraneous matter from surfaces (except rust occurring on items specified to be primed under other Sections shall be removed and work reprimed under those Sections).

3.2.2.1 Gypsum Board: Examine surfaces after for imperfections showing through and fill small nicks or holes with patching compound and sand smooth. Examine surfaces after priming for imperfections showing through. Clean surfaces dry, free of dust, dirt, powdery residue, grease, oil, wax or any other contaminants. Sand and dust as necessary prior to painting.

3.2.2.2 Woodwork for Painting: Seal all knots and sapwood in surfaces to receive paint with alcohol-based primer-sealer. Sand smooth rough surfaces of all woodwork to be finished and clean surfaces free of dust before applying first coat. Fill nail holes, splits and scratches with non-shrinking filler after first coat is dry. Remove salt deposits that may appear on wood surfaces treated with fire retarder.

3.2.2.3 Woodwork for Clear Finish or Stain: Sand smooth all woodwork to be finished and clean surfaces free of dust before applying first coat. Abrade surfaces with stiff brush to remove loose fibres and splinters. Fill nail holes, splits and scratches with non-shrinking filler tinted to match local grain condition after first coat is dry. Sand lightly between coats with No. 220 sandpaper and

remove dust. Remove salt deposits that may appear on wood surfaces treated with fire retarder.

3.3 **APPLICATION**

3.3.1 Provide finish uniform in sheen, colour and texture, free from streaks, shiners and brush or roller marks or other defects.

3.3.2 Apply materials in accordance with manufacturer' directions and specifications. Do not use adulterants. Any reduction of coating's viscosity shall be done in accordance with manufacturer's directions.

3.3.3 Finish listed surfaces indicated on Room Finish Schedule(s) and/or noted on Drawing(s) and as specified hereunder.

3.3.4 Finishes and number of coats specified hereinafter in Finish Schedule are intended as minimum requirements guide only. Refer to manufacturer's recommendations for exact instructions for thickness of coating to obtain optimum coverage and appearance. Some materials and colours may require additional coats and deeper colours may require use of manufacturers' special tinted primers. Unless otherwise specified, provide Premium (3 coats) finish as defined by OPCA as minimum finish.

3.3.5 Obtain colour chart giving colour schemes and gloss value for various areas from Departmental Representative. Colour chart shall give final selection of colours and surface textures of all finishes, and whether finishes are transparent (natural) or opaque (paint).

3.3.6 Spraying not allowed without written permission.

3.3.7 Paint entire plane of areas exhibiting incomplete or unsatisfactory coverage and of areas, which have been cut and patched. Patching not acceptable.

3.3.8 Do not paint baked enamel, chrome plated, stainless steel, aluminum or other surfaces finished with final finish in factory. Finish paint all primed surfaces.

3.3.9 Advise Departmental Representative when each applied paint coat can be inspected. Do not recoat without inspection. Tint each coat slightly to differentiate between applied coats.

3.3.10 Sand smooth enamel and varnish undercoats prior to recoating.

3.3.11 Apply primer coat soon after surface preparation is completed to prevent contamination of substrate.

3.3.12 Prime woodwork designated for painting as soon as possible after delivery to Site and before installation. Prime all cut surfaces, whether exposed or not, i.e. all six edges of wood doors, before installation. Prime all cut surfaces of woodwork to receive transparent finish with 1 coat of transparent finish reduced 25%.

3.3.13 Fill open grain woods with filler tinted to match wood and work well into grain. Wipe excess from surface before filler sets.

3.3.14 Apply primer-sealer coats by brush or roller. Permit to dry in accordance with manufacturer's recommendations before applying succeeding coats. Touch up suction spots and sand between coats with No. 120 sandpaper.

3.3.15 Apply final coats on smooth surfaces by roller or brush. Hand brush wood trim surfaces.

3.4 CLEANING

3.4.1 Upon completion, remove masking and clean adjacent surfaces free of overspray spatters, drips, smears and overspray.

3.5 DISPOSAL OF PAINT WASTE

3.5.1 Be responsible for removal and disposal of material and waste generated by this Section.

3.5.2 Remove empty and partly used containers from Site and recycle or disposed of as Hazardous Waste in accordance with local municipal, provincial and federal environmental regulations. Provide proof of such action in form of receipts of tipping fees, disposal fees or bills of lading, as applicable.

3.5.3 Remove from site peripheral items, such as clean up solvents, paint brushes, rags, and similar items and dispose of where necessary in accordance with local municipal, provincial and federal environmental regulations.

3.5.4 Do not rinse off of latex paints from brushes and rags under running water tap. While work is ongoing, whether using latex or alkyd products, rinse off all brushes and rags in container with appropriate solvent (water or paint thinner). Leave such container in well lit and well ventilated area , away from any flammable conditions. Dispose of emulsion created in accordance with local municipal, provincial and federal environmental regulations.

3.6 INTERIOR FINISH SCHEDULE

3.6.1 **Gypsum Board Surfaces - Existing**
RIN 9.2M
DSD 1 – Touch Up using MPI 145
DSD 2 – Spot prime using MPI 50 or MPI 137
DSD 3 – Full Prime Coat, using MPI 50 or MPI 137
2 coats Institutional low odor/VOC acrylic latex coating, Finish: type to match existing adjacent surfaces, MPI 144, 145 or 146 – confirm with Facility

existing adjacent surfaces, MPI 143, 144 or 145 – confirm with Facility

3.6.2 **Gypsum Board Surfaces - New**
INT 9.2M
1 Latex Primer Sealer MPI 50
2 coats Institutional low odor/VOC acrylic latex coating, Gloss/Sheen: type to match existing adjacent surfaces, MPI 143, 144, 145, 146, 147, 148 – confirm with Facility

3.6.3 **Steel - HM Doors, Frames and Screens, misc. metals etc.**: **Existing**
RIN 5.1S
DSD 1 – Touch Up using MPI 143,144, 145, 146, 147, 148
DSD 2 – Spot prime using MPI 107
DSD 3 – Full Prime Coat, using MPI 107
1 coat, Institutional low odor/VOC MPI 143, 144, 145, 146, 147, 148

3.6.4 **Steel, unprimed - HM Doors, Frames and Screens, misc. metals etc.**:
INT 5.1S
1 coat, rust inhibitive primer MPI 107
2 coats Institutional low odor/VOC MPI 143, 144, 145, 146, 147, 148

3.6.6 **Concrete Block - Existing**
RIN 4.2L
DSD 1 – Touch Up using MPI 138, 139, 140, 141
DSD 2 – Spot prime using MPI 138, 139, 149, 141
DSD 3 – Full Prime Coat, using MPI 50
2 coats Institutional Low Odor/VOC MPI 143,144,145,146, 147 148.
Gloss finish to match existing at Facility.

**(where existing walls are painted the paint type must be compatible as underlying existing finish)

3.7 **COLOUR SCHEDULE**

3.7.1 Colour of all surfaces shall match existing paint colours where wall or ceiling finishes are disturbed as a result of new work.

3.7.2 Colours are to match existing facility colour schedule for walls, doors, frames etc.

3.8 **Field Quality Control/Standard of Acceptance**

3.8.1 All surfaces, preparation and paint applications shall be reviewed by Departmental Representative.

3.8.2 Painted exterior and interior surfaces shall be considered to lack uniformity and soundness if any of the following defects area apparent to the Designated Representative.

3.8.2.1 brush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas and foreign materials in paint coatings.

3.8.2.2 Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.

3.8.2.3 Damage due to touching paint before paint is sufficiently dry or any other contributory causes.

3.8.2.4 Damage due to application on moist surfaces or caused by inadequate protection from the weather.

3.8.2.5 Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.)

3.8.3 Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:

3.8.3.1 Visible defects are evident on vertical surfaces when viewed at normal viewing angles form a distance of not less than 1000 mm (39”).

3.8.3.2 Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm (39”).

3.8.3.3 Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.

3.8.3.4 When the final coat on any surface exhibits a lack of uniformity of colour, sheen texture and hiding across full surface area.

3.8.4 Painted surfaces rejected by Departmental Representative shall be made good at the expense of the Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

End of Section

STAINLESS STEEL TOILET PARTITIONS 10 21 00

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1. GENERAL:

1.1 General Requirements

1.1.1 Conform to Sections of Division 1, as applicable.

1.2 Related Work Specified Elsewhere:

1.2.1 Washroom Accessories: Section 10 80 00

1.3 Shop Drawings

1.3.1 Submit shop drawings in accordance with Section 01 11 55 General Conditions. Submittals, clearly indicating compartment layouts, dimensions, plans, elevations, the material being supplied and all connections, attachments, reinforcing, anchorage, hardware and location of exposed fastenings.

1.3.2 Submit necessary templates and instructions where supports or anchors have to be built in by others.

1.3.3 Operations and Maintenance Data
1. At completion of the job, furnish to the Designated Representative (2) copies of an Owners Operation and Maintenance Manual. The Manual shall consist of a hard cover three ring binder with the project name in the front. Include in the manual the following information: Maintenance instructions, Catalogue pages for each product, Name/Address and phone number of the Manufacturer and their Sales Agent, Copy of the final shop drawings.

1.4 QUALITY ASSURANCE

1.4.1 Substitutions
1. Manufacturers and model number listed are to establish a standard of quality. Similar items by approved manufacturers that are equal in design, function, quality and finish may be accepted upon prior written approval from the Designated Representative.

2. All requests for acceptable substitutions must be made in writing and submitted to the Departmental Representative at least 14 days prior to tender closing. If requested, all requests for substitutions must be accompanied by product literature and actual product samples.

1.4.2 Supplier Qualifications
1. Toilet Partition shop drawings and Toilet Partitions shall be procured from a source of supply approved by the Designated Representative. Supplier is responsible for the complete Toilet Partition subcontract.

1.5 DELIVERY, STORAGE AND HANDLING

1.5.1 Marking and Packaging
1. Toilet Partitions must be delivered to the job site in the manufacturers' original packages and marked to correspond with the approved shop drawings.

1.5.2 Delivery
1. Toilet Partitions must be delivered in an amount of time deemed appropriate by the Designated Representative.

1.6 WARRANTY

1.6.1 Written Guarantee
1. The Toilet Partition manufacturer shall guarantee all Toilet Partitions by written certification, for a period of (1) year from date of certified substantial performance of the project, against any defects in design, materials and workmanship. Any defects as described will be made good by the manufacturer at no additional cost to the owner.

1.7 MAINTENANCE

1.7.1 Maintenance
1. Upon request, at completion of the project, the Toilet Partition supplier may be required to brief Owner's maintenance staff regarding proper care of Toilet Partitions, such as: required lubrications, adjustments, cleaning, etc.

2 PRODUCTS

2.1 Materials:

2.1.1 Stainless Steel Toilet Compartments, Overhead Braced and Floor mounted with increased privacy, and heavy duty continuous stop and sight line fillers.

.1 Construction: Doors, Panels and Pilasters shall be constructed of two sheets of type 304, Embossed stainless steel , laminated under pressure to (1/2”) honeycomb core for impact resistance, rigidity and sound deadening. Formed edges to be welded together and interlocked, under tension, with a roll-formed oval crown stainless steel locking bar, mitred, welded and ground smooth at the

corners. Honeycomb to be of virgin, long fiber paper with a maximum 12.5mm (1/2") cell size.

.2 Doors: Shall be 25mm (1") thick with cover sheets not less than 22-gauge (0.8mm). All doors are 1613mm (63.5") high.

.3 Panels (including urinal screens): Shall be 25mm (1") thick with cover sheets not less than 22-gauge (0.8mm); 20-gauge (0.9mm) available upon request. All panels are 1613mm (63.5") high. Maximum panel depth is 1473 mm (58").

.4 Pilasters: Shall be 32mm (1.25") thick with cover sheets not less than 22-gauge (0.8mm). Pilaster tops shall be reinforced with 20-gauge channel to create extra strength and twist-free rigidity along with minimizing damage by handling and/or shipping.

.5 Hardware and Fittings: All panel-to-pilaster, panel-to-wall and pilaster-to-wall connections shall be made with full height continuous channels. All door hardware shall be chrome plated zinc die castings, standard. Fasteners are 12 x 1-3/4" and 12 x 5/8" TR-27 6-lobe security screws. Doors shall be equipped with a gravity type hinge mounted on the lower pilaster hinge bracket. Door hinges shall be wrap-around style and adjustable to permit the door to rest at any position when not latched. Each door to be fitted with a combined coat hook and bumper and a concealed latch, with face mortised flush with edge strip of door. Barrier-free doors shall include thumbturn lever to activate latch without fingertip grip application. Both standard and barrier-free latches shall have a turn slot designed to allow emergency access from exterior. The combined full length extruded aluminum door stop and keeper shall have a 1/4" wide continuous rubber bumper locked in place the length of the stop. To cover the sightline gap at door hinge side, full length extruded aluminum filler channel shall be provided. The "no sightline" continuous stop and hinge filler shall be #4 brushed to match door and pilaster finish. Threaded upper hinge pin shall have a metal core and self-lubricating nylon sleeve to ensure smooth, quiet operation. Pilaster shoes shall be a welded one-piece design made from polished stainless steel. Two-piece shoes that can disassemble when kicked are unacceptable.

2.2 Fabrication

2.2.1 Fabricate doors and partition panels and pilasters, 25 mm thick, to sizes indicated, 1613 mm high. Urinal screens to match the existing in size and located where indicated on drawings.

2.2.2 Doors opening shall be minimum for a Barrier-Free Door opening and must comply with the latest edition of the OBC.

3 EXECUTION

3.1 Partition Erection

3.1.1 Install partitions secure, plumb and square, in strict accordance with manufacturer's printed instructions.

3.1.2 Anchor fixing brackets to masonry-concrete surfaces using screws and shields: to hollow walls using bolts and toggle type anchors, to steel supports with bolts in threaded holes. Sleeve floor anchors minimum 50 mm into concrete.

3.1.3 Attach panel and pilaster to brackets with through type sleeve bolt and nut.

3.1.4 Equip each door with hinges, latch set, and coat hook. Adjust and align hardware for proper function. Set door open position at 15 deg. to front.

3.1.5 Set doors approximately 305 mm above finished floor.

********** END **********

WASHROOM ACCESSORIES 10 80 00

1 GENERAL

1.1 Conform to Sections of Division 1 as applicable.

1.2 General Contractor is responsible to install all salvaged and Government supplied washroom accessories as part of this Section.

1.3 RELATED SECTIONS

1.3.1 Rough-in for recessed or built-in fixtures: Section 09 29 00, Gypsum Board.

1.4 REFERENCES

ASTM A167-99	Standard specification for Stainless Heat Resisting Chromium Nickel steel Plate, Sheet and strips.
ASTM A653/A653M-01a	Standard Specification For Steel Sheet Zinc-Coated (Galvanized) or Zinc-Alloy Coated (Galvanealed) by the Hot-Dip Process
ASTM A924/A924M-99	Standard Specification for General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process.
CAN/CGSB 12.5M86	Mirror, Silvered
CAN/CSA B651-95	Barrier Free Design
CAN/CSA G164 M92	Hot Dip Galvanizing of Irregularly Standard Articles.

1.5 SHOP DRAWINGS

1.5.1 Submit shop drawings or manufacturers' data sheets bound in sets in accordance with General Requirements.

1.5.2 Submit necessary templates and instructions where recesses, openings, details for fastening devices or anchors to be built in by other Sections.

1.5.3 Submit complete list of washroom accessories proposed giving manufacturer's name and catalogue number for each.

1.6 SAMPLES

1.6.1 Submit manufacturer’s cut sheets of washroom accessories, finishes and fastening devices for approval by Departmental Representative before ordering.

1.6.2 Provide manufacturer’s service and parts manual for incorporation into the Building Maintenance Manual.

1.7 **DELIVERY, STORAGE AND HANDLING**

1.7.1 Deliver accessories wrapped in original packages with manufacturer's labels, and seals intact.

1.7.2 Store accessories inside building in location directed and in well identified package as to contents.

2 PRODUCTS

2.1 **General**

2.1.1 **Sheet Steel:** to ASTM A653/A653M with ZF001 designation steel coating.

2.1.2 **Stainless Steel** sheet metal: to ASTM A 167, Type 304, with satin finish.

2.1.3 **Stainless** Steel Tubing: Type 304, seamless welded, 18 gauge (1.2mm) wall thickness.

2.1.4 **Fasteners:** Concealed screws, and bolts, hot dip galvanized, where exposed to match face of unit. Expansion shields fibre, or rubber as recommended by accessory manufacturer for intended use.

2.2 **MANUFACTURED UNITS**

2.2.1 **Grab Bars And Safety Rails:** 30 mm (1-1/4") o.d. stainless steel satin finish with peened grip surface, min 1.270 mm (12 ga) wall thickness, complete with flanges, exposed mounting, shapes and lengths indicated on drawings, where indicated in the Barrier-free shower.

2.2.2 **Coat Hook:** surface mounted, satin finish, stainless steel, threaded flange conceals mounting plate, provides snug fit to the wall. Flange has 1 15⁄16" (50mm) diameter. Hook is 1⁄2" (13mm) high. Projects 1 5⁄16" (35mm). One in Barrier Free Washroom.

2.2.3 **Jumbo Toilet Tissue Dispenser, two rolls:** surface mounted, satin finish, stainless steel, 304 no. 4 finish; Door is drawn 18ga., stainless steel with brushed finish, with single viewing slot to reveal tissue. Moulded spindles can accommodate 57 mm or 76mm (2-1//4" or 3") diameter cores, in Barrier Free Washroom.

2.2.4 **Surface Mounted Napkin Disposal:** stainless steel type 304 No. 4 brushed finish, 114 mm (4.5") d x 203 mm (8") w x 336 mm (13.25") h; pivoting self closing lid, French/English napkin disposal label embossed on lid; pivoting door utilizes full length piano hinge; all welded stainless steel construction (22 ga)

2.2.5 **Stainless Steel Shelf:** stainless steel type 304 No. 4 brushed finish, 100 mm (4") d x 460 mm (18") w x 100 mm (4") h; rounded corner shelf with safety edges on all protruding sides, 22 ga. Stainless steel no. 4 brushed finish welded to stainless steel wall plate.

2.2.6 **Baby Change Table:** Constructed of polypropylene and a unibody steel chassis, supports 200 lbs., steel-on-steel hinge with gas spring mechanism for smooth open and close of the unit. The dual liner cavity with lock minimizes operator refills and discourages potential vandalism. The product includes child protection straps and bag hooks. ASTM and EN compliant. Meets ADA requirements when mounted properly. Bed surface contains Microban® antimicrobial, reducing odor causing bacteria. Liner dispenser features two liner cavities. Each cavity holds 25 liners, for a combined total of 50 liners per unit. Unit Dimensions: 893 mm x 565 mm (35-3/16" w x 22-1/4" H); Depth(closed): 102 mm (4"), Extension (open) 589 mm (23-3/16")

3 EXECUTION

3.1 INSTALLATION

3.1.1 Install washroom accessories securely level and plumb with concealed fastener supplied by accessory manufacturer and in accordance with their recommendations, and to satisfaction of Departmental Representative.

3.1.2 For recessed installations in gypsum board, coordinate with 09 29 00, Gypsum Board and supply units dimensions and clearances requirements to other trades to permit proper settings.

3.1.3 Install accessories in locations and at heights indicated on Drawings in accordance with all applicable codes and standards. Where not indicated, install as directed by Departmental Representative.

3.1.4 Insulate accessory surfaces to prevent electrolysis due to contact with masonry, concrete or dissimilar metal surfaces by approved means.

3.1.5 Upon completion of Work, or when directed, remove all traces of protective paper or coatings. Test mechanisms, hinges, locks and latches and adjust and lubricate where necessary to leave in perfect order. Make good all damage to satisfaction of Departmental Representative.

End of Section

SOLID SURFACING COUNTERTOPS 12 36 61

1 GENERAL

1.1 Conform to Sections of Division 1 as applicable.

1.2 RELATED SECTIONS

1.2.1 Supply of Steel support: Section 05 50 00, Miscellaneous Metals.

1.2.2 Installation of support: Section 06 10 00, Rough Carpentry.

1.2.3 Installation of caulking/sealants: Section 07 92 00 Sealants.

1.2.4 Installation of tile wall finish, backsplash, apron: Section 09 30 00, Tile

1.3 SUBMITTALS

1.3.1 **Shop Drawings:** Submit fully dimensioned shop drawings showing countertop layouts, joinery, terminating conditions, substrate construction, cutouts and holes. Show plumbing installation provisions. Include elevations, section details, and large scale details.

1.3.2 **Samples:** (2) Sets selection and verification samples for each color, pattern, and finish required

1.3.3 Maintenance Data: Submit manufacturer's published maintenance manual with closeout submittals

1.4 QUALITY ASSURANCE

1.4.1 **Qualifications:** Skilled workers who custom-fabricate solid surfacing countertops similar to work of this Project.

1.5 PROJECT CONDITIONS

1.5.1 Field Measurements: Verify dimensions of construction to receive countertops by field measurements before fabrication.

1.5.2 Adhesive: Acclimatize adhesives to occupancy room temperatures with maximum temperature not to exceed 75 deg F

1.6 WARRANTY

1.6.1 Manufacturer's Limited Warranty: Provide manufacturer's standard 10 Year Commercial Limited Warranty against defects in solid surface sheet materials

2 PRODUCTS

2.1 Solid Surfacing

2.1.1 **Material**: Homogeneous mixture containing 93% pure quartz with additions of high performance polyester resins, pigments and special effects.

2.1.2 Composition: Acrylic resins, fire-retardant mineral fillers, and proprietary coloring agents. Through-the-body color for full thickness of sheet material.

2.1.3 Performance:

2.1.3.1 Moisture Absorption: typical results 0.02%; ASTM C97

2.1.3.2 Modulus of Rupture: typical results 6,800 psi; ASTM C99

2.1.3.3 Compressive Strength: typical results 24,750 psi; ASTM C170

2.1.3.4 Moisture Expansion: typical results <0.01; ASTM C370

2.1.3.5 Abrasion Resistance: typical results 223; ASTM C501

2.1.3.6 Bond Strength: typical results 205 psi; ASTM C482

2.1.3.7 Thermal Shock: passes 5 cycles: ASTM 484

2.1.3.8 Coefficient of Thermal Expansion: typical results $1.2x10^{-5}$inch/°F; ASTM C531

2.1.3.9 Breaking Strength of Tile: typical results 3,661 lbf; ASTM C648

2.1.3.10 Resistance to Freeze Thaw Cycling: unaffected 15 cycles; ASTM C1026

2.1.3.11 Coefficient of Friction Pull Method: .75 avg. dry/.55 avg. wet; ASTM C1028

2.1.3.12 Surface Burning Characteristics: typical results 17; ASTM E84

2.1.3.13 Smoke Density: flaming 196, non-flaming 69; ASTM E662

2.1.3.14 Stain Resistance: Unaffected; ANSI Z124.6

2.1.4 **Finish:** Polished

2.1.5 **Colour:** to be selected from manufacturer’s standard colours.

2.1.6 Mounting Adhesive: Structural Grade ’50 year’ silicone or epoxy adhesive.

2.1.7 Joint Adhesive: Methacrylate-based adhesive for chemically bonding solid surfacing seams. Color complementary to solid surfacing sheet material. UL 2818 GREENGUARD Gold certified and complies with SCAQMD Rule 1168 or equal.

2.1.8 Sealant for Countertops: Manufacturer's standard sealant of characteristics indicated below that comply with applicable requirements in Division 07 Section "Joint Sealants" and will not stain the solid surfacing material it is applied to.

2.1.8.1 Single-component, neutral-curing silicone sealant.

2.1.8.2 Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 **FABRICATION - COUNTERTOPS**.

2.2.1 Nominal Thickness: 12.7 mm, (½")

2.2.2 Edge: Straight, slightly eased at top.

2.2.3 Fabricate components in shop, to greatest extent practicable, in sizes and shapes indicated according to approved shop drawings and other manufacturer's published fabrication requirements

2.2.4 Form joint seams between solid surfacing components with specified seam adhesive. Completed joints inconspicuous in appearance and without voids. Provide joint reinforced if required by manufacturer for particular installation conditions

2.2.5 Cutouts and Holes: Undercounter Fixtures: Make cutouts for undercounter fixtures in shop using template or pattern furnished by fixture manufacturer. Rout cutouts and complete with all edges smooth.

2.2.5.1 Counter-Mounted Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations.

2.2.5.2 Fittings: Drill countertops in shop for plumbing fittings, counter mounted soap dispensers, and similar items.

3 **EXECUTION**

3.1 **INSTALLER**

3.1.1 Installation shall be by a certified Installer, certified in writing by the Manufacturer.

3.2 **PRE- INSTALLATION EXAMINATION**

3.2.1 Verify dimensions by field measurements prior to installation.

3.2.2 Verify and examine substrates indicated to receive countertops and conditions under which solid surfacing countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2.3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 **CONSTRUCTION TOLERANCES**

3.3.1 Variation from Plumb: For vertical lines and surfaces, do not exceed 1/16 inch in 48 inches.

3.3.2 Variation from Level: Do not exceed 1/8 inch in 96 inches, 1/4 inch maximum.

3.4 INSTALLATION OF COUNTERTOPS

3.4.1 Install countertops over plywood subtops with full spread of water-cleanable epoxy adhesive.

3.4.2 Install solid surfacing components plumb, level, and true according to approved shop drawings and manufacturer's published installation instructions. Use woodworking and specialized fabrication tools acceptable to manufacturer.

3.4.3 Form joint seams with specified seam adhesive. Seams to be inconspicuous in completed work. Seams in locations shown on approved shop drawings and acceptable to manufacturer. Promptly remove excess adhesive.

3.4.4 Provide minimum 1/2 inch radius for countertop inside corners.

3.4.5 Fill gaps between countertop and terminating substrates with specified silicone sealant.

3.4.6 Rout sink cutouts to manufacturer's template. Adhere solid surface cast sink units to countertops with specified adhesive.

3.4.7 Install backsplashes and endsplashes where indicated on Drawings. Adhere to countertops with specified construction adhesive.

3.4.8 Vanities: Secure front panels to solid substrate with specified construction adhesive. Maintain 1/16 inch gap between fixed and removable panels.

3.5 CLEANING AND PROTECTION

3.5.1 Clean solid surfacing components according to manufacturer's published maintenance instructions. Completely remove excess adhesives and sealants from finished surfaces.

3.5.2 Protect completed work from damage during remainder of construction period.

End of Section

1 GENERAL

1.1 General Requirements

1.1.1 Conform to Sections of Division 1 as applicable.

1.2 Related Work

1.2.1 Section 32 12 16 Asphalt Paving

1.3 References

OPSS 1010, Apr 2004 Aggregates – Base, Subbase, Select Subgrade and Backfill Material

1.4 Definitions

1.4.1 Rock excavation: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 1 m3.

1.4.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation including dense tills, hardpan, frozen materials and partially cemented materials which can be ripped and excavated with heavy construction equipment.

1.4.3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

1.5 Protection of Existing Features

1.5.1 Existing buried utilities and structures:

.1 Size, depth and location of known existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.2 Prior to commencing any excavation work, notify applicable owner or authorities, establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during work.

.3 Identify lines that are to remain that service the building and other

adjoining properties.

.4 Confirm locations of buried utilities by carefully hand digging test excavations.

.5 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered. When such services and utilities are encountered, immediately notify Departmental Representativeand protect, brace and support active services and utilities. Confirm findings of unknown services and utilities in writing. Obtain direction of Departmental Representative before moving or otherwise disturbing utilities or structures.

.6 Advise utility company to remove or re-route existing lines in area of excavation. Costs for such work will be paid by Owner.

.7 Record location of maintained, re-routed and abandoned underground lines.

.8 In the case of damage to, or cutting off of an essential service or utility, notify Departmental Representative immediately and repair the service or utility under the Departmental Representative direction.

.9 Inform Departmental Representative about encountered services and utilities requiring adjustment or relocation to arrange for temporary disconnection and capping of services and utilities.

.10 Make good and pay for damages to existing services and utilities resulting from Work.

1.5.2 Existing buildings and surface features:

.1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, and paving, survey bench marks and monuments which may be affected by work.

.2 Protect existing buildings and surface features which may be affected by work from damage while work is in progress and repair damage resulting from work.

.3 Where excavation necessitates root or branch cutting, do so only in accordance with the direction of the Departmental Representative.

1.6 Site Conditions

1.6.1 Visit the site of work. Inspect the site and become thoroughly familiar with site conditions to determine extent of work required by this Section under this Contract.

1.6.2 Keep excavations and site free of standing water.

1.6.3 Protect bottoms of excavations from softening.

1.6.4 Dispose of water, including water containing silt.

1.6.5 Use approved methods to protect bottoms and sides of excavations from frost and freezing.

1.6.6 Protect from injury due to work of this Section all trees, shrubs and other vegetation indicated or designated by Departmental Representative to be saved. Where approved by Departmental Representative remove interfering tree branches without injury to tree trunks and cover scars with tree paint.

1.6.7 Wrap trees with burlap and boards to protect them from injury. Cover existing lawns with tarpaulins before placing earth on them and remove earth and tarpaulin as soon as possible.

1.6.8 Do not stockpile excavated material to interfere with site operation or drainage.

2 PRODUCTS

2.1 Materials

2.1.1 .1 Type 1 fill: Granular 'A' conforming to OPSS 1010.

.2 Type 2 fill: Granular 'B' conforming to OPSS 1010.

.3 Type 3 fill: Selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

.4 Type 4 fill: Clean, washed, coarse bank or river sand free from clay, shale and organic matter.

3 EXECUTION

3.1 Site Preparation

3.1.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.1.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.2 Stripping of Topsoil

3.2.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.

3.2.2 Commence topsoil stripping of areas as directed by Departmental Representative.

3.2.3 Strip topsoil and avoid mixing topsoil with subsoil.

3.2.4 Stockpile in locations as directed by Departmental Representative. Stockpile height not to exceed 2 m.

3.2.5 Dispose of unused topsoil off site.

3.3 Stockpiling

3.3.1 Stockpile fill materials in areas designated by Departmental Representative. Stockpile granular materials in manner to prevent segregation.

3.3.2 Should acceptable excavated material be removed from the site to extent that a deficiency will occur for backfilling or regrading requirements, this Section shall haul back to site, at his own expense, sufficient acceptable fill material to properly complete work of this Section.

3.3.3 No extra payment will be considered for the stockpiling or double handling of excavated materials which may be necessary.

3.3.4 Protect fill materials from contamination.

3.4 Dewatering

3.4.1 Keep excavations free of water while work is in progress.

3.4.2 Protect open excavations against flooding and damage due to surface run-off.

3.4.3 Dispose of water in a manner not detrimental to public and private property, or any portion of work completed or under construction.

3.5 Grading

3.5.1 Cut or fill as necessary to bring site areas to required elevations and supply and place fill as necessary.

3.5.2 Rough grade to the depths below finish grades as required for paving.

3.5.3 Restore all grade levels, existing at commencement of work of this Section, which are not required to be changed but which have been disturbed. Level the grade where required and supply additional material if needed to bring areas to original grade levels.

3.5.4 Place the fill in horizontal layers and compact as specified.

3.5.5 Slope rough grade away from existing buildings at 1:50 minimum.

3.5.6 Unless otherwise specified, maintain rough grade generally not more than 150 mm above or below required elevations. For areas within 3 m of existing buildings, under areas to be paved and in areas where drainage is critical, maintain rough grade not more than 25 mm above or below require elevations.

3.5.7 Unless otherwise indicated, slope subgrade evenly away from building walls for 7.6 m. at not less than 20 mm per metre. Provide roundings at top and bottom of banks and at other breaks in grade.

3.5.8 Evenly grade where required to leave all unfinished areas free from pockets.

3.5.9 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

3.5.10 Compact filled and disturbed areas to maximum dry density to ASTMD698-78, method, as follows: 95% under future paved and walk areas.

3.6 Excavation

3.6.1 Unless specified under other Sections, excavate to elevations and dimensions indicated or required for complete demolition and removal of structures.

Correlate work with mechanical and electrical excavation requirements.

3.6.2 Remove concrete, masonry, paving, walks, footings, foundations, rubble and other obstructions encountered during excavation.

3.6.3 Excavation must not interfere with normal 45° splay of bearing from bottom of any footing for adjoining properties.

3.6.4 When complete, have Departmental Representative inspect excavations to verify soil bearing capacity, depths and dimensions.

3.6.5 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw. Seal cuts with approved tree wound dressing.

3.6.6 Dispose of surplus and unsuitable excavated material off site.

3.6.7 Do not obstruct flow of surface drainage or natural watercourses.

3.6.8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

3.6.9 Notify Departmental Representative when soil at bottom of excavation appears unsuitable and proceed as directed by Departmental Representative.

3.6.10 Obtain Departmental Representative approval of completed excavation.

3.6.11 Remove unsuitable material from trench bottom to extent and depth as directed by Departmental Representative.

3.6.12 Where required due to unauthorized over- excavation, correct as follows: Fill areas with Type 2 fill compacted to minimum of 95%.

3.6.13 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

3.7 Trench Excavating

3.7.1 In the context of this Section, reference to "pipe" includes ducts, raceway systems and other such lines and services.

3.7.2 Provide excavating, backfilling and grading for removal of mechanical and

electrical work. The work shall be laid out and supervised by trade concerned.

3.7.3 Excavate trenches to a minimum of 150 mm below pipe conduit invert.

3.7.6 Cut trenches to minimum width required to permit removal of pipe and consolidating backfill, plus allowance for shoring if required. Trim and shape trench bottoms and leave free of irregularities, lumps or projections.

3.7.7 Where bottom of trench is in unstable soil, such as saturated clay or quicksand, deepen trench to depth required for installation of approved backfill material.

3.8 Fill Types and Compaction

3.8.1 Use fill of types as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698-78 or ASTM D1557-78. Ensure equipment and workmanship provides uniform density of entire thickness of layer. Compact each layer to density specified before placing another layer of loose material. In confined spaces, where heavy compacting equipment cannot be utilized, use power actuated compactors or other suitable equipment to achieve required density.

3.8.2 Dimensions specified in following paragraphs are minimum dimensions of fill after compaction, unless otherwise specified, compaction densities are Minimum Standard Proctor Density.

.1 Exterior side of perimeter walls and within perimeter of demolished structures: Use Type 2 fill to subgrade level and to underside of sub-base or base course levels. Compact to 95%.

.2 Underground Services:

.1 Sanitary and storm sewer pipe and conduit protective cover: cradle half diameter of pipe or conduit using Type 4 fill. After pipe or conduit is in place, cover with 300 mm depth of Type 1 fill. In areas within building and where concrete, paving and walks occur, fill remainder of trench with Type 1 fill, compacted to 95% density. In other areas, cover pipe or conduit with 450 mm of type 1 fill, then fill remainder of trench with Type 3 fill to subgrade level compacted to 85% density.

.2 Cable and cable duct bedding and immediate protective cover: cover bottom of trench with 150 mm of Type 1 fill. After cables and ducts are in place, side fill ducts with sand up to top of ducts. Tamp around ducts with hand tampers and cover with 150 mm of same material.

.3 Fill above protective cover: in areas where paving and walks occur, fill remainder of trench with Type 1 fill, compacted to 95% density. In other areas, cover pipe or conduit with 450 mm of Type 1 fill.

.4 Compaction: compact bedding and immediate protective cover to 85% minimum density. In areas within buildings and where paving and walks occur, compact remainder of fill to at least 95% density. In other areas compact remainder of fill to at least 85% density.

.5 Notify Departmental Representative prior to backfilling of trenches for electrical services.

3.9 Backfilling

3.9.1 In the context of this Section, reference to backfilling includes bedding.

3.9.2 Do not proceed with backfilling operations until Departmental Representative has inspected and approved removals.

3.9.3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

3.9.4 Do not use backfill material which is frozen or contains ice, snow or debris.

3.9.5 Prior to placing fill, compact existing subgrade to obtain same compaction as specified for fill. Remove "soft" material and fill with approved material until specified compaction is obtained.

3.9.6 Backfill simultaneously each side of existing walls and other existing structures to equalize soil pressures, wherever possible.

3.9.7 Where temporary unbalanced earth pressures are liable to develop on walls or other structures, erect bracing or shoring to counteract unbalance and leave in place until their removal is approved by Departmental Representative.

3.9.8 Place and compact backfill material in continuous horizontal layers not exceeding 150 mm loose depth. Use methods to prevent disturbing or damaging buried services, foundation drainage system, perimeter insulation.

3.9.9 Maintain optimum moisture content to enable compaction to attain specified density.

3.9.10 Maintain minimum 150 mm layer of sand fill between pipelines which cross

each other.

3.9.11 Use mechanical tampers, with suitably shaped bottoms, to properly compact material under and around pipes. Compaction effort and equipment shall be compatible with degree of compaction required and the strength of pipe so as to avoid any damage to pipe.

3.9.12 At any location where there is insufficient space between pipe and wall of trench to permit mechanical compaction equipment to be used effectively, provide hand compaction up to spring line, using suitably shaped tools to ensure that bedding material is compacted as specified against wall of pipe and for full width of trench.

3.9.13 Should existing ground water conditions and bedding material be such as to produce the possibility of a "French Drain" effect in the trench, provide impervious barriers. The location and type of barrier shall be as directed by Departmental Representative.

3.9.14 At pipe joints, leave bedding materials clear of joints to permit connections. After connection has been completed, properly bed pipe section by thoroughly tamping approved bedding material under the joint. Do not take bedding material from completed portions of trench for this purpose.

3.9.15 Place backfill material to a minimum depth of 1 metre above crown of pipe before using power operated tractors or rolling equipment to compact the backfill.

3.9.16 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

3.9.17 Install drainage or filter system in backfill as indicated or as directed by Departmental Representative.

3.10 Restoration

3.10.1 Upon completion of work, remove surplus materials and debris, trim slopes, and correct defects noted by Departmental Representative.

3.10.2 Replace topsoil as directed by Departmental Representative.

3.10.3 Reinstate area outside of work to condition and elevation which existed before excavation.

3.10.4 Clean and reinstate areas affected by work as directed by Departmental

Representative.

End of Section

ASPHALT PAVING 32 12 16

1 GENERAL

1.1 General Requirements

1.1.1 Conform to Sections of Division 1 as applicable.

1.2 Related Sections

1.2.1 Section 31 23 10: Excavation, Trenching & Backfilling

1.3 References

OPSS 206, Nov 2000	Construction Specification for Grading
OPSS 310, Nov 2008	Hot Mix Asphalt
OPSS 314, Nov 2004	Untreated Granular, Subbase, Base, Surface, Shoulder and Stockpiling
OPSS 1003, Nov 2006	Aggregates – Hot Mix Asphalt
OPSS 1010, Apr 2004	Aggregates – Base, Subbase, Select Subgrade and Backfill Material
OPSS 1103, Nov 2007	Emulsified Asphalt
OPSS 1150, Nov 2008	Hot Mix Asphalt

1.4 Protection

1.4.1 Take measure to prevent damage to buildings, landscaping, curbs, sidewalks, trees, and adjacent property. Make good any damages.

1.4.2 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38°C. Do not permit stationary loads on pavement until 24 h after placement.

1.4.3 Provide access to buildings as required. Arrange paving schedule so as not to interfere with normal use of premises.

2 PRODUCTS

2.1 Materials

2.1.1 Granular sub-base (Granular B):

Crushed or uncrushed bank or pit gravel or stone obtained from an approved source and conforming to requirements OPSS 1010 for Granular 'B' aggregate.

2.1.2 Granular base (Granular 'A'):

Crushed gravel or stone, obtained from an approved source and conforming to requirements OPSS 1010 for Granular 'A' aggregate.

2.1.3 Hot mix asphalt:

HL8 binder course and HL3 surface course conforming to OPSS 1003 and 1150.

2.1.4 Asphaltic primer:

SS.1 Emulsified Asphalt as specified in OPSS 1103.

3 EXECUTION

3.1 Inspection

3.1.1 Check adjacent grades to ensure that final grades will be achieved with new graded subgrade surface.

3.1.2 Proof roll new graded subgrade surface with weight and type of roller approved by Departmental Representative and:
- .1 Check for unstable areas.
- .2 Check for areas requiring additional compaction.
- .3 Notify Departmental Representative of unsatisfactory conditions.

3.1.3 Do not begin work of this Section until such conditions have been corrected and are ready to receive sub-base and base materials and/or paving.

3.2 Preparation

3.2.1 Remove ice, snow and water from surfaces before doing any work on such surfaces. Ensure sub-grades are not frozen.

3.2.2 Fine grade and maintain existing gravelled surfaces until asphalt paving is placed.

3.2.3 Fine grade new subgrade surfaces in areas to be paved to within 12 mm of specified grade and cross section, but not uniformly high or low, and maintain surface at required grade and compaction until sub-base course is placed.

3.3 Granular Sub-Base And Granular Base Courses

3.3.1 Place granular sub-base and base in accordance with OPSS 314.

3.3.2 Place granular sub-base to 400 mm compacted thickness. Place granular base to 100 mm compacted thickness.

3.3.3 Place in layers not exceeding 100 mm loose thickness.

3.3.4 Mechanically compact granular sub-base and base materials to density not less than 98% maximum Proctor dry density in accordance with ASTM D698-78 method D.

3.3.5 Grade and compact surface until it conforms to lines and grades required. If sub-base material becomes mixed with base material and is determined to be unacceptable by Departmental Representative remove materials affected; replace with clean, acceptable sub-base and base materials and re-compact.

3.3.6 Use water, if required, within acceptable limits, to aid compaction and dust control.

3.3.7 Each specified course thickness shall be thickness after compaction.

3.4 Pavement Thickness

3.4.1 Pavements for heavy duty asphalt and roadways shall be no less than:

.1 Base course: 50mm HL8,
.2 Wear course: 38mm HL3.

3.5 Asphalt Concrete Paving

3.5.1 Unless otherwise specified, place hot mix asphaltic concrete paving in accordance with OPSS 310.

3.5.2 Do not place asphalt paving during winter months or during wet weather nor if base is water saturated. Remove loose and foreign material from surfaces to be paved. Do not place any asphaltic mixture, unless air temperature is minimum 7 deg. C and rising.

3.5.3 Place compacted asphaltic concrete paving in two layers of thickness indicated, in layers not exceeding 50 mm.

3.5.4 Spread asphalt mixture over base evenly and to correct thickness so that, after first passage of roller, a minimum amount of back patching will be

required.

3.5.5 Minimum 120 deg C mix temperature required when spreading.

3.5.6 Maximum 150 deg C mix temperature permitted at any time.

3.5.7 Place mixture as continuously as possible. Compact each course with roller as soon as it can support roller weight without undue cracking or displacement.

3.5.8 Roller shall be power driven, minimum mass of 4.5 T, minimum wheel width 600 mm.

3.5.9 Roll until roller marks are eliminated. Compact to 95% Marshall Density ASTM D1559-82.

3.5.10 Keep roller speed slow enough to avoid mix displacement and do not stop roller on fresh pavement.

3.5.11 Moisten roller wheels with water to prevent mix adhesion.

3.5.12 Compact mix with hot tampers or other approved equipment in areas inaccessible to roller. Effectively seal joints between paving and structures so that joints are completely watertight.

3.5.13 The finished paving shall have average thickness specified and shall not vary more than 6 mm from specified thickness at any point.

3.5.14 Finish surface smooth, true to grade to within 6 mm in 3 m.

End of Section.

1 GENERAL

1.1 General requirements

.1 Conform to Sections of Division 1 as applicable.

2 PRODUCTS

2.1 Grass seed

.1 Low Maintenance Grass Seed, “No-Mow” by Prairie Nurseries, “Eco-Lawn” by Wildflower Farm 1-866-476-9453 or equal.

2.2 Water

.1 Free of impurities that would inhibit germination and growth.

.2 Supplied by at designated source.

2.3 Fertilizer

.1 To Canada "Fertilizers Act" and "Fertilizers Regulations".

.2 Complete synthetic fertilizer with guaranteed minimum analysis as specified.

3 EXECUTION

3.1 Quality of work

.1 Do not perform work under adverse field conditions as determined by Departmental Representative

.2 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger off site.

3.2 Seed bed preparation

.1 Verify that grades are correct. If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.

.2 Fine grade surface free of humps and hollows to smooth, even grade, to tolerance of plus or minus 15 mm, surface draining naturally.

.3 Cultivate fine grade approved by Departmental Representative to 25 mm depth immediately prior to seeding.

3.3 Seed placement

.1 For manual seeding:

.1 Use "Cyclone" type manually operated seeder.

.2 Use manually operated, water ballast, landscaping type, smooth steel drum roller.

.2 Blend applications 150 mm into adjacent grass areas to form uniform surfaces.

.3 Sow half of required amount of seed in one direction and remainder at right angles as applicable.

.4 Incorporate seed by light raking in cross directions.

.5 Consolidate mechanically seeded areas by rolling area if soil conditions warrant immediately after seeding.

3.4 Maintenance during establishment period

.1 Perform following operations from time of seed application until acceptance by Departmental Representative:

.1 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.

.2 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.

.3 Cut grass to 50 mm whenever it reaches height of 70 mm. Remove clippings which will smother.

.4 Fertilize seeded areas after first cutting in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

3.5 Final acceptance

.1 Seeded areas will be accepted by Departmental Representative provided that:

.1 Areas are uniformly established and turf is free of rutted, eroded, bare or dead spots and free of weeds.

.2 Areas have been cut at least twice.

.3 Areas have been fertilized.

.2 Areas seeded in fall will be accepted in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

3.6 Maintenance during warranty period

.1 Perform following operations from time of acceptance until end of warranty period:

.1 Water seeded area to maintain optimum soil moisture level for continued growth of grass. Control watering to prevent washouts.

.2 Repair and reseed dead or bare spots to satisfaction of Departmental Representative.

.3 Cut grass to 50 mm whenever it reaches height of 70 mm. Remove clippings which will smother grass as directed by Departmental Representative.

.4 Fertilize seeded areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

END OF SECTION

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to Sections of Division 1 as applicable.

1.1.2 Section 20 05 01 applies to and governs work of all Sections of Division 15.

1.1.3 Conform to Section 26 05 00, General Electrical Requirements.

1.2 **RELATED WORK**

1.2.1 Fire stopping and smoke seals: Section 07 84 00, Penetration Fire stopping.

1.2.2 Flashings for mechanical work located on or passing through roof except integral flashing collars on equipment and piping where available as standard or optional component: Roofing repair performed under cash allowance.

1.2.3 Painting and finishing for mechanical work: Section 09 91 00, Painting and Finishing.

1.2.4 Reinsulation of pipework, equipment and ductwork: Section 15080, Thermal Insulation.

1.2.5 Heating: Section 15700, Heating Ventilating and Air Conditioning.

1.2.6 Refer to other Divisions of Specifications and to Drawings for work related to mechanical work to avoid interferences with work of other trades and to ensure proper completion of work as whole.

1.3 **REFERENCES**

CAN/CGSB-1.40-M89	- Primer, Structural Steel, Oil Alkyd Type
CAN/CGSB-24.3-92	- Identification of Piping Systems.
ANSI B31.1 to B31.9 inclusive:	- Piping.
CSA B51-95	- Boiler, Pressure Vessel and Pressure Piping Code
AWWA C651	

1.4 **DESCRIPTION**

1.4.1 Provide work in accordance with full intent and meaning of Drawings and Specifications as required to result in complete operating systems.

1.4.2 Drawings show arrangement and general design. Work is suitably outlined on Drawings with regard to sizes, locations, general arrangements and installation details. Mains and connections thereto are indicated more or less in diagram except where in certain cases Drawings may include details giving exact locations and arrangements required.

1.4.3 Classify and apportion materials and performance of labour to several trades involved in accordance with local customs, rules, regulations, jurisdictional awards, decisions, insofar as they may apply and as required to efficiently execute work involved in this Contract.

1.5 **ELECTRICAL REQUIREMENTS**

1.5.1 **General**

1.5.1.1 Comply with requirements of Ontario Hydro Electrical Safety Code.

1.5.1.2 All equipment specified in Division 15 or shown on Mechanical Drawings to be supplied and installed by Division 15 and wired by Division 16 unless specifically indicated otherwise. Generally, all wiring above 50 volts by Division 16 and all low voltage control wiring below 50 volts by Division 15 unless otherwise indicated.

1.5.1.3 The nominal electrical service available for mechanical equipment is 600 (480, 208) volts 3 ph, 60 Hz, and 120 (208, 240) volts, 1 ph, 60 Hz, unless specifically stated otherwise on Drawings.

1.5.1.4 Provide motors with all electrically driven equipment furnished under this Contract.

1.5.1.5 If Owner's Designee gives approval of substitution of any item of mechanical equipment, include and pay for all necessary electrical changes (labour, materials, overhead, etc.) due to substitution of equipment.

1.5.2 **Motors**

1.5.2.1 Provide motors of 0.37 kW (1/2 HP) and larger having a nameplate rating of 575 (460) volts, 3 ph, 60 Hz, and motors of 0.25 kW (1/3 HP) and less with a nameplate rating of 115 volts, 1 ph, 60 Hz, unless otherwise specified hereinafter or otherwise indicated on Drawings.

1.5.2.2 For types of motors required for this project refer to and comply with requirements of Division 16, Electrical.

1.5.3 **Starters, Disconnects, Motor Control Centres, etc.**

1.5.3.1 As specified in Division 16, Electrical.

1.5.4 **Identification of Electrical Equipment**

1.5.4.1 As specified in Section 16010, General Electrical Requirements.

1.5.5 **Identification of Motors**

1.5.5.1 Provide all motors with brass tags attached by small chain loop, bearing equipment identification of driven equipment as described on Mechanical Equipment Schedules. Stamp or engrave identification information with lettering of 9 mm (3/8") high min.

1.5.6 **Wiring**

1.5.6.1 Provide power and control wiring as defined under respective Sections of Divisions 15 and 16. Refer to and conform with Division 16 for details of raceways, boxes, wiring, colour coding, etc.

1.6 **SUBMITTALS**

1.6.1 **Shop Drawings**

1.6.1.1 Submit shop drawings in accordance with Paragraph 11. Shop drawings of section 01 11 55 for items hereinafter listed which are exactly as specified. Supplement shop drawings with brochures where necessary or as required. The initial submission of shop drawings for any one trade shall include a checklist of all related specified items for that trade to ensure complete submittal and review.

1.6.1.2 Stamp as follows: SHOP DRAWINGS FOR RECORD PURPOSES ONLY - CHECKED FOR CONSTRUCTION IN ACCORDANCE WITH CONTRACT DOCUMENTS.

1.6.1.3 For record purpose submissions shall include:

- Plumbing Fixtures
- Plumbing Specialties
- Piping Specialties

1.6.1.4 Submit 1 PDF Copy of such drawings or brochures to Owner's Designee for review. If items are not as specified, re-submit PDF copy.

1.6.1.5 Prepare shop drawings specifically for this work by qualified drafters and in sufficient detail to avoid decisions being made in shop or field.

1.6.1.6 General shop drawings showing more than one size or model will not be considered unless properly marked up.

1.6.1.7 Include performance data and characteristic curves with all fan and pump shop drawings.Include wiring diagrams and schematics for equipment which has electrical controls or devices furnished with equipment. Wiring diagrams alone are not sufficient; schematic and interconnecting drawings, and sequence of operation of equipment are required for review.

1.6.1.8 Clearly indicate materials and/or equipment being supplied, all details of construction, finish, accurate dimensions, capacities and performance on shop drawings and brochures. Have all drawings certified correct for construction by manufacturer, before submission. Identify equipment Shop Drawings with designations as indicated on drawings or in Specifications. If not complied with, shop drawings will not be reviewed and will be returned to Contractor.

1.6.1.9 Each shop drawing and/or brochure must bear stamp and signature of responsible official in Contractor's and Sub-Contractor's organization for each submission as evidence that drawing has been checked against requirements as called for in Specifications and Drawings. Also, in case where equipment attaches to and/or where there is external wiring connecting to other equipment, that it has been properly coordinated with this equipment, whether supplied under this or other contracts.

1.6.1.10 Revisions to shop drawings will not be allowed after they are reviewed unless further review and submission is required.

1.6.2 **Record Drawings**

1.6.2.1 Maintain an accurate dimensional record of underground piping and deviations and changes in above ground piping, ductwork and equipment from Contract Drawings. Transfer this information to 2 sets of record drawings filed at project site and submit to Owner's Designee at completion of project.

1.6.3 Installation and Start-up Instructions

1.6.3.1 Furnish (3) copies of installation instructions and (3) copies of start-up instructions for any item of equipment when requested by Owner's Designee.

1.6.4 **Operating and Maintenance Instruction Manuals**

1.6.4.1 Provide (3) (5) copies of complete operating and maintenance instructions for equipment furnished under this Contract.

1.6.4.2 Bind instructions in loose-leaf 3-ring binders. When only one volume is required, provide a complete index. When more than one volume is required, include in first book a complete index of all volumes and an individual index in

each succeeding volume. Include following manuals:

- Schematic diagram of pneumatic, electrical, oil and/or gas systems.
- Control Shop Drawings and operating sequence including wiring of components.
- Wiring diagram of control panels.
- Non-dimensional layout showing location of all electrical devices on mechanical equipment.
- Operating instructions, including start-up and shut-down procedure.
- Maintenance instructions including preventive maintenance instructions for components of equipment.
- Lubricating instructions and recommended cycle of lubrication for each item of equipment, including various types of lubricants.
- Complete parts list of assemblies and their component parts, showing manufacturer's name, catalogue number, and nearest replacement source.
- List of recommended spare parts and quantity of each item to be stocked.
- Manufacturers' warranties and guarantees.

1.6.4.3 Above applies to component parts of equipment whether they are manufactured by Supplier of equipment or are supplied as a component part of item of equipment.

1.6.5 **Valve Tags and Indexes**

1.6.5.1 Upon completion of Work, furnish and install 25 mm (1") dia. brass tag at each valve bearing an Index Number designating valve. Attach tags to valve handwheels or operators by key chain. Review valve designation with Owner's Designee before ordering.

1.6.5.2 Provide in duplicate, typewritten directory mounted in glazed hardwood frame for each system, giving the valve index number, size, make and Catalogue No. and "service" of each valve and location of valve.

1.6.6 **Equipment Nameplates**

1.6.6.1 Provide nameplates for mechanical and electrical equipment installed under this Division, adequately describing function or use of particular equipment involved and including equipment number and equipment name generally as listed on Drawing Schedules. Submit list of nameplates to Owner's Designee for review. Do not commence fabrication of nameplates until after receipt of Owner's Designee's review.

1.6.6.2 Fit nameplates to electrical equipment, including, but not limited to: motor starters, pushbutton stations, control panels, time switches, disconnect switches, and contactors or relays in separate enclosures.

1.6.6.3 Furnish nameplates of laminated phenolic plastic with white finish and minimum 10 mm (3/8") high black letters.

1.6.6.4 Securely fasten nameplates to the equipment with round-head cadmium plated steel self-tapping screws.

1.6.7 **Pipe Identification**

1.6.7.1 Label piping installed under this Division to indicate content and direction of flow. Include operating pressure or vacuum, as applicable for piping carrying steam, compressed air or vacuum.

1.6.7.2 Locate labels as follows:

- At every end of every pipe run, adjacent to valve or item of equipment serviced.
- At valves, tees and changes of direction.
- On each exposed pipe passing through wall, partition or floor (one on each side of such wall, partition or floor).
- At intervals of 15 m (50'-0") along every exposed pipe run exceeding 15 m (50'-0") in length.
- At every access point on concealed piping.

1.6.7.3 Locate labels so they are visible from 1.5 m (5'-0") above the adjacent floor or platform.

1.6.7.4 Treat any surface which is "dusty" or "chalky" with a sodium silicate solution before application of the labels. After application of labels, apply a clear lacquer, as approved by the Owner's Designee, over the labels, and at least 25 mm (1") beyond perimeter of labels.

1.6.7.5 Provide labels of plastic coated tape with self-adhesive backing surface. For installation on insulated pipe, provide adhesive suitable for this application.

1.6.7.6 Where outside diameter of pipe (or insulation) exceeds 75 mm (3"), provide labels with a minimum width of 64 mm (2-1/2") and 50 mm (2") high letters. Where outside diameter of pipe (or insulation) is 75 mm (3") or less, provide labels of 29 mm (1-1/8") width and 25 mm (1") high lettering. Length of labels as dictated by legend.

1.6.7.7 Conform with CAN/CGSB-24.3 for primary label colour, and with legend and direction arrows in black. Print legend in full wherever feasible, or a recognized abbreviation of service involved.

1.6.7.8 Before ordering identification labels, submit to Owner's Designee for approval, a full list of all services to be labelled and colour and legend it is proposed to use for each service.

1.7 **QUALITY ASSURANCE**

1.7.1 **Regulatory Requirements**

1.7.1.1 Conform to governing Municipal or Provincial Codes, Rules and Regulations and/or Authorities having jurisdiction.

1.7.1.2 Codes and Standards referred to hereinafter are by inference, in each case, latest issue of the Specified Code or Standard, including all revisions and amendments thereto as adopted and published at date of bid closing.

1.7.1.3 Do all work and supply all equipment in accordance with requirements and recommendations of latest issue of applicable standards and codes of:

National Standards of Canada (NSC)
Canadian General Standards Board (CGSB)
Canadian Standards Association (CSA)
American National Standards Institute (ANSI)
American Society for Testing and Materials (ASTM)
American Society of Mechanical Engineers (ASME)
Ontario Regulation 413/90 (Ontario Building Code) (OBC)
Ontario Building Code, Part 7 (Plumbing)O.Reg. 160/93, Ministry of Housing
Ontario Regulation 189/94 and 190/94 - Non-Venting of Refrigerants
Ontario Regulation 413/94 - Halon Fire Extinguishing Equipment
Ontario Fire Code
Ontario Ministry of Labour
American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
Sheet metal and Air Conditioning Contractors'National Association(SMACNA)

1.7.2 **Permits and Fees**

1.7.2.1 Obtain all permits required for installation of mechanical trades work, arrange for inspections and tests therewith and pay all fees and costs for permits, inspections and fees. Obtain permits immediately after notification of award of Contract.

1.7.2.2 Obtain copies of Drawings from the Owner's Designee for submission with application for permits.

1.8 **SITE CONDITIONS**

1.8.1 **Existing Service**

1.8.2 Do not shut down or make connections to any existing service without written permission of Owner's Designee.

2 Products

2.1 **GENERAL**

2.1.1 Use materials and equipment as specified herein, or specified equivalent. Design of mechanical systems has been based on first listed supplier and model number/size stated on Equipment Schedules on Drawings.

2.2 **DRIVES AND ACCESSORIES**

2.2.1 **Drives**

2.2.1.1 Select v-belt drives for 150 percent of motor size rating. Provide sheaves of cast iron construction with machined grooves. Provide sheaves of 75 mm (3") size and larger diameter with taper lock bushings. Statically and dynamically balance all sheaves as an operating unit. For multi-belt drives use matched sets.

2.2.1.2 Provide adjustable pitch sheaves on motors of less than 11 kW (15 HP) rating, with diameter range selected to obtain specified RPM of the driven equipment at approximately the mid-point setting of the sheave.

2.2.1.3 Provide solid type drive sheaves on motors of 11 kW (15 HP) and greater. Should such sheaves not provide design requirements under operating conditions, supply and install a new drive sheave of proper size at no additional cost to Owner.

2.2.1.4 Submit drive data with shop drawings of each item of driven equipment.

2.3 **CONCRETE INSERTS AND ANCHORS**

- ITW "Redhead"
- Star "SSS"
- USM "Parabolt"

2.4 **PIPE SLEEVE SEALS**

- Thunderline "Link-Seal" Series LS

2.5 **BEAM CLAMPS**

- Grinnell
- Myatt
- Carpenter & Paterson

2.6 **CONCRETE GROUTS**

- Sika "Sikagrout 212"
- Master Builders "Embeco 636"
- Meadows V-3

2.7 **BONDING AGENTS**

- Sika "Sikadur 32" Hi-Mod

2.8 **DRIVE COUPLINGS**

- Falk
- Fast
- Thomas

2.9 **MOTORS, STARTERS, DISCONNECTS, MOTOR CONTROL CENTRES**

Refer to Division 16.

2.10 **CABLE MARKERS**

- Electrovert Type Z
- Brady
- Mystik

2.11 **PIPE HANGERS**

- Grinnell
- Myatt
- Carpenter & Paterson

2.12 **INSULATION BEARING PLATES**

- Grinnell
- Myatt
- Pipe Shields Inc.

2.13 **PIPE LABELS, IDENTIFICATION TAPES AND TAGS**

- Brady
- Safety Supply Co.
- S.M.S.
- Revere-Seton

2.14 **ISOLATING UNIONS**

- Epco
- Marpac "Petro"
- Corrosion Service

2.15 **CAULKING COMPOUNDS**

- Denso-Plast

3 Execution

3.1 **PROTECTION**

3.1.1 Protect all work and materials before and after erection from weather and other hazards and keep in a clean and orderly manner.

3.1.2 Protect pipe ends, valves and parts of equipment left unconnected to prevent damage or intrusion of foreign matter. Provide pipe caps for threaded male connections and plugs for threaded female connections.

3.1.3 Protect plumbing fixtures or mechanical equipment having a baked enamel finish by covering with polyethylene sheet securely held in place.

3.2 **GENERAL INSTALLATION REQUIREMENTS**

3.2.1 **General**

3.2.1.1 Conform with applicable requirements of Occupational Health and Safety Act and Regulations for Construction Projects.

3.2.2 **Measurements and Deviations**

3.2.2.1 Where any parts of the mechanical work are specifically located by dimensions on Drawings, check and verify these dimensions on site prior to installation.

3.2.2.2 Before installing piping, review architectural, structural and electrical drawings with mechanical drawings. Where interference may occur and departures from arrangements as shown are required, consult with other trades section involved, come to agreement as to changed locations or elevations and obtain approval of Owner's Designee for proposed changes before proceeding with work.

3.2.2.3 Examine work of other trade section or contractors, prior to commencement of mechanical installations. Report in writing, to Owner's Designee, any discrepancies which will affect mechanical installations. Failure to do so shall be considered acceptance of conditions.

3.2.2.4 Where Site conditions require minor deviations from indicated arrangements or locations, make such changes on approval of Owner's Designee without additional cost to Owner.

3.2.2.5 Should any discrepancies occur during installation of mechanical work which will necessitate major revisions to mechanical trades work or work of other

trade sections or contractors, notify Owner's Designee immediately and obtain his written authorization before proceeding with the work.

3.2.3 **Scaffolding and Hoisting Equipment**

3.2.3.1 Refer to and comply with requirements of Section 01 51 00, Construction Facilities.

3.2.3.2 Do not drill, cut or weld building steel or building structure for erection of materials or equipment without prior written approval of Owner's Designee.

3.2.4 **Overloading**

3.2.4.1 During installation of mechanical work, do not load any part of building structure with load greater than it is capable of bearing. Bear full responsibility should any accident occur or damage result through violation of this requirement.

3.2.4.2 Any temporary supports used during installation must be as strong as permanent supports.

3.2.5 **Attachment to Building Construction**

3.2.5.1 Use welding studs of size not larger than 10 mm (3/8") for attaching miscellaneous materials and equipment to building steel. If weight of materials or equipment require bolts or studs larger than 10 mm (3/8") dia., use steel clips or brackets, secured to building steel by welding or bolting as approved by Owner's Designee.

3.2.5.2 Use self drilling expansion type concrete inserts for securing miscellaneous equipment and materials to masonry or concrete construction already in place, of sufficient number and size to prevent concrete from breaking away. Use of powder or power actuated fasteners will not be allowed unless prior written approval is obtained from Owner's Designee.

3.2.5.3 Install all inserts required for attachment of hangers, either for suspension of piping or equipment.

3.2.5.4 For masonry or poured concrete construction use expansion type units. Insert into concrete after concrete has cured. Anchors or inserts installed by explosive means shall not be used.

3.2.6 **Flashings**

3.2.6.1 Furnish and set all required counter-flashings for gas vent stacks.

3.2.6.2 For safety vents, plumbing vents and all other pipes passing through roofs,

stack flashings will be supplied and installed by roofing trade.

3.2.7 **Cutting and Patching**

3.2.7.1 Cutting of holes up to 200 mm in diameter and related patching shall be done under Division 15. Holes and other openings larger than 200 mm in diameter, all chases, bulk-heads, furring and related patching shall be done under Section 01 11 55, General Conditions. Read same for detailed information regarding cutting and patching.

3.2.7.2 Do not cut, remove or burn structural parts or sections of building, whether they are steel, concrete or masonry, without written authorization of Owner's Designee.

3.2.7.3 Should cutting, repairing, and patching of previously finished work of other trades be required to allow installation of mechanical work, pay all costs for trade section concerned to perform work.

3.2.8 Firestopping and smoke seal

3.2.8.1 Be responsible for installation of firestopping and smoke seal inside mechanical assemblies (i.e. fire dampers).

3.2.8.2 Firestopping and smoke seals around outside of mechanical assemblies, where they penetrate fire rated separations shall be part of work of Section 07840, Penetration Firestopping and shall be carried out under supervision of this Division.

3.2.8.3 Be responsible for any additional cost incurred as a result of oversizing of openings during cutting and patching operation of openings to be firestopped up to 200 mm (8") in diameter

3.2.8.4 Install sheet steel covers supplied by Section 05999, Miscellaneous Metals over temporarily unused sleeves provided in fire separations for future mechanical installations.

3.2.9 **Roof and Floor Openings**

3.2.9.1 Locations and dimensions of curbs and roof and floor opening framing, where indicated on Drawings, are based on arrangement to suit above named supplier. Be responsible to verify actual size requirements of openings, and notify Owner's Designee immediately in case dimension of unit supplied and connecting ductwork/piping, etc. are at variance with dimensions given on Drawings.

3.2.9.2 Bear costs for modification of curbs and floor/roof openings resulting from failure to notify Owner's Designee prior to fabrication or construction of opening

framing and curb.

3.3 EQUIPMENT INSTALLATION

3.3.1 General

3.3.1.1 Erect equipment in a compact, neat and workmanlike manner. Align, level and adjust for satisfactory operation. Install in such a manner that connecting and disconnecting of piping and accessories can be made readily and that all parts are easily accessible for inspection, operation, maintenance and repair.

3.3.1.2 Install and start up items of equipment in complete accordance with the manufacturer's printed installation and operating instructions.

3.3.2 Noise and Vibration

3.3.2.1 Select noise and vibration levels of equipment and systems to conform to design intent. If unnecessary noise or vibration should be created by any mechanical equipment and systems and transmitted to occupied portions of building or other mechanical work, make all necessary changes and additions as approved by Owner's Designee without additional cost.

3.3.3 Lubrication

3.3.3.1 Lubricate all equipment prior to start up, in accordance with manufacturer's printed instructions. Provide all lubrication including sufficient quantity for drainage and refilling of oil sumps, or similar items when required by manufacturer's instructions.

3.3.4 Roof and Floor Openings

3.3.4.1 Locations and dimensions of curbs and roof and floor opening framing, where indicated on Drawings, are based on arrangement to suit above named supplier. Be responsible to verify actual size requirements of openings, and notify Owner's Designee immediately in case dimension of unit supplied and connecting ductwork/piping, etc. are at variance with dimensions given on Drawings.

3.3.4.2 Bear costs for modification of curbs and floor/roof openings resulting from failure to notify Owner's Designee prior to fabrication or construction of opening framing and curb.

3.4 PIPING CONSTRUCTION METHODS

3.4.1 General

3.4.1.1 Unless specified otherwise herein, construct and install all piping in accordance with ANSI Sections B31.1 to B31.9 as applicable to service, except that

soldered joints will not be permitted in compressed air piping.

3.4.1.2 To avoid unnecessary cutting of masonry, provide inserts, sleeves and anchors to other trades for building in as work proceeds. Arrange with other trades to leave openings, slots and chases to accommodate later installation of mechanical work.

3.4.1.3 Inspect pipe and fittings for soundness and clean of all dirt and other foreign matter immediately prior to installation. Reject all damaged items.

3.4.1.4 Install piping in most direct, straight and functional manner possible. Except where otherwise shown, install all vertical lines plumb, and run horizontal lines parallel to building walls. Install piping close to walls, partitions and ceilings. On multiple runs of piping, space piping to allow for installation of insulation and for proper servicing of valves.

3.4.1.5 Ensure that trenches for piping below grade are dry and firm when laying pipe.

3.4.1.6 In fill areas, provide a minimum clearance of 100 mm (4") on all sides of pipe passing under or through building grade beams to prevent possible damage from settling of building. If a greater settlement can be expected, increase the clearance to prevent possible damage.

3.4.1.7 Conceal all piping in finished areas and rooms within walls or ceilings, and in furred spaces elsewhere. Provide access doors or panels as hereinafter specified for access to concealed piping specialties etc.

3.4.2 **Expansion and Contraction**

3.4.2.1 Install all piping so as to be free from strain and distortion due to expansion and contraction and governed by requirements of ANSI B31.1, except as hereinafter modified. Allow for expansion and contraction by offsets, expansion U-bends or loops. Do not use expansion joints of any type unless specifically indicated on Drawings or specified under another Section of Division 15 for a particular installation.

3.4.2.2 Base provision for expansion and contraction on 25 mm (1") movement per 30 m (100 feet) of steel pipe and 38 mm (1-1/2") movement per 30 m (100 feet) of copper or brass pipe for each 55 C (100 F) temperature difference from 21 C (70 F) ambient. Fabricate expansion bends in steel pipe from pipe sections and long radius welding elbows.

3.4.2.3 Use swing or swivel joints on all steam or hot water heating piping for connections from mains to risers and from risers to radiation and other heating units. Use at least five fittings from main to riser including tee in main. Use at least four fittings from riser to heating unit including tee in riser.

3.4.3 **Piping Subject to Freezing**

3.4.3.1 Where horizontal or vertical piping is run along an outside building wall and concealed in a pipe space, circulation of interior air shall be maintained in the pipe space by means of an air grille(s) located at the top and the bottom of the pipe space, facing the interior of the building.

3.4.3.2 Where horizontal piping is run in a ceiling space under uninsulated roof, the insulated pipe shall be encased in slab insulation on both sides and top and circulation of interior air shall be maintained in the encasement by means of air grilles located in the ceiling below, facing down into the interior of the building. The spacing of grilles shall not be less than 3000 mm o.c.

3.4.4 **Lines, Grades and Slopes**

3.4.4.1 Install piping in conformity with elevations and grades. Verify such axis lines and bench marks. Each trade shall lay out his work and be responsible for lines, elevations, measurements, etc., required for installation of his work.

3.4.4.2 Slope piping drains and sewers as indicated on Drawings. Install so that slope between elevations indicated on the Drawings is even and constant.

3.4.4.3 Install liquid and air lines free of pockets and pitch to drain at low points in line with valves or traps installed as required for drainage of the lines.

3.4.4.4 When slope is not indicated on Drawings, install piping to following slopes:

- Drainage piping: 1:50 on drains of NPS 3 size and less and 1:100 on drains of NPS 4 and larger. In special circumstances as provided for under the Codes and Regulations and express approval of Owner's Designee, drains of NPS 4 size and larger may be laid at a lesser slope.

- Domestic water lines: pitch to low points so that all lines may be completely drained.

- Hot water heating, chilled water and condenser water lines: slope up 1:500 in direction of flow.
- Steam and condensate lines: slope down 1:500 in direction of flow.

- Compressed air, natural gas, fuel oil: slope down 1:1000 in direction of flow.

3.4.5 **Immersion Wells and Sensing Bulbs**

3.4.5.1 Where a temperature sensing bulb or immersion well is installed in piping of NPS 2-1/2 size and less, increase the tee fitting and piping as required in which bulb or well is inserted a minimum of one pipe size larger than adjoining pipe to prevent restriction of flow of liquid.

3.4.5.2 To improve heat transfer pack all immersion wells in piping for liquids up to a

temperature of 150 deg C (300 deg F) with a mineral type grease prior to installation of sensing bulb.

3.4.6 **Pipe Joints**

3.4.6.1 Ream all pipe ends and thoroughly clean all dirt, cuttings and foreign matter from pipe after cutting and threading. Thoroughly clean all fittings, valves and equipment before connections are made. Cut copper tubing with a tube cutter and clean the joining surfaces of the tubing and fitting with fine emery cloth. Wipe clean with a dry cloth.

3.4.6.2 Make screwed joints with Teflon tape or Masters metallic compound with the compound applied to the male threads only and particular care taken to prevent the compound from reaching the interior of the pipe or fittings.

3.4.6.3 Install sleeve type couplings for cast iron plain end soil pipe, such as Titan Foundry Type MJ, or Bibby MJ Series 2000 in strict accordance with manufacturer's printed instructions.

3.4.6.4 Make joints on cast iron bell and spigot soil pipe with either neoprene compression type preformed gaskets such as Bibby "Bi-seal", or lead and oakum with a minimum of 0.5 kg (1 lb.) of lead per 25 mm (1") of pipe diameter, and caulk in such a manner to produce a permanently tight joint. Cold caulking compound in cord form such as W.R. Meadows PC4 may also be used. Assemble preformed neoprene gaskets to manufacturer's printed instructions.

3.4.6.5 Assemble mechanical joint on ductile iron pressure pipe with cast iron gland, rubber sealing gasket and high strength malleable iron bolts in accordance with manufacturer's recommendations.

3.4.6.6 Install couplings, fittings, etc. on grooved end piping systems in accordance with manufacturer's printed instructions.

3.4.6.7 Make soldered joints on copper tubing in accordance with the following usage:

Service	Solder Type
- Dom. Hot and Cold water	lead free with matching flux
- Drain, Waste, Vent	50/50 with matching flux
- Hot water heating	95/5 with matching flux

3.4.6.8 Do not use core type solder. Use solder conforming to ASTM requirements.

3.4.6.9 Make carbon steel welded joints in compliance with latest acceptable practices, either by electric arc welding, gas metal arc welding, or oxy-acetylene gas welding.

3.4.6.10 Employ qualified welders holding a current up-to-date Provincial Certificate for

process and rating involved as required by Provincial Regulations.

3.4.6.11 Conform to ANSI B31.1 Section IX for welding and be responsible to ensure that supervisory staff, fitters and welders are fully conversant with requirements laid down by that Standard prior to the commencement of welding.

3.4.6.12 Unless more stringent methods of inspections are specified the Owner's Designee will visually inspect welded joints for fusion of metal, icicles, alignment, or similar items. Remove any defects and remake the joint to his satisfaction.

3.4.6.13 For welding of materials other than carbon steel conform to the requirements specified in relevant section of Specifications.

3.4.7 **Unions and Flanges**

3.4.7.1 Provide unions or flanges in following locations:

- At connections to equipment. Locate between shut-off valve and equipment.

3.4.7.2 Do not conceal unions in walls, partitions or ceilings unless access thereto is provided.

3.4.7.3 Provide dielectric unions or isolating type companion flanges at all connections between copper tubing and ferrous piping.

3.4.7.4 Assemble flanged joints with appropriate flanges, gaskets and bolting. Provide clearance between flange faces such that connections can be gasketed and bolted tight without undue strain on piping system with flange faces parallel and bores concentric. Centre gaskets on flange faces so as not to project into bore. Lubricate bolts before assembly to assure uniform bolt stressing. Machine off raised face flanges when joining to a flat companion flange and use a full face gasket.

3.4.8 **Fittings**

3.4.8.1 Use of couplings between fittings, valves or equipment, will not be permitted except on long runs in pipe sizes NPS 2 or smaller. Where length of pipe between fittings requires a connection, make the joint by welding. Do not use running couplings in any pipeline.

3.4.8.2 Fittings and ancillary items installed in systems operating at pressures in excess of 103 kPa (15 psig) must be registered in accordance with CSA B51.

3.4.8.3 Use eccentric reducing fittings in locations where piping changes size and at

connections to equipment and control valves, to provide proper drainage or venting of lines. Do not use bushings.

3.4.8.4 Tee connections in welded piping may utilize either of the following:

- Factory fabricated standard buttweld fittings.

- Bonney Forge "Weldolets", "Thredolets" or "Sockolets".

3.4.8.5 Mitring, notching or direct welding of branches to mains, will not be permitted.

3.4.8.6 Use standard pipe fittings for changing direction of piping. No mitred joints or field fabricated pipe bends are permitted. Use long radius welded steel elbows unless short radius elbows are specifically authorized by Owner's Designee.

3.4.8.7 In copper tubing, direct connection of branch into main using "T-Drill" method may be used where allowed by Regulation 815, under the Water Resources Act, Ministry of Housing, in lieu of manufactured tee fittings.

3.4.9 **Piping Connections to Mains**

3.4.9.1 Make branch connections of steam, gas and compressed air lines to respective horizontal piping of larger diameter to upper quadrant of larger pipe.

3.4.9.2 Make down feed piping connections of all water piping to horizontal supply and return mains to bottom quadrant of mains.

3.4.10 **Sleeves**

3.4.10.1 Install sleeves where piping passes through foundations, above grade floors and walls. Fabricate sleeves of Schedule 40 black steel pipe or type "K" copper tubing for installation in foundations or floors, and of 1 mm (20 ga.) galvanized sheet steel where installed in above grade walls.

3.4.10.2 Sleeves for piping passing through roofs will be supplied and installed under other Sections or Contracts or under Roofing Section, unless specifically indicated otherwise on Drawings.

3.4.10.3 Make sleeves large enough to pass full thickness of pipe covering where same is used, and with sufficient clearance between pipe and sleeve to allow for any lateral movement of piping due to expansion and contraction.

3.4.10.4 Terminate sleeves flush with finished ceilings, walls and floors on grade. For piping passing through floors above grade extend sleeve a minimum of 75 mm (3") above the floor.

3.4.10.5 For pipes entering structures from below grade, seal annular space between sleeve and pipe with prefabricated seals.

3.4.10.6 In case of pipes passing through fire walls or through walls, partitions or floors which are considered as serving as fire stops and in partitions around washrooms, seal space around pipe, in sleeve, in accordance with preparation and application requirements of Section 07 84 00, Penetration Firestopping.

3.4.10.7 Fill sleeves for future use with lime mortar.

3.4.10.8 Assume all responsibility for setting of all sleeves necessary for this work in masonry walls during construction or in concrete forms before concrete is poured.

3.4.10.9 Coat exterior surface of all sleeves of ferrous material with a heavy asphalt emulsion.

3.4.11 **Escutcheon Plates**

3.4.11.1 Provide escutcheon plates on bare piping passing through finished walls or floors.

3.4.11.2 Use escutcheon plates made of cast brass or stamped metal, either one to be heavy chromium plated and, if constructed in two pieces, fitted with substantial hinges and positive latches. Provide plates with tempered springs to ensure positive attachment to pipe.

3.4.12 **Valves**

3.4.12.1 Supply and install valves in all locations indicated on Drawings, at all piping connections to equipment, at all connections to control valves or control devices, and where required for sectionalizing a system or floor.

3.4.12.2 Use gate or butterfly valves for shut-off purposes and globe or plug valves for throttling purposes.

3.4.12.3 Install check valves wherever required to ensure flow of liquid in one direction.

3.4.12.4 Provide drain valves with hose thread outlet connection or valve with long nipple on outlet at all low points of each water system and above all riser or branch stop valves for proper drainage of lines.

3.5 **STERILIZATION OF POTABLE WATER SYSTEMS**

3.5.1 Flush each system after completion by allowing full flow of water through system for a period of fifteen minutes or longer when directed by Owner's Designee.

3.5.2 After flushing of the system is completed, provide a 24 hour contact sterilization treatment by treating the water with 50 ppm of chlorine as recommended in

AWWA Specification C-651. After sterilization period has elapsed, flush system to reduce chlorine content to an acceptable level.

3.6 PIPE HANGERS AND SUPPORTS

3.6.1 General

3.6.1.1 Support or suspend all piping with necessary hangers, structural supports and/or brackets as shown on Drawings and/or as required, to prevent sagging, warping and vibration and to allow for movement due to expansion and contraction. Place hangers and supports close to fittings, valves and/or other heavy parts.

3.6.1.2 Do not allow loads of any nature to be transmitted through piping connections to equipment not specifically designed for such loads. Where flexible connections are not called for at connections to equipment, support pipe by stands attached to both pipe and supporting structure so that force in any direction is not transmitted to the equipment.

3.6.1.3 Provide suitably dampened spring hangers for first three supports from equipment connection on piping subject to excessive movement or shock from any source, thermal expansion and contraction, selected in accordance with ANSI B31.1. Where it is evident that no undue loads will be transmitted to equipment by system concerned, i.e. small bore connections to comparatively large equipment, cold service piping not subject to shock, etc., then spring hangers may be omitted and standard hangers used.

3.6.1.4 Use trapeze type hangers where pipes are grouped together, unless specifically indicated otherwise on Drawings. Suspend horizontal member by adjustable rods with locking feature for maintaining level and slope. Space trapeze type hangers based on closest interval required by any pipe supported thereon. Provide any auxiliary steel required to support trapeze between building steel.

3.6.1.5 Do not hang any pipe from another pipe unless specifically indicated on Drawings.

3.6.2 Saddles and Roller Supports

3.6.2.1 Provide saddles at roller supports for piping carrying liquids at 10.5 deg C (51 deg F) or higher. Weld saddles to black or galvanized steel piping. Refinish galvanized surfaces destroyed by welding with a zinc rich paint such as W.R. Meadows "Galvafroid".

3.6.3 Hangers

3.6.3.1 For all insulated piping up to NPS 4 carrying liquids at temperatures 10.5 deg C

(51 deg F) and higher, use standard weight clevis hangers with level adjustment and locknut.

3.6.3.2 For insulated lines of NPS 4 dia. and larger carrying liquids at temperatures 10.5 deg C (51 deg F) or higher, use adjustable roller type hangers with locknuts, and rollers of sufficient width to clear outside diameter of insulation on piping. Support rollers at both ends, either by a yoke, swivel type hanger or by 2 adjustable rods with locknuts.

3.6.3.3 For insulated piping carrying liquids at a temperature of 10 deg C (50 deg F) or less, use elongated clevis type hangers, with clevis of sufficient width to fit over insulation bearing plate.

3.6.3.4 Provide insulation protection bearing plates at all hangers and supports for piping carrying liquids at a temperature of 10 deg C (50 deg F) or less. Install temporary spacers between plate and the pipe equal to thickness of insulation specified. (Refer to Section 15080, Thermal Insulation).

3.6.3.5 Bearing plates may be either shop fabricated, or manufactured plates of size required to properly fit outside diameter of pipe insulation.

3.6.3.6 Fabricate bearing plates conforming to the following table for various pipe sizes:

Pipe Size (NPS)	Length of Plate (mm) (in) Thickness of Plate (mm) (ga)	
1/2 through 1-1/2	130 (5)	1.2 (18)
	150 (6)	1.52 (16)
2-1/2	200 (8)	1.52 (16)
3	230 (9)	1.52 (16)
4 and up	250 (10)	1.52 (16)

3.6.3.7 Form bearing plates to outside dia of adjoining pipe insulation and extend plate up to the horizontal centre line of pipe.

3.6.3.8 For non-insulated piping use clevis type of wrought steel construction with adjustable rod, level locking feature and backnuts.

3.6.3.9 For copper tubing provide copper coated hangers. Regulations of some municipalities require that copper tubing be taped with a plastic tape at hanger location, or hanger be provided with a plastic insert. Meet these requirements when required, in which case the copper coating may be omitted on the hanger.

3.6.3.10 Attach hanger rods to building structure by means of malleable iron beam clamps, concrete inserts, and/or approved anchors as hereinbefore specified.

3.6.4 **Hanger Spacing**

3.6.4.1 For horizontal runs of plumbing and drainage piping comply with hanger spacing requirements of OBC Part 7 (Plumbing) as amended by O. Reg. 160.

3.6.4.2 For horizontal runs of black or galvanized steel pipe, other than for plumbing service, do not exceed maximum distances between supports and with minimum diameter rods as follows:

Pipe Size (NPS)	Distance (m) (ft)	Dia. of Rod (mm) (in)
Up thru 1-1/4	1.8 (6)	10 (3/8)
1-1/2	1.8 (6)	10 (3/8)
2	3.05 (10)	10 (3/8)
2-1/2 & 3	3.66 (12)	12 (1/2)
4	4.27 (14)	16 (5/8)
6	5.18 (17)	19 (3/4)
8	5.79 (19)	22 (7/8)
10 & 12	6.71 (22)	22 (7/8)

3.6.4.3 Provide additional hangers in locations where there are concentrated loads such as valves, specialties, etc.

3.6.4.4 For horizontal runs of copper tubing for services other than plumbing, do not exceed 1.8 m (6 ft.) between hangers for lines up to and including NPS 3/4 and 2.4 m (8 ft.) for lines of NPS 1 and larger.

3.6.4.5 For horizontal runs of piping fabricated of PVC, use hanger spacing as recommended by manufacturer.

3.6.5 **Vertical Piping Supports**

3.6.5.1 Support vertical plumbing and drainage piping as required by OBC Part 7 (Plumbing) as amended by O. Reg. 160, unless more stringent requirements are specified herein.

3.6.5.2 Support cast iron soil pipe at every floor and other piping at every other floor unless otherwise required by expansion conditions or otherwise specified.

3.6.5.3 Support bottom of riser with base fitting set on concrete pier or by hanger located at top of riser pipe as close to riser as possible.

3.6.5.4 For supports at intermediate floors, use Grinnell Fig. 261 or approved equal steel extension pipe clamp, bolted securely to pipe. Rest ends of clamp on the pipe sleeve or on the floor.

3.6.5.5 Provide lateral stability of vertical piping by fabricated brackets or malleable iron, extension type split hangers. Run vertical piping at columns in the

column webs, on either or both sides of the column, unless otherwise directed by Owner's Designee.

3.6.6 **Anchors and Guides**

3.6.6.1 Supply and install anchors where indicated on Drawings and/or as required to maintain permanent location of pipe lines. Construct anchors for steel or galvanized pipe of approved steel straps and/or rods and for anchoring copper lines use copper plated anchors or provide insulation bands between tubing and clamps if steel straps or rods are used. Install anchors and guides in an approved manner.

3.7 DISCONNECTION AND DEMOLITION OF EXISTING WORK

3.7.1 Disconnect and seal off mechanical equipment and services as required on Site.

3.7.2 Be responsible for demolition and removal of mechanical equipment and services designated for removal on Drawings and as required by work, unless otherwise specified under Section 02 41 00, Selective Demolition.

3.7.3 Mechanical work being removed under Section 022 41 00, Selective Demolition shall be carried out under supervision of this Division. Do all disconnecting and capping prior to authorizing removal.

3.8 MISCELLANEOUS STEEL

3.8.1 Supply and install action of miscellaneous structural supports, platforms, braces as may be required to hang or support all equipment, piping, ductwork and similar items, unless Drawings or other Sections of Specifications state otherwise, shall be provided under Section 05 50 00, Miscellaneous Metals.

3.9 PAINTING

3.9.1 **Painting and Cleaning**

3.9.1.1 Touch up minor damage to finish on equipment with standard factory applied baked enamel finish. If, in the Owner's Designee's opinion, the damage is too extensive to be remedied by touch up, replace damaged equipment.

3.9.1.2 Clean steel by scraping, wire brushing or other effective means to remove base scale, rust, oil, dirt or other foreign matter.

3.9.1.3 Apply 1 coat of zinc chromate iron oxide primer, conforming to CAN/CGSB-1.40-M to all miscellaneous steel.

3.9.1.4 In field, touch up all bolt heads and nuts, previously unpainted connections and surfaces damaged during erection with primer as hereinbefore specified.

3.9.1.5 Give two coats of primer to all surfaces which will be inaccessible after erection.

3.9.1.6 Thoroughly remove all foreign matter from steelwork on completion of installation.

3.9.2 **Painting work Supplied by Section 09 91 00, Painting and Finishing**

3.9.2.1 Finish painting of prime painted steel work specified above.

3.9.2.2 Paint interior surfaces of airducts that are visible through grilles and louvres with one coat of flat black paint to limit the line of sight.

3.9.2.3 Complete painting of insulated (unless finish with PVC jacketing) and bare pipes.

3.9.3 **Supervision Supplied by Division 15**

3.9.3.1 Provide assistance in form of supervision to Section 09 91 00, Painting and Finishing to ensure that painting of work of Division 15 is correctly done.

3.10 **PRESSURE TESTS**

3.10.1 Make specified pressure tests on all piping included in this Contract. Furnish all pumps, compressors, gauges and connectors necessary for tests.

3.10.2 Conduct tests in presence of the Owner's Designee and all other personnel of governing authorities having jurisdiction. Notify all parties in ample time to permit them to be present. Conduct tests before piping is painted, covered or concealed.

3.10.3 Conduct hydrostatic tests for a minimum period of 2 hours, or longer when requested by Owner's Designee or governing authority at test pressure specified under respective Section of Specifications

3.10.4 During this time the pressure shall remain constant and the exterior surfaces of pipe or fittings shall not show any cracks or other form of leak.

3.10.5 For pneumatic tests, first pressurize system with air to approximately one-half specified pressure but not to exceed 345 kPa (50 psig) and examine all joints for leaks with a soapsuds solution. After any repairs have been made and soap test has been met satisfactorily, pressure system with air to test pressure

specified under respective Section of Specifications.

3.10.6 Conduct final tests on natural or propane gas piping in accordance with requirements of local Utility or governing authority. If feasible, make tests when ambient air temperature is approximately constant. Take into account corrections for pressure change due to temperature differential as approved by Owner's Designee.

3.10.7 Disconnect pumps or compressors used for applying test pressure, during test period.

3.10.8 Disconnect and/or remove equipment or specialties not designed to withstand test pressure during test and reconnect same after completion of test.

3.10.9 Promptly correct any defects that develop through tests and re-test to complete satisfaction of Owner's Designee and other parties involved.

3.10.10 Forward copies of all final tests on all pressure and drainage piping and a copy of governing authority approvals to Owner's Designee immediately on acceptance of tests and/or approvals.

3.10.11 Final payment for work will not be made until above has been received.

3.11 **PERFORMANCE TESTING AND BALANCING**

3.11.1 Assume responsibility for testing, balancing and placing all air handling and liquid systems in operation, prior to final acceptance in presence and under direction of Owner's Designee.

3.11.2 Provide all instruments required to test and balance systems. Install test probe inlets in ductwork and equipment in locations selected by Owner's Designee. Balance systems in accordance with design requirements indicated on Drawings. Report to Owner's Designee immediately any deficiencies in systems or equipment performance resulting in design requirements being unobtainable.

3.11.3 On completion of testing and balancing of all systems, submit to Owner's Designee a typewritten report (4 copies) of findings, including complete data of fan performance, static pressures, air quantities, final readings at all outlets, and ampere readings of all motors, taken at motor terminals when equipment is operating under full load conditions.

3.11.4 Submit with each copy of report, complete sets of duct layout prints neatly marked in red ink, showing all locations at which test readings were taken, air volume, velocity and static pressure in each supply and return duct, and final reading at all outlets. Obtain duct layout prints for mark-up purposes from Owner's Designee.

3.12 CLEANING, TESTING AND APPROVAL RECORDS

3.12.1 Maintain records of all pressure tests and flushing and sterilization tests, glycol/water concentrations, inspections and approvals by Plumbing Inspector, and similar items and forward these to Owner on completion of work. Provide Owner's Designee with copy of records on completion of each test, cleaning operation, and similar items.

3.13 ADJUSTMENT AND OPERATION OF SYSTEMS

3.13.1 When work is complete, adjust all equipment items of various systems for proper operation within framework of design intent, and operating characteristics as published by equipment manufacturer.

3.13.2 Additional instructions are specified under respective Sections of this Division.

3.13.3 Owner's Designee reserves right to require services of an authorized representative of manufacturer in the event that any item of equipment is not adjusted properly. Arrange for such services and bear all incurred costs thereof. After completion of adjustments, place the systems in full operating condition and advise Owner's Designee that work is ready for acceptance.

3.14 ACCEPTANCE

3.14.1 After all equipment has been installed and adjusted and all systems balanced, conduct performance tests in presence of Owner's Designee. Arrange time for these tests at convenience of Owner's Designee and Owner. Conduct tests under climatic circumstances to ensure complete and comprehensive tests and of such a manner and duration as Owner's Designee may deem necessary.

3.14.2 During these tests, demonstrate correct performance of all equipment items and of systems they comprise. Should any system or any equipment item fail to function as required, make such changes, adjustments or replacements necessary to meet performance requirements. Repeat tests until these requirements have been fully satisfied and all systems accepted by Owner's Designee.

End of Section.

1 General

1.1 GENERAL REQUIREMENTS

1.1.1 Conform to Sections of Division 1 as applicable.

1.1.2 Conform to General Mechanical Requirements, Section 20 05 01 as applicable.

1.2 RELATED WORK

1.2.1 Finish painting: Section 09 91 00, Painting and Finishing.

1.2.2 Thermal insulation: Section 15080, Thermal Insulation.

1.2.3 Electrical wiring: Division 16, Electrical.

1.3 REFERENCES

ASME Standards - American Society of Mechanical Engineers
CGA Standards - Canadian Gas Association
CSA Standards - Canadian Standards Association
National Electrical Code Standards
Ontario Ministry of Consumer and Commercial Relations - Pressure Vessels Safety Branch
ULC Standards - Underwriters' Laboratories of Canada

1.4 SYSTEM DESCRIPTION

1.4.1 Supply and installation of complete and operational plumbing and drainage systems in accordance with Drawings and Specifications.

1.4.2 Excavation, bedding, and back-filling of pipe trenches for buried piping inside building and to 1.5 m (5') outside.

1.4.3 Sanitary drainage system within building(s) including connection to buried sanitary sewer 1.5 m (5') outside building wall.

1.4.4 Domestic hot water piping to plumbing fixtures from connection to water heater.

1.4.5 Plumbing specialties.

1.4.6 Plumbing fixtures and fittings.

1.4.7 Sump pumps.

1.5 **SUBMITTALS**

1.5.1 **Shop Drawings**

1.5.1.1 Prepare and submit complete plumbing, drainage and vent piping shop drawings for washrooms. Show on shop drawings final run-out connections to fixtures and equipment. Include shop drawings of following:

- Plumbing fixtures, fixture carriers and fixture trim.
- Drainage products,
- Pumps.
- Valves.

1.5.2 **Test Reports**

1.5.3 **Certificates**

1.5.4 **Record Drawings**

1.5.5 **Operational and Maintenance Data**

1.6 **CONNECTIONS SERVICES**

1.7 **QUALITY ASSURANCE**

1.7.1 **Regulatory Requirements**

1.7.1.1 Comply with requirements of Ontario Building Code, Part 7 (Plumbing) O.Reg. 160/93, Ministry of Housing and Local Municipal Authorities.

1.7.1.2 Comply with latest issue of Codes, Standards and Regulations, including revisions and amendments thereto as adopted and published at date of bid closing.

1.8 **DELIVERY, STORAGE, AND HANDLING**

1.8.1 Cover equipment and take special precautions to prevent damage and entry of foreign materials into any working parts and into piping.

2 Products

2.1 **PIPE, FITTINGS AND VALVES**

2.1.1 Following Piping Standards form part of Contract Documents General Mechanical Requirements:

Standard 001 Sanitary Drain and Vent Piping

Standard 008 Potable Hot and Cold Water Piping

2.1.2 Where like products are used in quantity, such as accessories, valves, specialties, furnish products of 1 manufacturer only for each category of product.

2.2 PLUMBING AND DRAINAGE SPECIALTIES

2.2.1 General

2.2.1.1 Furnish plumbing and drainage specialties manufactured by Ancon, Zurn or Enpoco. Ancon catalogue numbers are specified to indicate quality and features required. Furnish sizes as indicated on Drawings.

2.2.2 Floor Drains

2.2.2.1 Furnish floor drains with tapped primer connection in drain body.

2.2.2.2 Type letter allocated to following list of floor drains identifies that particular drain on Drawings.

- Type "A" for washrooms and kitchens.

2.2.2.3 **FD-"A"**

2-piece epoxy coated cast iron body with double drainage flange, weep holes, non-puncturing flashing collar, adjustable 13 mm (½") thick, 125, 150 or 175 mm (5", 6" or 7") dia polished nickel bronze strainer, and push-on, caulked or "MJ" bottom outlet.

Enpoco
Ancon

2.2.3 Floor Drain Traps and Primers

2.2.3.1 Furnish each floor drain installation with deep seal "P" trap unless otherwise indicated. Furnish trap primer connection tapping to conform with Code requirements.

2.2.3.2 Prime floor drains connected to sanitary drainage system.

2.2.3.3 Furnish trap seal primer valves with cast brass body, vacuum breaker and NPS ½" sweat connections.

Enpoco

Ancon

2.2.4 **Drainage Cleanouts**

2.2.4.1 Furnish drainage cleanout fittings in drainage piping at locations indicated on Drawings, at base of each vertical stack or rainwater leader, as required to comply with applicable plumbing code.

2.2.4.2 For buried piping furnish flush floor type cast iron ferrule cleanout with push-on, MJ, inside caulked or spigot connection outlet, and nickel brass frame and cover suitable for type of floor in which it is to be installed, e.g. tile, terrazzo, carpet, concrete.

- Enpoco (membrane floors)
- Ancon (membrane floors)

2.2.4.3 **Shock Absorbers**

2.2.4.4 Furnish water hammer shock absorbers in hot and cold domestic water lines generally located at far ends of mains, at branch lines to each flush valve and quick closing valve, and at dead ends of branch piping or to groups of plumbing fixtures, or to isolated individual plumbing fixtures.

2.2.4.5 Enpoco "Water Hammer Arrestors" or Ancon Series "Shok-Gards" or S-M-S P.P.P. type II, sized in accordance with P.D.I.-WH201.

2.3 **PIPING SPECIALTIES**

2.3.1 **Flexible Hose on Submersible Pump Discharge**

2.3.1.1 Heavy duty material conducting hose with wire and fabric reinforcing, flanged or union ends and of size and length shown on Drawings.

2.4 **PLUMBING FIXTURES**

2.4.1 **General**

2.4.1.1 Furnish CSA approved plumbing fixtures, of make, type and size specified herein, of manufacturer's standard design and material specification as indicated by trade name and/or catalogue number, and as described.

2.4.1.2 Type number allocated to each style of fixture identifies that particular fixture on Drawings.

2.4.1.3 Furnish plumbing supplies and fixture trim of CSA approved plumbing brass with chrome plated finish, and of make and type specified. Furnish each item

bearing name of manufacturer, or identifying trademark.

2.4.2 **Plumbing Fixture Carriers and Brackets**

2.4.2.1 Provide plumbing fixtures with appropriate fixture carriers and brackets as described in Part 3, Execution.

Ancon
Zurn
Enpoco

2.4.3 **Lavatories - Type LV-2**

2.4.3.1 Lavatory: 540 x 540 mm wall hung white vitreous china with integral back, recessed self draining faucet ledge, rectangular basin drilled for center hole supply fitting, carrier arms, splash lip, rear overflow, and wall hanger.

2.4.3.2 Supply Fitting: Battery operated, combination supply fitting C.P. cast brass with valve inlets center hole only, spray face spout, and metal indexed lever handles. Limit flow to a maximum of 0.139 l/s (1.5 Can gpm) at test pressure of 60 psi, pressure compensating, infrared sensor on faucet base, solenoid valve with serviceable strainer filter, above deck temperature control mixer,

2.4.3.3 Waste Fitting: C.P. cast brass P.O. drain with open grid strainer with off-set waste connection and NPS 1¼" adjustable C.P. cast brass "P" trap, with cleanout and wall escutcheon.

2.4.3.4 Lav. Supplies: "Rigid-flex" angle supplies, NPS _" with lockshield or screw-driver stops and wall escutcheons.

2.4.3.5 Carrier: Full wall carrier concealed in wall.

2.4.4 **Lavatories - Type LV-1**

2.4.4.1 Lavatory: Under counter type 304 stainless, satin finish, with rear overflow, countertop is to be site drilled for center hole supply fitting. Undercoated.

2.4.4.2 Supply Fitting: Battery operated, combination supply fitting C.P. cast brass with valve inlets center hole only, spray face spout, and metal indexed lever

handles. Limit flow to a maximum of 0.139 l/s (1.5 Can gpm) at test pressure of 60 psi, pressure compensating, infrared sensor on faucet base, solenoid valve with serviceable strainer filter, above deck temperature control mixer,

2.4.4.3 Waste Fitting: C.P. cast brass P.O. drain with open grid strainer with p trap waste connection and NPS 1¼" adjustable C.P. cast brass "P" trap, with cleanout and wall escutcheon.

2.4.4.4 Lav. Supplies: "Rigid-flex" angle supplies, NPS _" with lockshield or screw-driver stops and wall escutcheons.

2.4.5 **Lavatories - Type LV-3**

2.4.5.1 Lavatory: White vitreous china, counter-top self rimming 533 x 445 mm, faucet ledge, lavatory with "D" shaped basin, side rear overflow, and drilled on 100 mm (4") centres.

2.4.5.2 Supply Fitting: Battery operated, combination supply fitting C.P. cast brass with valve inlets center hole only, spray face spout, and metal indexed lever handles. Limit flow to a maximum of 0.139 l/s (1.5 Can gpm) at test pressure of 60 psi, pressure compensating, infrared sensor on faucet base, solenoid valve with serviceable strainer filter, above deck temperature control mixer,

2.4.5.3 Waste Fitting: C.P. cast brass P.O. drain with open grid strainer with off-set waste connection and NPS 1¼" adjustable C.P. cast brass "P" trap, with cleanout and wall escutcheon.

2.4.5.4 Lav. Supplies: "Rigid-flex" angle supplies, NPS _" with lockshield or screw-driver stops and wall escutcheons.

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2.4.6 **Urinals - Type 1**

2.4.6.1 Urinal: White Water Saver vitreous china syphon jet wall hung urinal with

integral extended shields, flushing rim and open trap, NPS ¾" top spud, and wall hanger, urinal wall access cleanout with S.S. V.P. face plate. Limit flow to max. of 5.68L (1.25 Can.) per flush cycle.

2.4.6.2 Flush Valve: Exposed external adjustable battery operated flush valve complete with NPS ¾" lock-shield angle stop, wall escutcheon, NPS ¾" flush connection, spud nut and flange, and vacuum breaker with pressure loss check. Limit flow to a maximum of 5.68 l (1.25 Can. Gal.) per flush cycle.

2.4.6.3 Carrier: Enpoco EC-510 with bearing plate.

2.4.7 Flush Valve: Exposed pushbutton metering valve complete with NPS ¾" lock-shield angle stop, wall escutcheon, NPS ¾" flush connection, spud nut and flange and vacuum breaker with pressure loss check. Limit flow to a maximum of 5.68 l/s (1.25 Can. Gal.) per flush cycle.

2.4.8 **Water Closets - Type WC-2**

2.4.8.1 Closet Bowl: White Water Saver vitreous china wall hung syphon-jet bowl, everclean antimocrobial surface, condensate channel, with elongated rim and NPS 1½" top spud. For handicapped WC. mount 419 above finished floor to rim of closet.

2.4.8.2 Flush Valve: Exposed external battery operated, adjustable flush valve complete with NPS 1 lock-shield angle stop with seat bumper, integral infrared sensor, solenoid controller, mechanical manual flush, vacuum breaker, wall escutcheon, NPS 1½" flush connection, spud nut and flange, vacuum breaker with pressure loss check. Limit flow to a maximum of 4.8l (1.28 Can. Gal.) per flush.

2.4.8.3 Closet Seat: (White) solid plastic elongated open front seat less cover, with check hinge, metal hinge posts and hardware. Handicapped provide wall mounted toilet back rest, satin finish, type 304 stainless, plastic laminate panel

2.4.9 **Water Closets - Type WC-1**

2.4.9.1 Closet Bowl: White Water Saver vitreous china wall hung syphon-jet bowl, everclean antimocrobial surface, condensate channel, with elongated rim and NPS 1½" top spud. For handicapped WC. mount 381 above finished floor to rim of closet.

2.4.9.2 Flush Valve: Exposed external battery operated, adjustable flush valve complete with NPS 1 lock-shield angle stop with seat bumper, integral infrared sensor, solenoid controller, mechanical manual flush, vacuum breaker, wall escutcheon, NPS 1½" flush connection, spud nut and flange, vacuum breaker with pressure loss check. Limit flow to a maximum of 4.8l (1.28 Can. Gal.) per flush.

2.4.9.3 Closet Seat: (White) solid plastic elongated open front seat less cover, with check hinge, metal hinge posts and hardware.

2.4.10 **Water Closets - Type WC-3**

2.4.10.1 Closet Combination: White Water Saver vitreous china everclean antimocrobial surface, floor mounted syphon-jet closet bowl with elongated rim and close coupled vitreous china closet tank with anti-sweat liner, complete with fittings. Limit flow to a maximum of 4.8 l (1.28 Can. Gal.) per flush cycle.

2.4.10.2 Closet Seat: (Black) (White) solid plastic elongated open front seat - with cover and, with check hinge, metal hinge, post and hardware.

2.4.10.3 Closet Supply: "Rigid-flex" angle supply, NPS _" with lockshield or screwdriver stop and wall escutcheon.

2.4.11 **Service Sinks - Type SS-1**

2.4.11.1 Sink: 695 mm x 691 mm trap floor mounted with SS adjustable legs, type 304, grade 18-10 16 guage stainless steel, rolled rim scullery sink with 229 integral blank back (not drilled), stainless steel strainer, rim guard and wall hanger. C/w 695 mm x 691 mm 16 guage, 304 stainless removable drainboard on the left side.

2.4.11.2 Faucets: Wall mounted, two handle, chrome plated, 200mm centerset, cast brass body, 2.2 GPM, 200mm swing set, scullery sink supply fitting with rigid spout, pail hook, brace to wall above spout, adjustable wall flanges, integral stops, aerator and cross or lever handles, vacuum breaker, hose end.

2.4.11.3 Trap: Cast iron "P" trap standard with cleanout, adjustable floor flange, and NPS 2" outlet.

2.4.12 **Double Service Sink - Type SS-2**

2.4.12.1 Sink: 695 mm x 1200 mm trap with SS adjustable legs, type 304, grade 18-10 16 guage stainless steel, rolled rim scullery sink with 229 integral blank back (not drilled), stainless steel strainer, rim guard and wall hanger.

2.4.12.2 Faucets: Wall mounted, two handle, chrome plated, 200mm centerset, cast brass body, 2.2 GPM, 200mm swing set, scullery sink supply fitting with rigid spout, pail hook, brace to wall above spout, adjustable wall flanges, integral stops, aerator and cross or lever handles, vacuum breaker, hose end.

2.4.12.3 Trap: Cast iron "P" trap standard with cleanout, adjustable floor flange, and NPS 2" outlet.

2.4.13 **Stainless Steel Sinks**

2.4.13.1 **Single Compartment - Type S-1**

460 x 478 x 203 mm OD self rimming backledge, satin finish, stainless steel ledge back sink drawn from 18-10 Type 304 heavy gauge stainless steel, with baked-on undercoating, and complete with 90 mm (3½") stainless steel crumb cup strainer and brass tailpiece.

2.4.13.2 Faucets: Deck type sink supply fitting cast brass C.P. with 200 mm (8") swing spout, tail nut inlets on 200 mm (8") centres, indexed hooded lever metal handles and 2.2 GPM aerator, ceramic disc cartridge.

2.4.13.3 Trap: Adjustable cast brass "P" - trap with cleanout & escutcheon.

2.4.13.4 Supplies: ½" (12.7mm) rough stops with flex tube connections & escutcheons.

2.5 **EQUIPMENT**

2.5.1 **Drinking Fountain Coolers (DF) and Bottle Filling Stations(BF)**

2.5.1.1 Type DF-1

Wall mounted wheel chair type water cooler with stainless steel top, front or side mounted push to operate lever(s), service stop and trap package, removable strainer, minimum capacity of 0.008 l/s (7 USgph) of 10 deg C (50 deg F) water with 27 deg C (80 deg F) inlet water temperature and 32 deg C (90 deg F) ambient. Furnish unit complete with power cord and "U" ground moulded plug. Mount cooler at 840 mm (33") from finished floor to rim of receptor.

2.5.2 Type BF-1

Surface wall mounted wheel chair (ADA), accessible, type bottle filing station with stainless steel top, rear mounted electronic sensor, touchless activation,auto 20 second shut off timer, service stop and trap package, removable strainer, removable, replaceable filter, c/w visual monitor to indicated replacement is required, flow rate 1.1 to 1.5 GPM, laminar flow,

2.5.3 **Circulators CP-1**

2.5.3.1 Furnish domestic hot water circulators of 1 GPM, 120 volt.

2.5.3.2 Furnish "in-line" type circulators with oval or round flanges matching threaded companion flanges and direct connected through flexible connection to motor.

2.5.3.3 Furnish all-bronze construction circulators, with alloy steel shaft, oil-lubricated bronze sleeve bearings, and mechanical seal.

2.5.4 **Submersible Sump Pump SP-1**

2.5.4.1 Furnish submersible sump pump 30 GPM at 15 FT head, 120 volt.

2.5.4.2 Furnish pump of bronze construction, with stainless steel shaft, semi-open type bronze impeller to pass solids of 32 mm (1¼") diameter, and integrally cast base and discharge elbow.

2.5.4.3 Furnish motor with built-in thermal overload protection, and sealed from contact with pumped fluid.

2.5.4.4 Furnish pump controlled automatically by a diaphragm actuated, factory set, integral liquid level control, complete with 3 m (10') long ULC approved waterproof, 3 wire power cable with U-ground moulded plug.

2.6 **PIPING AND EQUIPMENT CONSTRUCTION METHODS**

2.6.1 **General**

2.6.1.1 Install work of this Section to applicable requirements of Section 15010, General Mechanical Requirements.

2.6.2 **Piping**

2.6.2.1 Install complete plumbing, drainage and vent piping within washrooms, in accordance with reviewed shop drawings showing final run-out connections to fixtures, equipment, and in accordance with code requirements, standard trade practice and as specified herein.

2.6.2.2 Arrange piping within pipe spaces behind washroom fixtures to allow unimpeded access to piping for servicing.

2.6.3 **Balancing Valves**

2.6.3.1 Where 2 or more branches are fed from domestic hot water recirculating line, provide each return branch with globe or plug valve.

2.6.4 **Trap Seal Primers**

2.6.4.1 Install trap seal primer valve in cold water supply line to nearest plumbing fixture (preferably water closet) and run NPS ½" Type K copper piping to primer connection on drain body. Obtain Owner's Designee's approval for location of primer valves prior to installation.

2.6.4.2 Install trap primer tank in truss space or other suitable location as directed by Owner's Designee, or as indicated on Drawings. Refer to Piping Standard 008 and Drawings for piping.

2.7 **PLUMBING FIXTURES**

2.7.1 Install wall hung lavatory and urinal hanger brackets supplied with fixtures to wall by means of 10 mm (_") bolt studs welded to steel anchor plates embedded within wall. In locations where pipe space is provided behind wall, extend bolt studs through wall and anchor with steel back-plates. Ensure proper placement and positioning of anchor plates and bolt studs during wall construction.

2.7.2 Rough-in and install plumbing fixtures and drinking fountains at recommended height for normal or handicapped use as applicable to location.

2.7.3 Insulate waste of handicap lavatory with 25 mm (1") thick insulation as described in Section 15080, Thermal Insulation.

2.8 **EQUIPMENT**

2.8.1 Set equipment in place, align, connect and place in operation with:

2.8.1.1 Controls set for efficient, stable operation.

2.8.1.2 Initial lubrication and oil sumps filled.

2.8.1.3 Connections and required safety devices installed.

2.8.2 Protect equipment from damage during and after installation, and on completion of work ensure that equipment is free from cracks, scratches, discolourations, tool marks, and other defects. Thoroughly clean finished surfaces before acceptance of work.

2.8.3 Install heater vents complete with necessary supports, hangers, braces, roof flashing, storm collar, and round top.

2.9 **FLUSHING AND STERILIZATION**

2.9.1 Sterilize water piping connected to Municipal water supply in accordance with applicable articles in Section 15010, General Mechanical Requirements.

2.9.2 Flush water piping, regardless of service, by allowing full flow of water through pipe for at least 30 minutes. Perform flushing before connections to equipment are made.

2.9.3 Remove and clean strainer screens after flushing operation is completed and again after initial operation of systems.

2.10 **TESTING**

2.10.1 Test piping in accordance with procedures outlined in Section 15010, General Mechanical Requirements, and/or as specified and in Minister's Designee's presence.

2.10.2 Test sections as authorized by Minister's Designee to accommodate construction schedule. However, test complete systems on completion of work.

2.10.3 Test drainage piping and potable water piping in accordance with requirements of the Ontario Building Code, Part 7 (Plumbing), O. Reg. 160, Ministry of Housing and with any additional requirements of applicable local By-laws.

2.10.4 Test following services with compressed air or inert gas at 1½ times working pressure, but in no event less than 345 kPa (50 psig).

2.10.4.1 Natural Gas Piping

2.10.4.2 Distilled Water Piping

2.10.4.3 Vacuum Piping

End of Section.

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to Sections of Division 1 as applicable.

1.1.2 Conform to General Mechanical Requirements, Section 20 05 01.

1.1.3 Conform to General Electrical Requirements, Section 26 05 00.

1.2 **RELATED WORK**

1.2.1 Painting: Section 09 91 00, Painting and Finishing.

1.2.2 Pipe, fittings and valves: Piping Standards appended to Section 15010, General Mechanical Requirements.

1.2.3 Thermal insulation: Section 15080, Thermal Insulation.

1.2.4 Plumbing and drainage: Section 15400, Plumbing and Drainage.

1.3 **REFERENCES**

AMCA	-	Air Movement and Control Association
ASHRAE 52.2-2007	-	Methods of Testing Air-Cleaning Devices used in General Ventilation for Removing Particulate Matter
ASTM A167-99	-	Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
ASTM A525-93	-	Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process
CGA	-	Canadian Gas Association
CSA	-	Canadian Standards Association
CSA C22.2 No. 113-15	-	Fans and Ventilators
FM		-Factory Mutual
NFPA 90A-2015	-	Air Conditioning and Ventilating Systems
NFPA 90B-2015	-	Warm Air and Air Conditioning Systems
SMACNA	-	Sheet Metal and Air Conditioning Contractors' National Association
ULC	-	Underwriters' Laboratories of Canada

1.4 **SYSTEMS DESCRIPTION**

1.4.1 Provide systems of heating, ventilating and air conditioning in accordance with Contract Documents including but not limited to following:

- Exhaust fans
- Grilles, registers and diffusers
- Ductwork systems
- Cleaning, testing, balancing and adjusting of mechanical systems

1.5 **INFORMATION REQUIREMENT**

1.5.1 Advise appropriate trade sections of actual size requirements for products provided under this Section, taken from certified shop drawings, of roof and wall openings prior to construction of openings and curbs. Bear costs for modifications to curbs or openings resulting from delay of this information.

1.6 **SUBMITTALS**

1.6.1 **Shop Drawings**

1.6.1.1 Prepare and submit shop drawings for equipment and systems

1.6.2 **Record Drawings**

1.6.2.1 Record, as work progresses, on 1 set of white prints provided, changes or deviations in location of ductwork, dampers, terminal equipment, and equipment and such other approved changes that occur during progress of Work.

1.6.2.2 Provide at completion of work, 1 final set of Drawings with changes correctly marked in red ink, and one digital set of acad drawings, on CD.

1.6.3 **Operational and Maintenance Data**

1.6.3.1 Provide equipment literature, operating instructions, maintenance instructions, parts lists, and other pertinent data for equipment and systems covered by this Section.

1.7 **QUALITY ASSURANCE**

1.7.1 **Regulatory Requirements**

1.7.1.1 Conform to requirements of local by-laws, Ministry of Labour Regulations, and authorities having jurisdiction.

2 Products

2.1 PIPE, FITTINGS AND VALVES

2.1.1 Furnish pipe, fittings and valves as required in accordance with Piping Standards appended to Section 15010, General Mechanical Requirements.

2.2 ACCESSORIES

2.2.1 Attachments: Furnish ULC Approved and Listed beam clamps to secure hanger rods, angles and straps to structural steel members. Furnish clamps of type that rod load is transmitted concentrically to structural member centreline. "C" and "I" beam side clamps and similar clamps shall not be allowed.

2.2.2 Tape Sealant: Furnish closed cell neoprene separation tape between mechanical equipment and curb mountings.

2.3 SHEET METAL WORK

2.3.1 General

2.3.1.1 Furnish sheet metal work in accordance with material specifications and construction details specified herein, and conforming to standard and recommended practices as defined by SMACNA Duct Construction Standards.

2.3.1.2 Furnish ductwork constructed to SMACNA 3" w.g. pressure classification, unless noted otherwise on Drawings.

2.3.1.3 Furnish ductwork of galvanized steel sheet with Z-275 (G90) designation zinc coating to ASTM A525M (A525).

2.3.1.4 Furnish ducts of sizes indicated on Drawings. Where ducts are to be furnished with internal acoustical liner, adjust duct size to accommodate acoustic liner thickness, with clear inside dimensions as indicated on Drawings.

2.3.1.5 Fabricate ductwork free from vibration, rattle or drumming under operating conditions. Furnish necessary reinforcements, bracing, framing, gasketing, to comply with performance criteria.

2.3.1.6 Furnish sleeves at duct penetrations roof, fabricated from same material and thickness sheet material as for ductwork. Furnish closure plates each side of wall to cover sleeve.

2.3.1.7 Furnish flanged joints and gaskets of neoprene or other resilient non-flammable for duct connections to AC units, coils. Fabricate flanges from mild steel angles to match equipment flanges.

2.3.1.8 Furnish galvanized screens of 13 mm (1/2") mesh x 2.7 mm (0.105") diameter wire for exhausts and open ends of ductwork.

2.3.2 **Rectangular Ductwork Type I - Low Pressure - Medium Pressure**

2.3.2.1 Fabricate rectangular ductwork to metal thickness and construction methods as specified herein for various size ranges of ducts. Given dimensions represent widest side of duct.

Galvanized Steel Gauges and Equivalent Thicknesses

Gauge (gsg)	mm	Low Pressure	Medium Pressure	Slip
26	0.49 mm	Up to 300 mm		
24	0.64 mm	330 - 762 mm	Up to 457 mm	Up to 762 mm
22	0.84 mm	787 - 1372 mm	483-1219 mm	787-1524 mm
20	0.94 mm	1397-2134 mm	1245-1829 mm	1549 mm and over
18	1.24 mm	2134 mm and over	1854 mm and over	

2.3.2.2 For longitudinal joints on rectangular ductwork, furnish Pittsburgh Lock joints tightly closed along full length of seam. For transverse joints furnish Ductmate or Nexus flanged connections, of class to suit size of duct.

2.3.2.3 Fabricate rectangular duct elbows, transition sections and take-off fittings of metal 1 gauge heavier than thickness specified for duct in which they are installed. Furnish elbows of standard radius design with inner radius equal to width of elbow unless shown otherwise, with Pittsburgh Lock seams, and with ends to match transverse joints of duct.

2.3.2.4 Where elbows are indicated as square type, provide air turning vanes of double blade construction.

2.3.2.5 For uninsulated duct cross-break flat surfaces between joints, or between joints and intermediate reinforcements, to prevent vibration or buckling.

2.3.2.6 Seal joints on rectangular ductwork with high velocity duct sealer, 3M EC800, Foster #30-02, Hardcast Iron Grip #601, Duro-Dyne S-2 or Transcontinental Equipment "MP". Do not use duct tape.

2.3.2.7 Shop or field fabricate buried rectangular ductwork from galvanized sheet, shop coated inside and outside with PVC.

2.3.3 **Supports and Hangers - Rectangular Ductwork**

2.3.3.1 Except where indicated otherwise on Drawings, furnish strap hangers of 3 mm x 25 mm (1/8" x 1") mild steel bar stock for ducts up through 760 mm (30") width. Bend strap hanger around bottom of duct for minimum of 38 mm (1-1/2") and attach to sides and bottom of duct. Furnish mild steel rod hangers of 10 mm (3/8") dia minimum size for ducts over 760 mm (30") in width and furnish 38 mm x 38 mm x 3 mm (1-1/2" x 1-1/2" x 1/8") steel angle across bottom of duct and attach hanger to angle (not duct).

2.3.4 **Round Ductwork Type III - Low Pressure**

2.3.4.1 Construct round ductwork to specifications established by National Warm Air Heating Association. Use spiral lock seam type duct conforming to following gauges:

Duct Diameter	Thickness of Sheet Metal
203 mm and under	0.5 mm (26 ga.)
229 to 330 mm	0.5 mm (26 ga.)
356 mm and above	0.6 mm (24 ga.)

2.3.4.2 Girth joints as follows:

Duct Diameter	Type of Construction
203 mm and under	Crimped and beaded
229 mm and above	Crimped and beaded

2.3.4.3 Lap slip joints in direction of flow. Make external diameter of edged end same as internal diameter of belled end on slip joints. Seal entire surface of overlap with high velocity duct sealer compound before sections. Construct butterfly disc type balancing dampers of 10 gauge metal, with well rounded edges set in round sheet metal housing with pliable rubber packing glands. Securely rivet slip joints and angle joints.

2.3.5 **Flexible Type Round Ducts**

2.3.5.1 Furnish flexible type round ductwork for between trunk supply duct and air diffusers.

2.3.5.2 In ceiling areas and spaces used as return air plenums, furnish flexible duct of single ply aluminum construction with mechanical lock spiral joints, Flexmaster "Triple-Lock" or Thermaflex equivalent.

2.3.5.3 Furnish flexible duct bearing ULC approved labels and conforming to flame spread and smoke developed ratings as required by code.

2.3.5.4 Furnish sealed joints between flexible duct and rigid ductwork or equipment,

made with non-flammable high velocity duct sealer, applied in accordance with duct manufacturer's recommendations, and gear type nylon strap connectors.

2.3.6 **Balancing Dampers**

2.3.6.1 Furnish balancing dampers, manually operated opposed blade type, splitter type, or butterfly blade type, fabricated from galvanized steel sheet of thicknesses specified herein.

2.3.6.2 Furnish factory built opposed blade type balancing dampers, with galvanized channel type frames, non-binding pre- lubricated type linkage, and blades fabricated of minimum 1.6 mm (16 ga) core thickness material. Furnish damper blades of 200 mm (8") maximum width, and of length coinciding with frame opening on horizontal plane to maximum length of 1200 mm (48").

2.3.6.3 Furnish opposed blade balancing dampers complete with inter-connecting linkage, manual operator and locking type quadrant as required for synchronous operation and setting of blades.

2.3.6.4 Except where indicated otherwise on Drawings, furnish splitter dampers in supply and return ductwork where main ducts are split into two more trunks, and at branch duct connections to main or trunk ducts. Fabricate splitter dampers from same material and thickness as ducts in which they are to be installed, down to minimum of 0.8 mm (22 ga). Furnish splinters formed of double thickness of metal and with rounded surface at air entering edges. Furnish length of splitter at least 1-1/2 times width of smaller branch duct, but in no case less than 300 mm (12"). Provide splitter dampers with locking type quadrant.

2.3.6.5 Furnish butterfly blade balancing dampers for round ducts (other than fume exhaust system) fabricated of 1.6 mm (16 ga) metal and with locking type quadrant.

2.4 **DIFFUSERS, REGISTERS AND GRILLES**

2.4.1 **General**

2.4.1.1 Refer to Drawings for neck size, dimensions, capacity, of grilles, registers and diffusers.

2.4.1.2 Furnish supply diffusers and registers to deliver indicated air quantities indicated with throw to reach intended space limits without increasing sound level of room. Furnish blank-off baffles where required. Furnish equalizing deflectors on diffusers and in other locations as indicated or required.

2.4.1.3 Coordinate placing of diffusers, registers and grilles in ceilings with electrical and ceiling installation trades and exact location to final approval of owner.

2.4.1.4 Unless otherwise noted, furnish other grilles, registers and diffusers shop primed and painted.

2.5 FANS

2.5.1 General

2.5.1.1 Furnish fans of type, size and capacity designated in schedules on Drawings for each specific application and conforming to requirements of manufacture, operation and performance as specified.

2.5.1.2 Furnish fans designed and constructed in strict conformity with the AMCA Standards and bearing "Certified Rating Seal".

2.5.1.3 Fan construction and installation must comply with applicable sections of CSA C22.2 No. 113.

2.5.1.4 Submit manufacturer's certified shop drawings to owner and include complete information on fan construction and performance, performance curves over full range from shut-off to free delivery, and also drive details. Include make, type and catalogue number of bearings. State hour rating of bearings when specified.

2.5.1.5 Furnish fans of heavy gauge steel construction, unless otherwise specified.

2.5.1.6 Furnish free standing or unitary fans with wheels dynamically and statically balanced to acceptable tolerances relative to size and speed.

2.5.1.7 Interior and exterior surfaces of air handling equipment, including screens, must be cleaned at factory with approved de-greasing agent and, except for galvanized steel or aluminum, given coating of red oxide or zinc chromate primer unless special protective coating is specified.

2.5.1.8 Furnish grease lubricated ball or roller type fan bearings with ample thrust provision to prevent end play during normal life of bearings. Bearings smaller than 36 mm (1-7/16") diameter may be of cartridge type. For bearings 36 mm (1-7/16") and larger, furnish shaft adapter sleeve type utilizing horizontally split pillow blocks and mechanical flinger type grease seals. On shafts smaller than 56 mm (2-3/16") diameter, interference fit bearings may be considered acceptable in lieu of adapter sleeve type.

2.5.1.9 Furnish bearings in air stream with well secured extended grease lubricating lines unless bearing is easily accessible through man-size access door. Pack bearings with low temperature grease in factory.

2.5.1.10 Except where installed in fans driven by motors 0.25 kW (1/3 HP) and smaller, provide bearings with Zerk or Alemite grease fittings, with provision for automatic relief of lubricant pressure to outside of fan, away from wheel, visible

from maintenance location. Furnish service fittings and relief fittings easily accessible from maintenance locations and at separate and opposite sides of bearing housing.

2.5.1.11 Furnish fans complete with motors of type, kW (HP) rating, motor speed and electrical characteristics indicated on Drawings, and in accordance with Section 15010, General Mechanical Requirements.

2.5.1.12 Furnish bearings for unitary, axial and free standing fans designed for 200,000 hour service in accordance with latest AFBMA Code according to L10 Life Standard. Furnish other fan bearings designed for 8,000 hour service in accordance with same code and standards.

2.5.1.13 Furnish roof mounted ventilators with factory installed and wired unfused disconnect switch and conduit running through fan housing or wiring post so that wiring may be run to disconnect switch from below roof without disturbing roof construction.

2.5.1.14 Furnish drive and belt guards to requirements of Section 15010, General Mechanical Requirements.

3 Execution

3.1 **INSTALLATION - GENERAL**

3.1.1 Refer to and comply with applicable requirements specified in Section 15010, General Mechanical Requirements.

3.1.2 Prior to start-up of fans, blow out complete systems of ductwork with high velocity air for not less than 2 hours using where possible installed air handling equipment to full capacity and by blanking off duct sections to achieve required velocity. Do not install air filters prior to blow- out of ductwork systems. Use auxiliary portable blowers for cleaning where installed fan systems are not adequate to blow out complete system free from dust and dirt.

3.1.3 After duct systems have been blown out, clean interior of plenums, coils, and register, grille or diffuser outlet collars with industrial type vacuum cleaner. On completion of cleaning process, install filters before placing systems in final operation.

3.2 **SHEET METAL WORK**

3.2.1 **General**

3.2.1.1 Install ductwork in arrangement indicated on Drawings in accordance with standards and recommended practices off ASHRAE and SMACNA. Provide required offsets and transitions, whether specifically indicated or not, to facilitate duct arrangement and to avoid interference with building structure,

piping, equipment and services.

3.2.1.2 Install ductwork in locations and at elevations appropriate to ceiling height indicated on Drawings. Where required to be concealed, install ductwork in furred spaces provided in walls and ceilings. Where there is no provision for concealed ductwork, install as close as possible to walls, partitions and overhead structures to attain maximum headroom and clearance.

3.2.1.3 Install sleeves where ducts pass through walls or floors. Pack space between duct and sleeve with mineral wool and seal both ends with non-inflammable fire resistant sealing compound. Install sheet metal closure plates on each side of wall to cover sleeve.

3.2.1.4 At air intakes, exhausts and open ends in ductwork install removable galvanized screens securely fastened in place.

3.2.1.5 Install gasketed flanged joints at duct connections to air conditioning units, coils.

3.2.1.6 Install beam clamps or supplementary steel to secure hanger rods, angles and straps to structural steel framing.

3.2.1.7 In suspended ceiling areas, adjust final location of grilles and diffusers to suit reflected ceiling plan.

3.2.1.8 Where shape of duct changes, install transition piece so that angle of side of transition piece does not exceed 15° from straight run of duct being connected, unless indicated otherwise on Drawings.

3.2.1.9 In office area paint interior of ductwork for at least 600 mm (24") behind supply and exhaust grilles with matte black paint so as to render ductwork invisible from occupied space.

3.2.2 **Supports and Hangers - Rectangular Ductwork**

3.2.2.1 Install supports and hangers at intervals not over 2400mm (8'-0") centres for ducts up to 1500 mm (5'-0") in width and at 1200 mm (4'-0") centres for ducts 1500 mm (5'-0") in width and over.

3.2.2.2 Miscellaneous steel angles or channels as required between joists or building steel for structural support of duct where building framing spacing does not coincide with required hanger spacing shall be provided under Section 05 50 00, Miscellaneous Metals.

3.2.3 **Round Ductwork**

3.2.3.1 Secure joints with sheet metal screws and seal with tape or sealant.

3.2.3.2 For round ductwork installed below grade, make joints watertight and fasten, tape and seal as recommended by duct manufacturer. Install to slope indicated on Drawings.

3.2.4 **Flexible Duct Connections**

3.2.4.1 Install flexible connectors with fabric in folds, not drawn tight.

3.2.4.2 Install guides to prevent flexible connection from collapsing on suction side of fans.

3.2.4.3 For installation between sections of air handling units, install flexible connectors suitable for connecting to flanges of casings where so provided.

3.2.5 **Balancing Dampers**

3.2.5.1 Install dampers at locations in supply and return ductwork where main ducts are split into 2 more trunks, and at branch duct connections to main or trunk ducts.

3.3 **FANS**

3.3.1 After installation of fans, rotate fan shafts at least once every month until acceptance of Work by owner.

3.3.2 Install roof mounted ventilators on curbed roof openings in accordance with manufacturer's instructions.

3.3.3 Install separation tape sealant between fan and curb.

3.4 **FIELD QUALITY CONTROL**

3.4.1 **Testing of Ductwork**

3.4.1.1 Inspect and test ductwork for air leakage at joints and connections to equipment, under normal operating conditions. Provide systems leakage tests to SMACNA Class 12 requirements.

3.4.1.2 Test ductwork before ducts are insulated, painted or concealed.

3.4.1.3 Immediately correct defects discovered during tests and retest systems to complete satisfaction of Owner.

3.5 **BALANCING OF AIR HANDLING SYSTEMS**

3.5.1 Balance air handling systems in accordance with Section 15010, General Mechanical Requirements and as specified herein.

3.5.2 Retain independent firm of Testing Specialists to balance air handling systems

subject to approval of owner.

3.5.3 Balancing Specialists shall provide instruments required to test and balance systems, and co-operate with associated trades involved in adjustment of equipment to obtain design performance. Balancing Specialists shall select location of probe inlet fittings in ductwork to assure proper readings. Balance systems in accordance with design requirement shown on Drawings. Immediately report to owners deficiencies in systems or equipment performance which result in design requirements being unobtainable.

3.5.4 On completion of testing, adjusting and balancing of systems, Balancing Specialists shall submit to owner typewritten report (4 copies) of his findings, including complete data of fan performance, static pressures, air quantities, final readings at outlets, and ampere readings of all motors, taken at motor terminals when equipment is operating under full load conditions.

3.5.5 Balancing Specialists shall submit with each copy of report, complete sets of duct layout prints with locations at which test readings were taken, air volume, velocity and static pressure in each supply and return duct, and final reading at outlets neatly marked in red ink.

End of Section.

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to Section of Division 1 as applicable.

1.1.2 Conform to Section 20 05 01, General Mechanical requirements.

1.1.3 Conform to Section 26 05 00, General Electrical Requirements.

1.1.4 Conform to Section 16225, Motors, Starters and Wiring.

1.2 **RELATED WORK**

1.2.1 Heating, ventilating and air conditioning: Section 15700, Heating, Ventilating and Air Conditioning.

1.2.2 Work by Other Trade Sections

1.2.2.1 Adjusting, calibrating, modifying or operating any installed equipment or control to be provided by other Sections.

1.2.2.2 Testing and checking of equipment supplied by other trade Sections, except where such equipment forms integral part of mechanical systems.

1.3 **REFERENCES**

1.3.1 Perform testing and balancing in accordance with current issue of SMACNA Standards. Use recently calibrated instruments and state date of calibration in reports.

1.4 **DEFINITIONS**

1.4.1 BALANCING: To proportion and regulate flows within distribution system (subsystems, branches, mains, terminals and similar items) at appropriate pressures in accordance with design intent. This includes setting discharge volume and patterns of terminal devices, and individual return and exhaust air volumes.

1.4.2 TESTING: To measure, interpret and report in writing, such parameters as may be required to verify design compliance and as hereafter specified.

1.5 **DESCRIPTION**

1.5.1 Work to be performed under this Section includes, without limiting to, performance testing and balancing of heating, ventilating, air conditioning and liquid system, including labour, materials and equipment required to carry out Work under this Contract. Co-operate with other Sections of Division 15 which will operate systems and make any required adjustments to systems to meet specified and intended performance.

Principal items of work are as follows:

- Performance testing and balancing of air systems
- Survey installed automatic controls and verify their functional performance
- Test performance of vibration isolation equipment
- Measure and report specified space noise levels
- Rechecking of testing and balancing during alternate (heating/cooling) season

1.5.2 **Design Requirements and Performance Requirements**

1.5.2.1 Balance systems to performance parameters indicated on Drawings and in Specifications. If interpretation, clarification or additions to performance parameters are required, request such information from Owner's Designee.

1.5.2.2 Balance systems to within following tolerances:

- Duct Leakage Rates (at operating pressures)

Low pressure ducts
0 to 0.5 kPa (0 to 2" W.G.) - 5% of full flow

- Air Flow Rates

Under 70 L/S (150 cfm) -10% of flow
Over/at 70 L/S (150 cfm) -5% of flow

Water Heaters -5% of design capacity

1.6 **SUBMITTALS**

1.6.1 **Reports**

1.6.1.1 Submit following:

Site visit reports
Review and recommendation report
Initial report
Alternate season report
Final report

1.6.2 **Record Drawings**

1.6.2.1 Record, in red ink, any changes to set of plans submitted with review and recommendation report while work progresses. At completion of work, transfer this information to set of sepias and submit to Owner's Designee.

1.7 **QUALITY ASSURANCE**

1.7.1 **Qualifications**

1.7.1.1 Use independent Testing and Balancing Firm with minimum of 5 years experience in this type of work to carry out performance testing and balancing.

1.8 **PROJECT/SITE CONDITIONS**

1.9 **SEQUENCING AND SCHEDULING**

2 Products

2.1 **MATERIALS**

2.1.1 Supply test equipment required to perform work of this Section.

3 Execution

3.1 **GENERAL**

3.1.1 **Site Visits**

3.1.1.1 Visit Site as required prior to testing and balancing systems to advise respective trades of requirements for probe inlets. Submit report to Owner's Designee after each Site visit.

3.1.2 **Review and Recommendations**

3.1.2.1 Within 30 days of award of this Contract, identify and neatly mark specific location of adjusting, balancing and permanent measuring devices on set of plans for approval by Owner's Designee. Owner's Designee will provide set of sepias for this purpose.

3.1.2.2 With same submission, propose, for review by Owner's Designee, additional devices deemed advisable for satisfactory operation and completion of mechanical work under Division 15.

3.1.2.3 Submit proposed format for initial report with above mentioned plans. Include complete list of instruments and tests for which they are to be used as they relate to this Project.

3.1.3 **Coordination and Cooperation**

3.1.3.1 Review before fabrication, location of balancing devices, test connections and access openings and report conditions which could affect optimum system performance. By inspection, assure that testing, balancing and metering devices are installed properly and in preselected locations. Report any errors to Owner's Designee. Obtain approval of Testing and Balancing Firm before relocating these devices due to field conditions.

3.1.3.2 Testing and Balancing Firm shall co-operate by giving adequate prior notification of request for services of tradesmen, and co-ordinating his efforts so that items requiring replacement and/or delivery time (sheaves, motors, and other similar items) are tested as early as possible.

3.1.3.3 Co-operate with Testing and Balancing Firm and provide following assistance and/or services:

-Schedule sufficient time so that initial testing and balancing can be completed before occupancy begins and co-ordinate with trades involved.
-Keep Testing and Balancing Company informed of any major changes made during construction and provide them with set of Drawings and approved shop drawings.
-Provide and install balancing devices, test connections access openings, balancing probe inlets and plugs.
-Clean and pre-run equipment, filters, and place heating, ventilating and air conditioning systems into full operation and continue same during each working day of testing and balancing.
-Provide immediate labour from pertinent mechanical trades and tools, equipment and materials to make equipment and system alterations and

adjustments, as required including control adjustments.
-Make available equipment data (shop drawing, performance data and operating instructions) to Testing and Balancing Firm.

3.1.3.4 As part of co-ordination effort, be responsible for systems having been constructed and adjusted to provide optimum performance. Any re-adjusting required as result of spot checks by Owner's Designee shall be done at no additional cost to Owner.

3.2 **PROCEDURE**

3.2.1 **General**

3.2.1.1 Review pertinent Drawings, Specifications, shop drawings, interference drawings and other documentation to become fully familiar with systems and their specified and intended performance.

3.2.1.2 Provide equipment and instruct sheet metal trade on proper use for conducting duct leakage tests. Conduct first test as way of instruction to above tradesmen in presence of Owner's Designee.

3.2.1.3 Test relative barometric pressures in various building areas, as deemed necessary by Owner's Designee and at least in areas served by different systems.

3.2.1.4 Report any objectionable noise or vibration and be prepared to locate cause by instrumentation and analysis (including Octave Band and analysis).

3.2.1.5 Test noise levels in typical areas of building(s) on A scale plus following specific areas/rooms:

3.2.1.6 Operate, test and balance air systems over their entire design range of operation including minimum and maximum fresh air, return air and supply air. Fully simulate both heating and cooling conditions. Record sufficient data to verify compliance with design requirements.

3.2.2 **Data Required**

3.2.2.1 Submit following data as minimum. If required by Owner's Designee, provide for additional data. Indicate where tests were not specifically made. Do not repeat design data or other values not specifically tested.

Fans:

Manufacturer
Model and Serial number
Rated L/S (CFM)
Rated RPM
Rated pressures (suction and discharge)
Measured L/S (CFM)
Measured RPM
Measured pressures (suction and discharge)
Pulley size, type and manufacturer
Belt size and quantity

Pumps:

Manufacturer
Model and Serial number
Rated L/S (GPM)
Rated Head
Rated pressures
Measured discharge pressure (full flow and no flow)
Measured suction pressure (full flow and no flow)
Measured L/S (GPM) at operating conditions
Operating head
Operating RPM

Air Systems (including inlets and outlets):

Grille, register or diffuser reference number and manufacturer
Grille, register or diffuser location
Design velocity
Design L/S (CFM)
Effective (or free) area factor and size
Measured velocity
Measured L/S (CFM)

Heat Transfer Equipment:

Manufacturer, type and serial number

Following are to be provided for both heated and heating medium.

Design inlet and outlet temperatures
Design pressure drop
Design flow rate

Measured inlet and outlet temperatures
Measured pressure drop
Measured flow rate

Present sound and any other data requested in suitable manner to be approved by Owner's Designee.

3.2.3 **Initial Testing**

3.2.3.1 On completion of testing, adjusting and balancing of systems, submit 6 typewritten copies of full report on tests, adjustments, and balancing performed to Owner's Designee, including following:

-summary of systems
-testing methods and instrumentation
-air systems testing and balancing data
-liquid systems testing and balancing data
-sound testing data
-attachments including systems schematics with numbered terminals for referring to data above
-diagrams showing pitot traverse points.

3.2.4 **Final Report**

3.2.4.1 Submit final report to Owner's Designee following completion of alternate season testing and balancing. Submit 6 typewritten copies in same format as initial report specified above.

3.3 **ACCEPTANCE AND FOLLOW-UP**

3.3.1 **Spot Checks**

3.3.1.1 Before acceptance of balancing report, Owner's Designee may request spot checks to be performed in his presence. If results indicate unusual testing inaccuracy, omissions, or incomplete balancing/adjustment, in opinion of Owner's Designee, rebalance entire affected system(s) at no additional cost to Owner.

3.3.2 **Deficiencies**

3.3.2.1 Report any deficiencies in systems or equipment performance resulting in design requirements being unobtainable immediately to Owner's Designee.

3.3.3 **Acceptance**

3.3.3.1 Substantial performance shall be considered reached when initial Balancing Report is accepted by Owner's Designee and in opinion of Owner's Designee systems have been satisfactorily installed, operated tested, balanced, and adjusted to meet specified and intended performance.

3.3.3.2 Substantial performance will not depend upon alternate season testing as specified hereafter, however, make such relevant repairs or modifications deemed necessary during this rechecking as part of guarantee of work.

3.3.3.3 Total performance of work shall not be considered reached until alternate season testing and balancing is completed and final report submitted and accepted by Owner's Designee.

3.4 ADDITIONAL TESTING

3.4.1 Owner's Designee may request such additional testing in connection with this project as he deems necessary. Additional testing and balancing shall be performed at rates quoted and costs shall be withdrawn from allowance for Testing and Balancing work as approved by Owner's Designee.

End of Section.

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to Sections of Division 1 as applicable.

1.1.2 Conform to General Mechanical Requirements, Section 20 05 01.

1.1.3 Conform to General Electrical Requirements, Section 26 05 00.

1.2 **RELATED WORK**

1.3 **REFERENCES**

CAN/ULC-S102-10	-	Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
CAN/CGSB-51.2-10	-	Thermal Insulation, Calcium Silicate, for Piping, Machinery and Boilers

1.4 **DESCRIPTION OF WORK**

1.4.1 Thermal insulation to piping, ductwork and equipment, including but not limited to following:

- Domestic cold water piping;
- Hot water piping (domestic);
- piping, equipment or ductwork where existing insulation has been removed in part or entirely as part of Work;
- Sheetmetal work.

1.4.2 Following equipment will be factory insulated:

- Domestic hot water heaters;

1.5 **SUBMITTALS**

1.5.1 **Shop Drawings:** Before ordering any insulating materials, submit to Owner's

Designee list of proposed insulation materials, exterior jackets and adhesive for various services and equipment on project. Deviation from approved list will not be allowed.

1.6 **QUALITY ASSURANCE**

1.6.1 Provide new, undamaged insulating materials of types specified for each application.

1.6.2 **Qualifications of Applicators:** Use skilled insulation applicator with established reputation and specializing in this type of work.

1.6.3 **Regulatory Requirements**

1.6.3.1 Comply with OBC and requirements of local and Provincial authorities having jurisdiction.

1.6.3.2 Provide fire retardant type insulation materials, coverings and adhesives with flame spread/smoke developed ratings not exceeding 25/50 when tested in accordance with CAN/ULC-S102-M.

1.6.3.3 Properly identify insulation materials, coverings and adhesives when required by Federal and/or Provincial Health and Safety WHMIS legislation.

1.7 **DELIVERY, STORAGE AND HANDLING**

1.7.1 Deliver, store and keep insulation materials in original cartons or containers until immediately prior to application. Keep dry during shipping and storage.

1.7.2 Keep adhesives in original containers with manufacturer's name and catalogue number clearly stated. Protect contents against freezing.

2 Products

2.1 **DOMESTIC COLD WATER PIPING**

2.1.1 Fibrous glass split sectional pipe insulation conforming to CAN/CGSB-51.9 25 mm (1") thickness with factory applied vapour barrier jacket and self-seal lap joint.

Micro-Lok with AP-T jacket by Schuller International Inc., or
Alley K with all purpose AP-T jacket by Manson Insulation Inc., or

850 with ASJ/SSL jacket by Knauf Fiber Glass.

2.2 **HOT WATER PIPING (DOMESTIC SYSTEMS)**

2.2.1 Fibrous glass split sectional pipe insulation conforming to CAN/CGSB-51.9 of 25 mm (1") thickness with factory applied vapour barrier jacket and self-seal lap joint.

Micro-Lok with AP-T jacket by Schuller International Inc., or
Alley K with all purpose AP-T jacket by Manson Insulation Inc., or
850 with ASJ/SSL jacket by Knauf Fiber Glass.

2.3 **STORM AND SANITARY DRAIN PIPING**

2.3.1 Insulate exposed horizontal above floor storm and sanitary drain piping within building, and concealed horizontal storm drains.

2.3.2 Insulate vertical sections of rainwater conductors between body of roof drain and horizontal section of pipe, also any exposed vertical piping in high humidity areas such as locker and shower rooms.

2.3.3 Insulate exposed waste pipe of handicapped lavatories.

2.3.4 Insulation shall be fibrous glass split sectional pipe insulation conforming to CAN/CGSB-51.9 of 25 mm (1") thickness with factory applied vapour barrier jacket and self-seal lap joint.

Micro-Lok with AP-T jacket by Schuller International Inc., or
Alley K with all purpose AP-T jacket by Manson Insulation Inc., or
850 with ASJ/SSL jacket by Knauf Fiber Glass.

2.4 **SHEET METAL**

2.4.1 Insulation for exposed rectangular ductwork shall be rigid board conforming to CAN/CGSB-51.10 of 48 kg/m^3 (3 lb/cu.ft.) density, 25 mm (1") thickness, and reinforced foil flame resistant kraft facing.

814 series Spin-Glass with FSK facing by Schuller International Inc., or
AK Board with FSK facing by Manson Insulation Inc., or
Elevated Temperature 850 Board by Knauf Fiber Glass.

2.4.2 Insulation for concealed rectangular ductwork and concealed and exposed round ductwork with flexible duct insulation of 12 kg/m^3 (3/4 lb/cu.ft.) density,

25 mm (1") thickness, with reinforced foil flame resistant kraft facing.

Microlite Type 75 with FSK facing by Schuller International Inc., or
Alley Wrap with FSK facing by Manson Insulation Inc., or
Duct Wrap with FSK facing by Knauf Fiber Glass.

2.5 **SEALANTS AND ADHESIVES**

2.5.1 Supply sealants and adhesives as recommended by manufacturers:

85-20 and 60-38 by Foster, or
230-39 and 130-11 by Bakor Inc.

2.6 SURFACE FINISHES

2.6.1 **Ductwork and Equipment:**

2.6.1.1 Finish exposed field insulated ductwork, vessels, equipment and accessories in Boiler Rooms, Mechanical Rooms, Equipment Rooms and areas where vehicular traffic could damage insulation, with ULC listed, plain weave cotton fabric (canvas) of 220 g/m^2 (6 oz.) weight, properly pasted in place with approved fire resistive lagging adhesive.

Maritex 3451-RW by Alpha
Diplag 60 by Clairmont
Thermocanvas by S. Fattal

2.6.1.2 Finish exposed insulated ductwork installed outdoors, with field applied metal jacket of 0.4 mm (0.0016") thick, plain or stucco embossed aluminum, with lapped longitudinal and butt joints with silicone caulking.

2.6.1.3 Finish field insulated vessels, equipment and accessories insulated with elastomeric closed cell foam or neoprene insulation with full coating of white acrylic latex as recommended by insulation manufacturer.

2.6.2 Piping:

2.6.2.1 Finish exposed insulated piping, valves and fittings in Mechanical Rooms and Boiler Rooms with PVC jacketing. PVC must have attained 25/50 fire rating, based on CAN/ULC-S102 testing.

Sure-Fit system by Sure-Fit Systems Inc.
Zeston PVC by Schuller International inc.

2.6.2.2 Finish exposed insulated piping, valves and fitting outdoors, with field or factory applied metal jacket of 0.4 mm (0.0016") thick, plain or stucco embossed aluminum, with longitudinal "snap-lock", or lapped joints caulked with silicon and butt joints secured with alloy straps and mechanical fasteners. Provide jacketing complete with factory attached protective liner.

2.6.2.3 Finish piping, valves and fittings indoors and outdoors insulated with elastomeric closed cell foam or neoprene with full coating of white acrylic latex as recommended by insulation manufacturer.

3 Execution

3.1 **PREPARATION**

3.1.1 Clean surfaces to be insulated to remove grime, grease, oil, moisture or other matter. Ensure insulation is applied to clean dry surfaces.

3.1.2 Apply insulation at ambient temperature conditions in accordance with insulation or adhesive manufacturer's recommendations.

3.1.3 Do not apply insulation until piping, heat tracing, ductwork and equipment has been tested, inspected, verified, and accepted by Owner's Designee.

3.2 **INSTALLATION**

3.2.1 **General**

3.2.1.1 Perform insulation work in accordance with latest trade application methods. Obtain Owner's Designee's approval of methods intended to be used.

3.2.1.2 Apply insulation neatly and tightly in unbroken lengths and with ends of sections firmly and squarely butted or engaged together. Lap canvas or other specified wrapping over joints and cement down with adhesive. Extend insulation through sleeves in walls (except fire walls) or other openings in building to make insulation and vapour barrier continuous and of uniform diameter.

3.2.1.3 Terminate insulation at each side of fire walls and pack space between wall sleeve and duct or pipe as specified in Section 15010, General Mechanical Requirements.

3.2.1.4 Where asbestos-containing insulation has been removed from existing piping,

equipment or ductwork, re-insulate (to same extent as removal work) or (to extent as indicated on Drawings). Maintain same thermal value as existing.

3.2.1.5 Replace insulation removed from existing piping or ductwork to make tie-in connections with new insulation. Cut back existing insulation sufficient distance to make neat and firm butt joint between old and new insulation.

3.2.1.6 At expansion joints in piping, apply insulation over sleeve of 1.6 mm (16 gauge) metal, fabricated to fit around expansion joint without restricting its movement. Fabricate sleeve so it can be removed to allow for repacking and lubrication of expansion joint without damaging adjoining insulation. Extend sleeves min of 75 mm (3") longer than expansion joint, fit with insulation retaining flanges and with means of maintaining position of sleeve over expansion joint.

3.2.1.7 Where piping is specified to be heat traced, provide oversized insulation to accommodate tracing cable specified in Division 16.

3.2.2 Hot and Cold Water Piping

3.2.2.1 Apply 75 mm (3") wide butt strips of same material as factory applied jacket. Seal both longitudinal and butt joint strips with Foster 85-20 or Bakor 230-39 vapour barrier fire resistive lap sealer, or secure with self seal lap joints where provided.

3.2.2.2 Insulate fittings, flanges and valves with fibrous glass insulation of same thickness as adjoining pipe insulation and finish with pre-moulded PVC cover, securely fastened and sealed to adjoining pipe covering with Foster 85-75 or Bakor 230-39 to form vapour proof joint.

3.2.2.3 Do not insulate screwed unions and final connections to fixture.

3.2.2.4 Terminate insulation at each end of unions with Partek Hilcote insulating and finishing cement, trowelled on bevel.

3.2.3 Storm and Sanitary Drain Piping

3.2.3.1 Build up insulation at joints and fittings with 2 or more layers of insulation to form unbroken surface over joint, coupling or fitting.

3.2.4 Sheet Metal

3.2.4.1 Apply insulation to following ductwork systems and components:

-Minimum of 3 m (10') of exhaust duct from exterior of building.

3.2.4.2 Secure insulation on exposed rectangular ductwork with welded impaling pins and speed washer type fasteners at 300 mm (12") centres. Provide minimum of 2 rows of fasteners on each side of duct.

3.2.4.3 In addition to mechanical fasteners, adhere insulation to duct with Foster 85-20 or Bakor 230-38 fire resistive adhesive applied to duct in 150 mm (6") wide strips at 450 mm (18") centres. Tightly butt joints and breaks in insulation and seal with Foster 30-35 or Bakor 130-11 fire resistive mastic and 75 mm (3") wide scrim foil pressure sensitive tape. Cut off protruding ends of welded pins and cover speed washers with same tape to ensure smooth application of exterior jacket.

3.2.4.4 Fasten insulation to concealed rectangular ductwork and to both concealed and exposed round ductwork with Foster 85-20 or Bakor 230-38 adhesive, applied in 150 mm (6") wide strips at 300 mm (12") centre. Tightly butt edges and joints and seal with Foster 30-35 or Bakor 130-11 fire resistive mastic and 75 mm (3") wide pressure sensitive scrim foil tape. Use tying cord only to temporarily secure insulation until adhesive has set. Remove prior to application of exterior jacket.

3.2.4.5 Insulate access doors or removable panels in ductwork as separate units to permit opening or removal without damage to adjoining insulation.

End of Section.

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to Sections of Division 1, as applicable.

1.1.2 * Section 26 05 00 shall apply to and govern work of all Sections of Division 16 , as applicable.

1.2 **RELATED WORK**

1.2.1* Painting and finishing for electrical work: Section 09 91 00, Painting and Finishing under supervision of Division 16, except as otherwise specified herein.

1.2.2* Firestopping and smoke seals: Section 07 84 00, Penetration Firestopping.

1.3 **SYSTEM DESCRIPTION**

1.3.1 **Incoming Service Data**

1.3.1.1* Available electric service is 120/208 volts, 60 Hz, 3 phase, 4 wire, grounded wye system. Located in the existing electrical room.

1.3.1.2 Available system fault duty is 22KA symmetrical.

1.3.1.3 Co-ordinate ratings and characteristics of all pertinent electrical equipment to ensure safe and satisfactory operations.

1.4 **SUBMITTALS**

1.4.1 **Shop Drawings**

1.4.1.1 Submit shop drawings

1.4.1.2 When equipment and apparatus of 1 system must be co-ordinated with or installed in a given area with equipment and apparatus of other system(s), prepare and submit necessary co-ordinated composite drawings for checking interferences.

1.4.2 **As-Built Drawings**

1.4.2.1 Submit "as built" drawings

1.4.2.2 For underground installations, dimension location with respect to building walls and mark levels with respect to elevation of finished floor below where wiring is buried.

1.4.2.3 Colour code changes using red for additions, and green for deletions.

1.4.3 **Operation and Maintenance Data**

1.4.3.1 Submit operation and maintenance data in accordance with requirements of Paragraph 40 of Section 01 11 55, General Conditions. Make changes or submit additional information if required.

1.4.3.2 Review instructions with owners Designee to ensure a thorough understanding of equipment and its operation.

1.5 **QUALITY ASSURANCE**

1.5.1 **Regulatory Requirements**

1.5.1.1 Ontario Hydro Approval: Immediately upon award of the Contract, submit complete set of electrical drawings to Ontario Hydro for approval. Prepare and submit any other documents required for approval.

1.5.1.2* Materials and workmanship shall be in accordance with requirements and recommendations of applicable rules, regulations, standards and codes as specified hereunder. All products shall bear certification label of CSA, ULC, Ontario Hydro, as applicable.

Ontario Electrical Safety Code (OESC)-publication containing Canadian Electrical Code and Ontario Hydro Supplements.

Canadian Standards Association (CSA)

Underwriter's Laboratories of Canada (ULC)

Electrical and Electronic Manufacturers Association of Canada (EEMAC)

Joint Industrial Council (JIC)

Ontario Building Code (0BC)

Ontario Fire Code (OFC)

Association of Edison Illuminating Companies (AEIC)

American Society for Testing and Materials (ASTM)

Insulated Power Cable Engineers Association (ICEA)

Boards, Service Companies or other Authorities having jurisdiction.

1.5.1.3 Permits, Fees and Certificates: Except as provided in Paragraph 13 Fees and Certificates of 01 11 55 G.C. 17.1 General Conditions, give notices, obtain permits, pay fees required for work of Division 16. Before final certificate of payment is issued by Owner, furnish certificates as evidence that work installed conforms with laws and regulations of all governing authorities. Determine detailed requirements of local authorities having jurisdiction and conform to those requirements.

1.5.2 **Qualifications**

1.5.2.1 Work shall be executed by Electrical Contractor or his designated sub-contractor, holding a valid Contractors' license (Master License).

1.5.2.2 Work shall be performed by qualified Electricians holding valid Ontario certificates of qualifications.

1.5.2.3 Work on signal, communication, related control and other similar systems shall be performed by relevant competent tradesmen.

1.6 **PROJECT/SITE CONDITIONS**

1.6.1 **Existing Conditions**

1.6.1.1 Examine Site and Contract Documents in accordance with Instructions to Bidders.

1.6.1.2 Electrical installations in areas classified as hazardous locations, corrosive environments, and other special area application, shall be governed by relevant Industry Standards and Regulatory Requirements.

1.6.2 **Interruption of Services**

1.6.2.1 Any interruption of lighting or electrical services to any part of existing building(s) shall come at a time agreeable to owners Designee as generally specified in Section 01 11 55, General Conditions. Make all necessary arrangements with those concerned, and include in Contract Sum for any overtime required to ensure that interruption is held to a minimum.

1.6.2.2 All such overtime work shall be carried out without additional cost to the owner.

2 Products

2.1 **MATERIALS**

2.1.1 **Inserts:** Supply and deliver inserts, anchors, bolts, sleeves, ferrules and other items to be built into work of other Divisions, with necessary templates, adequate instructions and assistance for locating and installing.

3 Execution

3.1 **EXAMINATION**

3.1.1 **Verification of Conditions**

3.1.1.1 Where any parts of systems and/or pieces of equipment are located by dimensions on Drawings, check and verify such dimensions at Site.

3.1.1.2 Notify owners Designee before proceeding further if any discrepancy or interference with other equipment is found which will necessitate revision in or deviation from Work as indicated or specified.

3.1.1.3 Location of conduit, raceways, wiring and other equipment shall be altered without charge to the owner if so directed by the owners Designee provided change is ordered before installation, and does not necessitate additional labour and material.

3.2 **PREPARATION**

3.2.1 **Cutting and Patching**

3.2.1.1 Cutting of holes up to 200 mm (8") in diameter and related patching shall be done under Division 16.

3.2.1.2 Holes and other openings larger than 200 mm (8") in diameter, chases, bulkheads, furring and related patching will be done under Section 01 45 00, Cutting and Patching.

3.2.1.3 Supply measurements of equipment to other Sections to allow for necessary openings to be left in work of other Sections.

3.2.2 **Firestopping and smoke seal**

3.2.2.1 Be responsible for installation of firestopping and smoke seal inside electrical assemblies.

3.2.2.2 Firestopping and smoke seals around outside of electrical assemblies, where they penetrate fire rated separations shall be part of work of Section 07 84 00, Penetration Firestopping and shall be carried out under supervision of this Division.

3.2.2.3 Be responsible for any additional cost incurred as a result of oversizing of openings during cutting and patching operation of openings to be firestopped

up to 200 mm (8") in diameter

3.2.2.4 Install sheet steel covers supplied by Section 05 50 00, Miscellaneous Metals over temporarily unused sleeves provided in fire separations for future electrical installations.

3.3 **INSTALLATION**

3.3.1 Instruct and supervise other Sections doing related work.

3.3.2 Electrical products and methods of installation shall be in accordance with relevant Sections of Division 16, and applicable requirements of other Divisions.

3.3.3 Correct installed work as directed by authorized inspector of such authorities.

3.3.4 No increase to Contract Sum shall apply for electrical items relocated from location indicated and prior to installation requiring extra labour and material up to 3meters (10'-0") from original location, nor will decrease to Contract Sum apply where relocation up to 3 metres (10'-0") reduces materials and labour.

3.3.5 **Equipment Identifications**

3.3.5.1 Electrical equipment and auxiliaries shall be identified in accordance with designations indicated on Drawings or as specified in other Sections of Division 16.

3.3.5.2 Identify electrical equipment, control cabinets, designated boxes, and other similar items, using Lamicoid plates.

3.3.5.3 Fasten Lamicoid nameplates using self-tapping screws for metal sheet enclosures or glued to PVC or fibreglass construction.

3.3.5.4 Identify wiring, as required, using standard indelible wire markers at each termination, in accordance with schematic and/or connection wiring diagrams.

3.3.6 **Painting work supplied under Division 16**

3.3.6.1 Touch up minor chips or damage to electrical equipment, installed in this Division, with standard, factory supplied, enamel finish.

3.3.6.2 Colour code, as specified herein, outlet boxes, pull boxes, junction boxes by applying a small dab of paint to inside of each item during installation.

3.3.6.3 Colour code, as specified herein, all exposed ducts, conduits, outlet boxes, and similar items by applying a 25 mm (1") wide band of paint around ducts and conduits adjacent to boxes described in above paragraph and on both sides of wall penetration.

3.3.6.4 Use following paint colour-code:

- Red: Fire Detection and Alarm System; Emergency Alarm System (Panic, Intrusion, etc.)
- Green: Communication System (Voice, Data, Electronics, etc.)
- Yellow: Emergency Power System

3.3.7 **Painting work supplied by Section 09 91 00, Painting and Finishing**

3.3.7.1 Priming and finish painting of exposed unfinished raceways, fitting, outlet boxes, junction boxes, pull boxes and similar items.

3.3.7.2 Division 16 shall assist in form of supervision, painting works by Section 09 91 00, Painting and Finishing.

3.3.8 **Symbols**

3.3.8.1 Electrical work is indicated generally on Drawings using standard symbols.

3.3.9 **Mounting Heights**

3.3.9.1 Measure mounting height dimension from operator's working floor level (finish) to centre-line of electrical device or enclosure, unless otherwise indicated or specified herein.

3.3.9.2* Mounting heights shall be as follows, unless otherwise indicated or specified as directed on Site:

Lighting Switches	1050	mm

3.3.9.3 Heights are subject to change to suit structural requirements, and other Site conditions, and therefore as work progresses, and before installing equipment, obtain instructions or directions from owners Designee for alternative heights or relocation.

3.3.10 **Mounting of Equipment**

3.3.10.1 Lighting panels, annunciators, control panels and cabinets, electrical enclosures, boxes, and other similar items indicated to be installed in pipe spaces or other areas where an exposed type of wiring is specified shall be surface mounted.

3.3.11 **Existing Installations**

3.3.11.1 Execute changes, alterations, relocations, removals, additions, and connections to existing electrical installation as indicated on Drawings or as specified.

3.3.11.2 Check electrically-operated equipment for proper wiring connection and operation before disconnecting and reconnecting it thereafter. Report defects in equipment to owners Designee before proceeding work.

3.3.11.3 Where connections are required to existing electrical equipment, install necessary raceways and wiring and connect up complete as required for proper operation.

3.3.11.4 Remove exposed existing conduit and its wiring made redundant by Work. Cut off and cap conduits concealed or embedded in concrete, flush with finished walls, ceiling and floors.

3.3.11.5 Provide new wiring for new and affected existing lighting fixtures, switches, receptacles, outlets and other electrical equipment indicated on Drawings, unless stated otherwise.

3.3.11.6 Repair damage caused by such works, including repainting required due to lack of reasonable care. Bring discrepancies regarding installation to owners Designee's attention for decision regarding procedure to be taken.

3.3.11.7 Maintain and protect during construction, existing wiring required to be retained. Where interruption of services cannot be avoided, conform to requirements specified herein.

3.3.11.8 Provide temporary feeder connections to equipment where interruption of services is not allowed.

3.3.11.9 Existing minor installations, such as conduits, boxes and wiring devices, which interfere with new electrical equipment installation, may be rerouted or relocated on prior approval of owners Designee.

3.3.11.10 Safely carry out (demolition and) removal of existing electrical installation and equipment as specified or as indicated on Drawings. Removed equipment shall become property of Division 16, unless noted otherwise .

3.3.11.11 Disconnect and seal off electrical equipment and services as required on Site.

3.3.11.12 Be responsible for demolition and removal of electrical equipment and services designated for removal on Drawings and as required by Work.

3.3.12 **Grounding**

3.3.12.1 Ground electrical equipment in accordance with requirements of Ontario Hydro Electrical Safety Code.

3.3.12.2 Arrange grounds so that under normal operating conditions, no injurious amount of current will flow in any grounding conductor. Connect single phase loads so that there is least possible unbalance of supply.

3.4 FIELD QUALITY CONTROL

3.4.1 Trial Usage

3.4.1.1 Trial usage by owners Designee of any electrical device, machinery, apparatus, equipment and other work supplied under this Division before final completion and written acceptance by owners Designee is not to be construed as evidence of acceptance by Owner.

3.4.1.2 Owner shall have privilege of such trial usage as soon as Contractor claims that said work is completed, in accordance with Drawings and specifications for such reasonable length of time as owners Designee deems sufficient for making a complete test.

3.4.1.3 No claim for damage shall be made for injury to or breaking of any parts of such tested work, whether caused by weakness or inaccuracy of structural parts or by defective materials or workmanship of any kind whatsoever.

3.4.2 Tests

3.4.2.1 At completion of installation, conduct grounding resistance test, voltage test, and empty conduit test in presence of owners Designee and make corrections where necessary and as directed.

3.4.2.2 Voltage provided to equipment in installation shall not exceed minimum and maximum permissible limits for equipment.

3.4.2.3 Perform insulation tests for installed wiring and equipment with appropriate "Megger" testing equipment. Megger lighting and power circuit feeders and if resistance to ground is less than recommendations on any lighting or power circuit, consider such circuit defective and replace it.

3.4.2.4 Test performance of equipment for mechanical and electrical defects. Make adjustments necessary for such equipment. When equipment has been placed in permanent operation give to operating personnel all necessary tuition and instructions for its operation and maintenance.

3.4.2.5 Test conduits which are required to be installed but left empty for clear bore, using ball mandrel, brushes and snake. Use lignum vitae ball of diameter equal to approximately 85% of conduit inside diameter. Clear any conduit which rejects ball mandrel in an approved manner and without damage thereto.

3.4.2.6 Furnish labour, materials, instruments and bear other costs in connection with

all tests, obtain required certificates of approval, acceptance, and compliance with regulations of agencies having jurisdiction and as specified. Work shall not be deemed complete and final certificate of acceptance will not be issued, until such certificates have been delivered to owners Designee.

3.5 **CLEANING**

3.5.1 Before starting and commissioning operations, installed new electrical enclosures, equipment and control devices, open-frame motors shall be air-blown and/or vacuum-cleaned.

3.5.2 Ensure no foreign objects, tools, and materials are left inside switchgears, cabinets, panelboards, control panels and similar enclosures before such equipment is energized.

3.5.3 Refer to Section 01 51 00, Construction Facilities, for other applicable final clean-up requirements.

End of Section.

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to Sections of Division 1 as applicable.

1.1.2 Conform to General Electrical Requirements, Section 26 05 00 as applicable.

1.2 **REFERENCES**

CAN/CSA C22.2 No. 4-M89	-	Enclosed Switches,
CAN/CSA C22.2 No. 18-3-12	-	Conduit Boxes, Tubing, and Cables
CAN/CSA C22.2 No. 94-M91	-	Special Purpose Enclosures
CSA C22.2 No. 51-14	-	Armoured Cables
CSA C22.2 No .56-13	-	Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit
CSA C22.2 No. 83-M1985	-	Electrical Metallic Tubing
CSA C22.2 No. 18.1-13	-	Metallic Outlet Boxes

1.3 **SUBMITTALS -** Submit shop drawings as defined in G.C. 5 of General Conditions of Contract for following equipment.

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1.3.1 Wires and cables

2 Products

2.1 **MATERIALS AND EQUIPMENT**

2.1.1 **Breaker**s

2.1.1.1 Single pole breakers: Connected to main buses so that any three adjacent breaker poles are connected to phase A, B and C and same phase sequence relationship maintained. Panelboards shall not be out of balance more than current value of one circuit between any two phases, when full load is on.

2.1.1.2 Two- or three-pole breakers: Shall have common trip; extension tie handles will not be accepted.

2.1.1.3 Ratings and number of circuits shall be as indicated on Drawings with lighting circuits located at top, receptacles and other circuits below, unless otherwise indicated on Drawings.

2.1.1 **Wires and Cables, and Accessories**

2.1.1.1 Wiring, general, for Power and Lighting Feeders: Copper conductors type "R90", 600V insulation, except as otherwise noted or scheduled on Drawings.

2.1.1.2 Wiring smaller than 8.3 mm^2 (No. 8) shall be solid. Conductors of 8.3 mm^2 (No. 8) and larger shall be stranded.

2.1.1.3 Do not use wiring smaller than 3.3 mm^2 (No. 12) except for control wiring specified under Division 16.

2.1.1.4 Size branch circuits and feeders for maximum 2% voltage drop from panelboard to farthest outlet in circuit and large enough to be protected by fuse or breaker of which they form a part.

2.1.1.5 Feeders, circuit wiring and ancillary items shall be colour-coded for phase identification.

2.1.1.6 Neutral Conductor: Full capacity, white insulation, continuous throughout circuit without fuses, breakers or switches of any kind.

2.1.5 **Raceway and Boxes**

2.1.5.1 Electrical Metallic Tubing (EMT), Couplings and Connectors: CSA C22.2 No. 83. Use for exposed, concealed surface installation not subject to mechanical stress or injury. Provide ground wire for sizes over 50mm (2").

2.1.5.3 Flexible Metallic Conduits: CSA C22.2 No.56. Use for connection to motors and recessed luminaires, indoor dry location, within Code requirement.

2.1.5.5 Cable pulling accessories: Fish cord, polypropylene or approved equal.

2.1.5.6 Fastening and accessories: in accordance with Section 01 60 00,Material and Equipment.

2.1.5.7 Outlet Boxes, Conduit Boxes, and Fittings: CSA C22.2 No.18,electro-galvanized sheet steel construction for outlet boxes; cast-type feraloy ‘FS’ or ‘FD’ with standard factory-threaded hubs or adapters as required for conduit boxes.

2.1.5.9 Box covers, types and sizes to match respective boxes and/or wiring devices as required, complete with (screwed)(hinged) covers, (gasketted).

2.1.6 **Wiring Devices**

2.1.6.1 Wiring devices for general purpose shall be of Standard quality "Specification Grade" manufactured and tested in accordance with CSA and NEMA standards.

2.1.6.2 General Use Switches: CSA C22.2 No.111 for controlling lighting loads: 20A, 120/277V, quiet toggle, Pass & Seymour Catalogue No. 20AC1(1-pole) , or 20AC3 (3-way), or approved equal by Hubbell, Leviton, Bryant, and others.

2.1.6.6 Wall Plates, brushed finish stainless steel type 301 (impact-resistant smooth thermoplastic) with chrome-plated screws, with protective removable film, to match respective wiring devices and boxes, finished wall application.

3 Execution

3.1 **INSTALLATION**

3.1.3 **Breakers**

3.1.3.1 Install new breakers in existing panelboards as indicated on Drawings.

3.1.4 **Wires and Cables and Accessories**

3.1.4.1 Install wires and cables in raceways and boxes in accordance with OESC requirement and other regulatory bodies having jurisdiction.

3.1.4.2 Terminate conductors in supply panelboards and designated termination points as shown on Drawings and respective panelboard schedule,using approved wire terminating materials and accessories..

3.1.4.3 Provide approved wire markers, complete wire numbers/identification ,as per equipment manufacturer’s wiring diagram or shop drawing as applicable, and in accordance with latest standards of OESC, CSA, OBC, and other Authorities having jurisdiction.

3.1.5 **Raceway and Boxes**

3.1.5.1 Install raceway, boxes, and necessary fittings, including supports, fasteners, and accessories, in compliance with current practices and standards by regulatory bodies having jurisdiction.

3.1.5.2 Route exposed raceway neatly, parallel to and perpendicular to building lines, and equally-spaced when in groups with other raceway .

3.1.5.3 Fasten and support boxes independent from raceway supports.

3.1.5.4 Use proper outlet boxes, device boxes to suit type of raceway and installation for general wiring in accordance with standards and practices by regulatory bodies and authorities having jurisdiction.

3.1.5.5 Thoroughly clean raceway and boxes, clear of obstructions, prior to wire and cable pulling.

3.1.5.6 Provide empty conduits and tubing with pulling cord secured at both ends, and cap for future wire installation. Provide blank cover for installed empty boxes.

3.1.6 **Wiring Devices**

3.1.6.1 Install light switches with handle “up” when switch is in “ON” position.

3.1.6.2 When more than 1 switch and/or receptacle are required in one location, use gang-type installation with matching outlet box and wall plate.

3.1.6.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.1.6.4 Remove protective film on stainless steel wall plates only after painting and other work is finished in respective area.

3.2 **TESTING AND INSPECTION**

3.2.1 Conduct visual inspection at times for signs of physical damages or defects prior to and after installation.

3.2.2 Test installed equipment and wiring for grounds and short-circuit upon completion of work. See also Section 16010 for additional instructions.

End of Section.

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to Section of Division 1 as applicable.

1.1.2 Conform to Section 20 05 01, General Mechanical requirements.

1.1.3 Conform to Section 26 05 00, General Electrical Requirements.

1.1.4 Conform to Section 16225, Motors, Starters and Wiring.

1.2 **RELATED WORK**

1.2.1 Heating, ventilating and air conditioning: Section 15700, Heating, Ventilating and Air Conditioning.

1.2.2 Work by Other Trade Sections

1.2.2.1 Adjusting, calibrating, modifying or operating any installed equipment or control to be provided by other Sections.

1.2.2.2 Testing and checking of equipment supplied by other trade Sections, except where such equipment forms integral part of mechanical systems.

1.3 **REFERENCES**

1.3.1 Perform testing and balancing in accordance with current issue of SMACNA Standards. Use recently calibrated instruments and state date of calibration in reports.

1.4 **DEFINITIONS**

1.4.1 BALANCING: To proportion and regulate flows within distribution system (subsystems, branches, mains, terminals and similar items) at appropriate pressures in accordance with design intent. This includes setting discharge volume and patterns of terminal devices, and individual return and exhaust air volumes.

1.4.2 TESTING: To measure, interpret and report in writing, such parameters as may be required to verify design compliance and as hereafter specified.

1.5 **DESCRIPTION**

1.5.1 Work to be performed under this Section includes, without limiting to, performance testing and balancing of heating, ventilating, air conditioning and liquid system, including labour, materials and equipment required to carry out Work under this Contract. Co-operate with other Sections of Division 15 which will operate systems and make any required adjustments to systems to meet specified and intended performance.

Principal items of work are as follows:

- Performance testing and balancing of air systems
- Survey installed automatic controls and verify their functional performance
- Test performance of vibration isolation equipment
- Measure and report specified space noise levels
- Rechecking of testing and balancing during alternate (heating/cooling) season

1.5.2 **Design Requirements and Performance Requirements**

1.5.2.1 Balance systems to performance parameters indicated on Drawings and in Specifications. If interpretation, clarification or additions to performance parameters are required, request such information from Owner's Designee.

1.5.2.2 Balance systems to within following tolerances:

- Duct Leakage Rates (at operating pressures)

Low pressure ducts
0 to 0.5 kPa (0 to 2" W.G.) - 5% of full flow

- Air Flow Rates

Under 70 L/S (150 cfm) -10% of flow
Over/at 70 L/S (150 cfm) -5% of flow

Water Heaters -5% of design capacity

1.6 **SUBMITTALS**

1.6.1 **Reports**

1.6.1.1 Submit following:

Site visit reports
Review and recommendation report
Initial report
Alternate season report
Final report

1.6.2 **Record Drawings**

1.6.2.1 Record, in red ink, any changes to set of plans submitted with review and recommendation report while work progresses. At completion of work, transfer this information to set of sepias and submit to Owner's Designee.

1.7 **QUALITY ASSURANCE**

1.7.1 **Qualifications**

1.7.1.1 Use independent Testing and Balancing Firm with minimum of 5 years experience in this type of work to carry out performance testing and balancing.

1.8 **PROJECT/SITE CONDITIONS**

1.9 **SEQUENCING AND SCHEDULING**

2 Products

2.1 **MATERIALS**

2.1.1 Supply test equipment required to perform work of this Section.

3 Execution

3.1 **GENERAL**

3.1.1 **Site Visits**

3.1.1.1 Visit Site as required prior to testing and balancing systems to advise respective trades of requirements for probe inlets. Submit report to Owner's Designee after each Site visit.

3.1.2 **Review and Recommendations**

3.1.2.1 Within 30 days of award of this Contract, identify and neatly mark specific location of adjusting, balancing and permanent measuring devices on set of plans for approval by Owner's Designee. Owner's Designee will provide set of sepias for this purpose.

3.1.2.2 With same submission, propose, for review by Owner's Designee, additional devices deemed advisable for satisfactory operation and completion of mechanical work under Division 15.

3.1.2.3 Submit proposed format for initial report with above mentioned plans. Include complete list of instruments and tests for which they are to be used as they relate to this Project.

3.1.3 **Coordination and Cooperation**

3.1.3.1 Review before fabrication, location of balancing devices, test connections and access openings and report conditions which could affect optimum system performance. By inspection, assure that testing, balancing and metering devices are installed properly and in preselected locations. Report any errors to Owner's Designee. Obtain approval of Testing and Balancing Firm before relocating these devices due to field conditions.

3.1.3.2 Testing and Balancing Firm shall co-operate by giving adequate prior notification of request for services of tradesmen, and co-ordinating his efforts so that items requiring replacement and/or delivery time (sheaves, motors, and other similar items) are tested as early as possible.

3.1.3.3 Co-operate with Testing and Balancing Firm and provide following assistance and/or services:

-Schedule sufficient time so that initial testing and balancing can be completed before occupancy begins and co-ordinate with trades involved.
-Keep Testing and Balancing Company informed of any major changes made during construction and provide them with set of Drawings and approved shop drawings.
-Provide and install balancing devices, test connections access openings, balancing probe inlets and plugs.
-Clean and pre-run equipment, filters, and place heating, ventilating and air conditioning systems into full operation and continue same during each working day of testing and balancing.
-Provide immediate labour from pertinent mechanical trades and tools, equipment and materials to make equipment and system alterations and

adjustments, as required including control adjustments.
-Make available equipment data (shop drawing, performance data and operating instructions) to Testing and Balancing Firm.

3.1.3.4 As part of co-ordination effort, be responsible for systems having been constructed and adjusted to provide optimum performance. Any re-adjusting required as result of spot checks by Owner's Designee shall be done at no additional cost to Owner.

3.2 **PROCEDURE**

3.2.1 **General**

3.2.1.1 Review pertinent Drawings, Specifications, shop drawings, interference drawings and other documentation to become fully familiar with systems and their specified and intended performance.

3.2.1.2 Provide equipment and instruct sheet metal trade on proper use for conducting duct leakage tests. Conduct first test as way of instruction to above tradesmen in presence of Owner's Designee.

3.2.1.3 Test relative barometric pressures in various building areas, as deemed necessary by Owner's Designee and at least in areas served by different systems.

3.2.1.4 Report any objectionable noise or vibration and be prepared to locate cause by instrumentation and analysis (including Octave Band and analysis).

3.2.1.5 Test noise levels in typical areas of building(s) on A scale plus following specific areas/rooms:

3.2.1.6 Operate, test and balance air systems over their entire design range of operation including minimum and maximum fresh air, return air and supply air. Fully simulate both heating and cooling conditions. Record sufficient data to verify compliance with design requirements.

3.2.2 **Data Required**

3.2.2.1 Submit following data as minimum. If required by Owner's Designee, provide for additional data. Indicate where tests were not specifically made. Do not repeat design data or other values not specifically tested.

Fans:

Manufacturer
Model and Serial number
Rated L/S (CFM)
Rated RPM
Rated pressures (suction and discharge)
Measured L/S (CFM)
Measured RPM
Measured pressures (suction and discharge)
Pulley size, type and manufacturer
Belt size and quantity

Pumps:

Manufacturer
Model and Serial number
Rated L/S (GPM)
Rated Head
Rated pressures
Measured discharge pressure (full flow and no flow)
Measured suction pressure (full flow and no flow)
Measured L/S (GPM) at operating conditions
Operating head
Operating RPM

Air Systems (including inlets and outlets):

Grille, register or diffuser reference number and manufacturer
Grille, register or diffuser location
Design velocity
Design L/S (CFM)
Effective (or free) area factor and size
Measured velocity
Measured L/S (CFM)

Heat Transfer Equipment:

Manufacturer, type and serial number

Following are to be provided for both heated and heating medium.

Design inlet and outlet temperatures
Design pressure drop
Design flow rate

Measured inlet and outlet temperatures
Measured pressure drop
Measured flow rate

Present sound and any other data requested in suitable manner to be approved by Owner's Designee.

3.2.3 **Initial Testing**

3.2.3.1 On completion of testing, adjusting and balancing of systems, submit 6 typewritten copies of full report on tests, adjustments, and balancing performed to Owner's Designee, including following:

-summary of systems
-testing methods and instrumentation
-air systems testing and balancing data
-liquid systems testing and balancing data
-sound testing data
-attachments including systems schematics with numbered terminals for referring to data above
-diagrams showing pitot traverse points.

3.2.4 **Final Report**

3.2.4.1 Submit final report to Owner's Designee following completion of alternate season testing and balancing. Submit 6 typewritten copies in same format as initial report specified above.

3.3 **ACCEPTANCE AND FOLLOW-UP**

3.3.1 **Spot Checks**

3.3.1.1 Before acceptance of balancing report, Owner's Designee may request spot checks to be performed in his presence. If results indicate unusual testing inaccuracy, omissions, or incomplete balancing/adjustment, in opinion of Owner's Designee, rebalance entire affected system(s) at no additional cost to Owner.

3.3.2 **Deficiencies**

3.3.2.1 Report any deficiencies in systems or equipment performance resulting in design requirements being unobtainable immediately to Owner's Designee.

3.3.3 **Acceptance**

3.3.3.1 Substantial performance shall be considered reached when initial Balancing Report is accepted by Owner's Designee and in opinion of Owner's Designee systems have been satisfactorily installed, operated tested, balanced, and adjusted to meet specified and intended performance.

3.3.3.2 Substantial performance will not depend upon alternate season testing as specified hereafter, however, make such relevant repairs or modifications deemed necessary during this rechecking as part of guarantee of work.

3.3.3.3 Total performance of work shall not be considered reached until alternate season testing and balancing is completed and final report submitted and accepted by Owner's Designee.

3.4 ADDITIONAL TESTING

3.4.1 Owner's Designee may request such additional testing in connection with this project as he deems necessary. Additional testing and balancing shall be performed at rates quoted and costs shall be withdrawn from allowance for Testing and Balancing work as approved by Owner's Designee.

End of Section.

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to Sections of Division 1 as applicable

1.1.2 Conform to General Electrical Requirements, Section 26 05 00 as applicable.

1.1.3 Conform to Interior Luminaires, Section 16510 as applicable.

1.1.4 Conform to Relay Schedules indicated on Electrical Drawings.

1.2 REFERENCES

CSA C22.2 No. 14-13	Industrial Control Equipment
CSA C22.2 No. 184-15	Solid-State Lighting Controls

1.3 **SYSTEM DESCRIPTION**

1.3.1 Low voltage control system designed to provide remote switching of lighting loads by use of Class 2 voltage rated switches, relays,control transformers, and “Master” panel/s, and programmable intelligence capability by means of lap-top computerizing softwares.

1.4 **SUBMITTALS**

1.4.1 **Shop Drawings**: Submit shop drawings, brochures and pertinent literature in accordance with Paragraph 11 of 01 11 55 General Conditions for the following:

1.4.1.1 System description, component data sheets.

1.4.1.2 All components of Lighting Control System.

2 Products

2.1 **MATERIALS**

2.1.1 **Switches**

2.1.1.1 Control shall be by led touch screen, communicating on RS485 bus to controller.

2.1.1.2 Wallplates, gang or switch arrangement as required, thermoplastic ivory, to match respective switches.

2.1.2 **Relays**

2.1.2.1 Control relays shall be low voltage type relays powered by short electrical impulses permanently locked until coil is energized.

2.1.2.2 Single-coil (polarized action) shall operate relay contact.

2.1.2.3 Nominal voltage of operation shall be 24 volts AC.

2.1.2.4 Output (load) contacts shall have capacity of 20 amperes at 120V for led, incandescent and/or fluorescent lighting system.

2.1.2.5 Auxiliary contact shall be available for a pilot light other interlocks, minimum 1 amp 24V AC isolated.

2.1.2.6 Relays to be heavy-duty type, rated for minimum of 50,000 'ON' - 'OFF' operations at full 20A rated load.

2.1.2.7 Relays shall have coloured, pre-stripped leads.

2.1.3 **Control Transformer**

2.1.3.1 Low voltage type transformer, Class 2, input 120V AC, 60 Hz, output 40 VA, 24V complete with over-current protection, reset, and voltage spike protection.

2.1.4 **Control Panel**: Surface wall mounted with lockable, hinged covers, painted grey ANSI 61, constructed of 14 ga cold rolled steel, complete with status viewing windows. Each panel to contain completed wiring schedule directory card fixed to rear of cover. Each control panel assembly shall include:

2.1.4.1 Plug-in inputs, and outputs

2.1.4.2 Control transformer.

2.1.4.3 A metallic divider to isolate low voltage from high voltage.

2.1.4.4 Relay bases and printed circuit board with pre-identified and integral control and power coupling terminals.

2.1.4.5 Provision for future interfacing

2.1.4.6 1048 programmable inputs and necessary integrated cards, for interfacing with building management control system.

2.1.4.7 Provisions to address each lamp separately with zoning as per drawings.

2.1.4.8 Control panels shall have central dataline access port to provide central monitoring, programming and control of panels as described for single intelligent panel.

2.1.4.9 Control panels shall have programmable plug-in intelligence control cards to provide operational and networking capability. No changes to low voltage switching system or to panels shall be required.

2.1.5 **Plug-in Intelligence Controller Card**: Shall provide following:

2.1.5.1 Time-delay Overrides with Flick Warn: Each relay may be assigned time delay which will be compatible with scheduled occupancy. In particular, direct overrides of relay by an occupant will initiate programmable time delay of 2 minutes to 24 hours. Time-delay OFF action will be ignored if it falls within scheduled ON period. Time-delay OFF action will be preceded by flick warn if that relay is "flickable".

2.1.5.2 Common Area Interlock with Egress Timer: Common areas or loads such as halls, support equipment, fans etc. shall remain ON as long as any associated occupant area is ON. Turning OFF last such occupant area will initiate programmable regress time-delay to allow last occupant to exit area safely.

2.1.5.3 Master Switch Control with Flick Option: Programmable switches in each panel shall allow relays to be "softwired" into groups while still retaining individual zone control. Master switches shall be capable of either direct ON/OFF control or ON/Flick-OFF control. Any remote master switch which could cause individual occupant to be left in dark must have flick warn function.

2.1.5.4 Cleaning Lights: System shall allow cleaning crew to turn ON specified lighting via special Cleaning Switch. This switch will not turn OFF any area which is scheduled ON or has an occupant override in effect; i.e. occupant overrides will have priority over cleaning.

2.1.5.5 Automatic Daylight Switching with Occupant Interlock/Override: A single photoswitch shall provide daylight signal for multiple areas (relays). Only daylight relays which are turned ON via schedule or occupant will track photoswitch; photoswitch changes of state will have no impact on unoccupied (OFF) zones. Occupants of each space will have option of overriding daylight shed function for that day.

2.1.5.6 Status and Runtime Data: Controller cards shall also store current status of all relays, how status was initiated and historical runtime data for management analysis and billing.

2.1.5.7 Communications: Each controller card shall support 2 communications port, RS232 port and dataline port. Either or both may be used for programming,

monitoring and control. Dataline shall allow simultaneous operation of multiple RS232 communications access points to support multiple operation terminals and communications with other building automation system. All relay changes of state and programmable switch actions shall be communicated over both RS232 port and dataline to support interactive graphics and online status monitoring.

2.1.5.8 Distributed Control with Direct Relay Override: Each panel shall be capable of standalone automatic operation. None of operating scenarios discussed above shall depend on operation of central operating computer. Furthermore, direct relay override switches and occupancy sensors shall continue to operate should a local intelligence card fail.

2.1.5.9 Off-Line Programming: All programming shall be off-line on IBM PC compatible personal computer with English Descriptors of loads, windows and help screens. Program data for panel intelligence shall then be transferred from PC to panel with all data transferred confirmed or accuracy. Program data in each panel shall also be transferable to PC for editing.

2.1.5.10 Expert Operating Scenarios: Operating scenarios described above must reside within each controller card. Systems which rely on operator to develop scenarios using erector-set command sequence will not be allowed.

2.1.6 **Hardware features**: Input/output cards, controller cards, operator's PC and software and Personal Computers.

2.1.7 **Controller Cards**

2.1.7.1 Each controller shall be capable of providing logic, control, runtime data, status information and communications function for up to 1048 outputs.

2.1.7.2 Specific capabilities shall meet or exceed following: Power loss memory and clock holdup time 10 days; no maintenance required. Battery backup systems with less than 10-year shelf life are not acceptable.

2.1.7.3 Direct Communication Port: RS232 port for modem or PC direct communications and 300/1200/2400/4800/9600/19200 autobaud.

2.1.7.4 Dataline Communications: Twisted pair 18/2 dataline with random access and bus arbitration capability up to 500 panels and no loss of data.

2.1.7.5 Self Diagnostics: Automatic diagnostics on all memory, input/output card modules, relays and dataline.

2.1.7.6 Direct Overrides: Each relay may be directly overridden by switch or sensor with state changes and switch actions monitored by controller.

2.1.7.7 Clock: Digital with time, day of week and date; automatic leap year compensation; programmable Daylight Savings Time and Standard Time adjustment.

2.1.7.8 Time Delay: Selectable for each relay. 2-1440 minutes and automatically deactivated during scheduled occupancy.

2.1.7.9 Flick Warning: Selectable for each relay. 1-second flick of only those zones which are ON with automatic five minute delay to OFF' and operates automatically for all scheduled OFFs and time-delay overrides.

2.1.7.10 Common Area Zones

- Each zone may be defined as a common area or load with an associated group of "Occupied Area" relays within that panel.
- Each common area relays may be assigned regress time of 2-1440 minutes.
- Common area relays with Flick Warn will flick 5 minutes prior to going OFF as warning and to allow override.

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2.1.8 **Operator's PC and Software**

2.1.8.1 All programming and editing to occur offline in PC.

2.1.8.2 Basic operating software to include following:

2.1.8.3 Site Wiring Documentation

- 20 character English descriptors of all zone loads, panel master switches, programmable system switches.
- automatic carryover of descriptions to other program/monitor/and control functions.

2.1.8.4 Program PC Database: Enter operating data for all panels on PC database.

2.1.8.5 Display PC Database: Display above.

2.1.8.6 RS232 Connect to Lighting Automation Panel

- On line with panel for transfer of database to or from panel.

- Monitor/Control all zones.

- Test all functions.

2.1.9 **Personal Computer**

2.1.9.1 Computer shall be "PC" class laptop with all memory, cables and software and must be factory tested prior to shipment.

2.1.9.2 Computer shall include lighting control system operating software and DOS 3x.

2.1.10 **Manufacture**

2.1.10.1 Operation and equipment function described herein, based on "Cooper" lighting control system, for reference only. “Approved equal” by others will be considered.

3 Execution

3.1 **INSTALLATION**

3.1.1 Locate and install equipment in accordance with manufacturer's recommendations and as indicated.

3.2 **DEMONSTRATION**

3.2.1 Actuate control units in presence of Owner’s Designee to demonstrate lighting circuits are controlled as designated.

End of Section

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to Sections of Division 1 as applicable.

1.1.2 Conform to General Electrical Requirements, Section 26 05 00, as applicable.

1.1.3 Conform to Section 16510, Interior Luminaires, for lamps, ballasts, and shop drawing submittals, and other applicable requirement.

1.2 **REFERENCES**

CSA C22.2 No. 9.0 -96 R2011-		Luminaires
CSA C22.2 No. 43-08 R2013-		Lampholders
CSA C22.2 No. 74-96 R2015-		Equipment for Use with Electric Discharge Lamps
CSA C22.2 No. 206-13	-	Lighting Poles

1.3 **RELATED WORK**

1.3.1 Underground power supply to Outdoor Lighting: is existing.

1.3.2 Controls for Exterior Luminaires: is existing

1.4 **SUBMITTALS**

1.4.1 **Shop Drawings**: Submit shop drawings in accordance with Paragraph 11 of 01 11 55 General Conditions for the following:

1.4.1.1 Outdoor Lighting Pole Standards and Luminaires: Showing dimensional outline and details for mounting and wiring connections, for base template, aluminum pole and arms, and luminaires. Submit colour chip of paint finish for approval.

1.4.1.2 Lamps and ballasts : Product data, photometric data, and technical data described in Section 16510.

2 Products

2.1 **MATERIALS**

2.1.1 **Outdoor Lighting Pole Standards**: 8 feet to 40 feet high, NEMA SH5 extruded aluminum, for outdoor application, dark brown polyester finish (submit colour chip for approval), standard shaft taper size and thickness dimensions,

reinforced flush handhole assembly with welded grounding bar and lug, and proper cable terminals and fuses. Supply required shoe base, anchorage hardware, and drawing template for anchor setting. [Supply required pole-top mounting accessories and hardware.]

2.1.1.1 Anchorage: Anchor bolts to ASTM A36, fabricated from hot-rolled steel, at least 55,000psi yield stress, each provided with necessary hex nuts, flatwashers, and lockwashers. Patterned to match existing, or provide covered transition base.

2.1.1.2 Lamps: (LED) in accordance with Section 16510, as applicable.

2.1.2 **Exterior Luminaires (for Site Lighting)**: Weatherproof gasketed aluminum housing, vandal-proof polycarbonate lens, polyster powder finish, complimentary stainless steel tamper-proof external hardware, accessible unit housing for ballasts and lamps maintenance, CSA certified.

2.1.2.1 Bollards: 1050mm(42") standard height,150mm(6") or 200mm(8") [(round) extruded aluminum gasketed housing, fluted anodized upper aluminum reflector, specular alzak, with spun aluminum anodized flared cone standard, in clear seamless pure acrylic enclosure, (LED) lamps, wattage and voltage ratings as shown on Drawings.

2.1.2.2 Perimeter Recessed Wall Luminaires: Die-cast, rugged, corrosion-resistant aluminum housing, integral back-wiring compartment with conduit entries, prismatic glass lens, specular anodized reflector, (LED) lamps, wattage and voltage ratings as shown on Drawings.

3 Execution

3.1 **INSTALLATION**

3.1.1 Use Outdoor Lighting Pole Standards for area lighting such as parking lots, street lighting, walkways, pedestrian lanes, among others.

3.1.2 Install new outdoor lighting pole standards and matching luminaries, in locations as indicated on Drawings, on existing bases, complete with mounting hardware such as anchors, bolts, and wiring terminating materials and accessories.

3.1.3 Provide approved type of strain-relief cable supports, or approved equal, for installing cables in vertical rise inside poles.

3.1.4 Install pole-top units plumb and true, in accordance with manufacturer’s recommended installation methods, and to approval of owners Designee. Follow instructions and methods for rotatable luminaire reflectors to acquire desired cutoff or light distribution.

3.1.5 Terminate cables and make connections inside handhole integral to pole.

Replace gasketed metal cover furnished with corrosion-resistant, vandal-proof screws.

3.1.6 Provide warning plate on outside of metal cover, to contain information, e.g., "De-energize circuit before removing cover" in 6mm high lettering.

3.1.7 Provide information plate on inside of metal cover indicating voltage in 6.5 mm high letters and panel/circuit breaker numbers. Plate shall be brass with stamping or non-deteriorating plastic (lamicoid) rivetted to cover.

End of Section

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to Sections of Divisions 1 as applicable.

1.1.2 Conform to General Electrical Requirements, Section 26 05 00 as applicable.

1.2 **REFERENCES**

CSA C22.2 No. 9.0 96 R2011	-	Luminaires
CSA C22.2 No. 43-08 r2013	-	Lampholders
CSA C22.2 No. 74-96 R2015	-	Equipment for Use with Electric Discharge Lamps
CAN/CSA C861-10 r2015	-	Performance of Compact Fluorescent Lamps and Ballasted Adapters

1.3 **SUBMITTALS**

1.3.1 **Shop Drawings**: Submit shop drawings in accordance with Paragraph 11 of 01 11 55 General Conditions for each type of luminaires, indicating following:

1.3.1.1 Product data, including installation instructions and details.

1.3.1.2 Photometric data showing total input watts, candela, distribution zonal lumen summary, luminaire efficiency, coefficient of utilization, lamp type and similar requirements.

1.3.1.3 Technical data sheets for each type of ballast used , showing number & type of lamps, lamp configuration, line voltage, % line current harmonics, sound ratings, crest factor, ballast factor, transient protection, E.M.I., class listing, among others.

2 Products

2.1 **MANUFACTURED UNITS**

2.1.1 **Lamps**: New, best quality type, compatible with lighting fixtures and ballast, if applicable. Lamps shall be manufactured in compliance with Energy Efficiency Act (EEACT) regulations, as applicable.

2.1.1.1 Fluorescent Lamps: Bulb shape T5, bi-pin, 20,000 hours rated life, rapid start, standard cool white, unless otherwise specified or indicated on Drawings, compatible with electronic-type ballasts.

2.1.1.2 Compact Fluorescent Lamps: Rated 5W thru 26W, T4 bulb type, 10,000 hours rated life, with matching integral HPF electronic ballasts,less than 25%THD,

2.1.1.3 Light Emitting Diode (lED) Lamps: approx. 50,000 hours rated life, clear. Min 100 lumens per watt.

2.1.1.4 Fluorescent Ballasts: Energy-saving, electronic-type, for T5 rapid-start lamps, integrated circuit for control of overall ballast operation,high frequency with THD below 13%, solid-state, for 120V(240)(347) nominal line voltage, 1.5 crest factor Or better, 0.95 high power factor,0.85 ballast factor or better, meets applicable Regulatory standards. References: Advance, Alliance, Ballastronix(Sola), Magnetek, Florotronic, Motorola,Ideal Ind.,Osram-Quicktronic or approved equal.

2.1.1.5 Compact Fluorescent Ballasts: CAN/CSA C861-95, certified, electronic-type, integral with lamp base or adaptor, encased and potted, for 120V compact fluorescent lamps. References: Advance, Alliance, Ballastronix(Sola),Magnetek, Florotronic, Motorola,Ideal Ind.,Osram-Sylvania, Pass & Seymour, or approved equal.

2.1.2 **Luminaires**: Complete lighting units or fixtures supplied with fluorescent, HID,or incandescent lamps and other components for light distribution, for power supply connection, and mounting accessories. Luminaire types and descriptions as specified under " Luminaire Schedule" shown on Drawings.

2.1.2.1 Diffusers: Lenses or louvers, as required, supplied with type of luminaires specified.

2.1.2.2 Lenses: Acrylic, extruded clear 100 percent, prismatic,minimum 3.2mm(0.125") thick, unless specified otherwise, for fluorescent fixtures.

2.1.2.3 Louvres: Acrylic,white, 45-deg shielding,open cubic cells, 12mm x 12 mm x 12mm(1/2"x1/2"x1/2"), straight blade 1.6 mm (.065") thick, unless specified otherwise, for fluorescent fixtures.

2.1.2.4 Downlighting : Rugged, smooth-edged steel frame-in module with integral plaster flange, complete with pre-wired junction box, bar hangers,trim retaining clips, lamp sockets, matte black baffle with anodized reflector,CSA certified for (compact fluorescent)(metal halide)(HPS)(incandescent) lamps, T-bar ceiling recessed mounting.

3 Execution

3.1 **INSTALLATION**

3.1.1 Install luminaires to conform to Ontario Hydro Electrical Safety Code and Ontario Building Code requirements, and in accordance with manufacturer's recommended installation procedures.

3.1.2 Install luminaires accurately, in line and level, complete with mounting appurtenances and hardwares, free from undue interferences.

3.1.3 Align luminaires mounted in continuous rows to form straight uninterrupted line.

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

3.1.5 Any luminaire which, in opinion of owners Designee are not installed properly, shall be corrected to his satisfaction, with no change to Contract Sum.

3.1.6 Luminaires indicated on Drawings shall be located to agree with approved reflected ceiling plan drawings. Co-ordinate installation of luminaires, plaster frames, and rings with metal furring, lath and plaster trades.

3.1.7 Support all luminaires independent of suspended ceiling system.

3.1.8 Confirm compatibility of specified luminaires with ceiling types used.

3.1.9 Preserve sufficient space during construction for proper installation of fixtures co-ordinate with related Sections to ensure clearances are maintained to accommodate luminaires.

3.1.10 Provide plaster frames and rings required for recessed fixtures for installation under the metal furring, lath and plaster contract.

3.1.11 Install luminaires after mechanical ducts, piping, and equipment in vicinity have been installed. Number of luminaires indicated on drawings shall be checked for exact location as approved by owners Designee prior to installation.

3.1.12 Verify catalogue numbers of luminaires prior to ordering. Check final ceiling finish in areas where recessed luminaires are indicated, in order to purchase correct ceiling trims, flanges and mounting brackets for particular ceiling construction.

3.2 **SCHEDULES**

3.2.1 Types of luminaires listed under "Luminaire Schedule" shall correspond to lighting symbols used on Drawings.

End of Section.

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to Sections of Division 1 as applicable.

1.1.2 Conform to Section 26 05 00, General Electrical Requirements.

1.2 **REFERENCES**

CAN/ULC-S524-06	- Standard for the Installation of Fire Alarm Systems
CAN/ULC-S536-04	- Standard for the Inspection and Testing of Fire Alarm Systems
CAN/ULC-S537-04	- Standard for the Verification of Fire Alarm Systems

1.3 **RELATED WORK**

1.4 **SYSTEM DESCRIPTION**

1.4.1 Complete and operating fire detection and alarm system.

1.4.2 Allow for changes to operations and functions to be made by on-site software programming selections.

1.4.3 Operation of system shall not require personnel with special operation skills.

1.4.4 Ensure equipment manufacturer provides information regarding wiring requirements before bidding. Owner will not be responsible for added cost and changes due to additional manufacturer's requirements.

1.5 **EXISTING SYSTEM**

1.5.1 Existing fire alarm system shall remain operational at all times during construction, except in zone of construction as approved by Owner’s Designee. Ensure that Owner’s Designee is advised at least 24 hrs before any planned shutdown.

1.5.2 When new devices are installed on the existing system, and verified, existing system including all raceways, wiring, devices and equipment must be removed and turned over to Owner’s Designee for choosing items to be kept. Non-selected items must be properly disposed of.

1.5.3 Ensure absolute minimum hours of such limited shutdown during working hours and after working hours entire system shall be totally operational.

1.5.4 Make necessary arrangements for special temporary equipment or connections to obtain above.

1.5.5 In zone of construction, install 120 Volt AC, interconnected, single station smoke alarms: in corridors max 10 m apart, in rooms over 150 m^2 and at least 1 outside either side of working area as directed by Owner's Designee.

1.5.6 Be responsible for operation of total system serving building during construction period and be available for related emergency calls at all times.

1.6 SUBMITTALS

1.6.1 Shop Drawings

1.6.1.1 Submit shop drawings in accordance with Paragraph 11 of 01 55 00 General Conditions for the following and prior to commencing installation. Do work in accordance with reviewed shop drawings.

1.6.1.2 Systems functional description, and actual sequence of operation.

1.6.1.3 Control equipment and annunciators, showing physical arrangement and features, rack-up arrangement and interconnecting wiring.

1.6.1.4 Manufacturers' brochures on devices.

1.6.1.5 Battery capacity calculation.

1.6.1.6 Typical installation riser diagram showing wire sizes and number of wires required.

1.7 MAINTENANCE MANUALS

1.7.1 **Operations and Maintenance Manuals:** Submit such manuals in accordance with Paragraph 40 of Section 01 55 00, General Conditions and prior to completion of Project, in triplicate, containing following:

1.7.1.1 Actual system functional description, and sequence of operation of completed installation.

1.7.1.2 Detailed maintenance instructions for control equipment and each device type, maintenance schedule in accordance with CAN/ULC-S536. Trouble shooting guide for control panels and devices.

1.7.1.3 Pictorial drawing of control equipment layout, showing location of components,

modules and parts, indicating their catalogue numbers.

1.7.1.4 Schematic diagrams of control equipment, except modules which can be exchanged as unit and internal interconnecting cables and wires.

1.7.1.5 Copy of verification certificate, verification report and warranty certificates such as for fire alarm system, batteries, ancillary devices, including battery suppliers date coding for batteries.

1.7.1.6 Name, address and telephone number of service representative of manufacturer to be contacted during warranty period.

1.8 **SYSTEM OPERATION**

1.8.1 **Upon activation of any alarm initiating device (e.g. manual station, smoke detector, heat detector, sprinkler device), system shall operate as follows**:

1.8.1.1 Annunciate respective zone, at local fire alarm control panel, local remote annunciator(s), zoned as indicated on drawings or zoning schedule.

1.8.1.2 Activate signal appliances in alarm mode as single stage system.

1.8.1.3 Provide for silencing signals manually at any time by authorized personnel only.

1.8.1.4 Provide automatic signal silencing in general alarm operation after 20 minutes.

1.8.1.5 Provide "Silent Test", preventing signal appliance operation during maintenance.

1.8.1.6 Sound alarm signal again as outlined herein, if subsequent alarm from another initiating circuit is activated.

1.8.1.7 Release throughout building electro-magnetically held open doors, after 2 to 15 second delay (adjustable).

1.8.1.8 Unlock throughout building electro-magnetically locked doors.

1.8.1.9 Shut down fans upon alarm signal in positive and fail safe manner as required. Connect with building control system for automatic shut down sequence.

1.8.1.10 Provide for transmission of signals to monitoring agency, or Fire Department via telephone line. Telephone line, monitoring transmitters and receiving equipment will be arranged and paid for by Owner Designee.

1.8.1.11 Provide system with annunciation of supervisory signals from building fire protection systems using gate valve monitor switches, pressure switches, and

similar items, where indicated on Drawings.

1.8.1.12 Should system wiring fault occur, such as open, ground or short, in alarm initiating, signal circuit or annunciator wiring, system over current devices or critical components fault, system must provide:

- Individual trouble annunciation of zone (except grounds) and component of system in which fault has occurred.
- Common trouble annunciation for system ground fault.
- Trouble indication at control equipment location.

1.8.1.13 Single ground on any conductor, inside or outside control panel, must not prevent normal operation of system or cause over current device to open.

1.9 **QUALITY ASSURANCE**

1.9.1 **Qualifications of Manufacturer**

1.9.1.1 Supply equipment, manufactured by experienced reputable manufacturer, whose installations have rendered satisfactory service for at least 2 years, and who will provide factory trained technicians.

1.9.2 **Regulatory Requirements**

1.9.2.1 Use equipment listed by Underwriters' Laboratories of Canada (ULC) or Canadian Standards Association (CSA).

1.9.2.2 Install system in accordance with requirements of applicable Electrical Safety Code and Underwriters' Laboratories of Canada Standard CAN/ULC-S524.

2 Products

2.1 **MATERIALS**

2.1.1 **Use following equipment:**

2.1.2 On alterations and renovations to existing system, provide new system components as indicated. Components shall be ULC approved and listed and compatible with electrical characteristics and operation of existing system, otherwise replace such existing components with new components at no extra cost to Owner.

2.2 **Automatic Fire Alarm Detectors**

2.2.1.1 57 deg C fixed temperature type, maximum smooth ceiling rating of 36 m^2, automatic reset.

2.2.1.2 88 deg C fixed temperature type, maximum smooth ceiling rating of 36 m^2, automatic reset.

2.2.1.3 Rate of rise and fixed temperature type, 9 deg C per minute rate of rise, and 57 deg C fixed temperature combined unit. Maximum smooth ceiling rating of 225 m^2.

2.2.1.4 Rate of rise and fixed temperature type, 9 deg C per minute rate of rise, 88 deg C fixed temperature, maximum smooth ceiling rating of 225 m^2.

2.2.1.5 57 deg C fixed temperature type, maximum smooth ceiling rating of 81 m^2. Moisture-proof and corrosion resistant, complete with cover plate, waterproof gasketed CSA type 3 back box and raintight connections for raceways.

2.2.1.6 Rate of rise and fixed temperature type, 9 deg C per minute rate of rise, 57 deg C fixed temperature, maximum smooth ceiling rating of 225 m^2. Explosion-proof, moisture-proof, complete with cover plate, gasket back box and screws, connections for 13 mm conduit.

2.2.1.7 Horizontal, rate of compensation temperature, automatic reset, 57 deg C fixed temperature, maximum smooth ceiling rating of 225 m^2. Explosion-proof, moisture-proof, complete with cover plate, gasket, back box and screws connections for 13 mm conduit.

2.2.1 Photoelectric Type Smoke Detector

2.2.1.1 Employing scattering light detection principle, exhibiting uniform response behaviour in course of time. Electronic components solid state, sealed to prevent being influenced by dirt, dust or humidity, and any radioactive parts safeguarded against tampering. No moving parts or components that wear out.

2.2.1.2 Protect circuitry against electrical transients and electromagnetic interference and no damage to detector due to polarity reversal or faulty zone wiring. Prevent intrusion from insects into measuring chamber with fine wire mesh at detector housing.

2.2.1.3 Factory set sensitivity to response to smoke density between .12 to .625 M.I.C. Provisions to test sensitivity in field and calibrated test feature, capable of simulating maximum amount of smoke for alarm.

2.2.1.4 Reliable operation within following environmental conditions:

Ambient Temperature:	-25 to 75 deg C
Relative Humidity:	Max. 95% RF continuous, no condensation

2.2.1.5 Incorporate indicating latched lamp or LED to signal operation of unit, facilitating easy viewing from room entry point and able to operate a remote

lamp or LED Supply ancillary NO/NC contacts to operate ancillary devices.

2.2.1.6 Simple twist-pull mechanism of detector head into base for easy cleaning and maintenance. Equip detector or part of detector with mechanism or tool to prevent removal by unauthorized personnel.

2.2.2 **End of Line Device:** Mounted on painted red metal single gang plate with terminal strips providing 4 screw terminal at rear of plate.

2.2.3 **Pull, Outlet and Junction Boxes**

2.2.3.1 Provide steel pull and junction boxes of sufficient size to take raceways entering them and conductors, and connections thereto without crowding.

2.2.3.2 Provide boxes with screwed covers, unless otherwise indicated on Drawings.

2.2.3.3 Install outlets and receptacles for exposed work in FS and FD cast galvanized steel or aluminum fittings.

2.2.3.4 Provide each detector, manual station, signal, end of line device and other outlets with suitable flush mounted outlet box, complete with ground lug, adapted to respective location and device.

2.2.3.5 Surface mounting of detectors, manual stations, signals, end of line devices and other outlets use back-box (FS or FD) or skirt as provided by devices suppliers, complete with ground lugs, fitted to suit and to cover total back of device.

2.2.3.6 In **basements** use raintight connectors and gasketed CSA type 3 back boxes.

3 Execution

3.1 **INSTALLATION**

3.1.1 **Standard Type Initiating Circuits**

3.1.1.1 Wire alarm initiating and supervisory circuits, manual and automatic, so that a pair of wires start at fire alarm control panel and end at end-of-line device, mounted in suitable box adjacent to last manual station of each individual alarm initiating circuit **or** mounted on suitable terminal strips in control panel. If circuit does not have manual station return pair of wires to control panel and install end of line device on suitable terminals.

3.1.1.2 Connect detectors, manual stations and supervisory devices between pair of wires at each outlet, cut pair at each outlet and connect to 4 terminal screws provided on units. These connections ensure supervision of circuit. Properly arrange and connect initiating and supervisory circuit wiring to their respective

circuits as indicated on Drawings.

3.1.2 Install wiring for standard alarm initiating circuits in separate raceway system from alarm signal circuits, unless wiring is individually shielded and single point ground connected and acceptable to equipment manufacturer.

3.1.3 Wire alarm signals in accordance with requirements by manufacturer and operation. Install end-of-line device for signal circuit in suitable box near last signal of signal circuit **or** mounted on suitable terminal strips in control panel.

3.1.4 Install lightning protection units at each interior building local alarm initiating or signal circuit wire, connected to ground bus in control panel with #12 gauge copper conductor.

3.1.5 Install surge protector at each external to building initiating or signal circuit as required by manufacturer.

3.1.6 Equip raceways with separate green ground-wire and bond to ground lug at each outlet box of device and bond ground wires directly to ground bus in control panel.

3.1.7 Take power for control panel from bus on load side of main disconnecting device as described in Section 32 of Electrical Safety Code. Make connection using approved lugs. Bond ground cable to ground bus at control panel.

3.1.8 Install external power regulator in electrical room, near power distribution supply for fire alarm system in accordance with manufacturer's instructions.

3.1.9 Clear wiring of shorts, opens and grounds on completion of work.

3.1.10 Mount detectors on ceiling as per CAN/ULC-S524 Standard unless otherwise specified herein with minimum and maximum distances as required for respective type of detector, at highest point where variations in ceiling height exist. Do not mount detectors on sides, undersides, less than 600 mm from walls, beams, joints, ducts, open web steel joists or structure projecting below actual ceiling height and especially from lighting fixtures and air exhaust handling or heating outlets, but 900 mm from air supply handling or heating outlet.

3.1.11 Should interference from obstruction, lamp positions, air outlets or heat radiating surfaces be encountered in locating detector where indicated, locate detector as near as possible to indicated position, clear of obstacles, to satisfaction of Owner Designee, but maintain clear space of 600 mm on ceiling, below and around.

3.1.12 Identify signal circuit, alarm initiating circuit, auxiliary circuit and all other wiring at fire alarm control panel, annunciator, terminal boxes or elsewhere on completion of work with appropriate marking labels. Mark single conductors

with suitable self adhesive type, indelible numbered markers, identify cables with clear polyester tag, attached with self-locking TY-RAP.

3.1.13 Provide, install and connect wiring and interconnecting wires and cables as specified herein, as required by control panel manufacturer and as indicated on Drawings.

3.1.14 Wire magnetic fire door holder and closing units, electro-magnetic locking devices, air conditioning fans and any other ancillary device in accordance with manufacturer instruction and their operational requirements.

3.1.15 Provide electro-magnetic locking devices, fire door releases and/or magnetic fire door holder and closing units to Section 06410, Carpentry and Millwork for installation. Supervise installation and ensure unit functions as per manufacturer's specifications.

3.1.16 Supply and install 1-15 A, 120 Volt AC duplex receptacle beside new control panel, connect into nearest receptacle circuit of adequate capacity.

3.1.17 Where moisture-proof, corrosion resistant or waterproof detectors are used, use raintight connectors with waterproof gasketed back box and tape wiring connectors.

3.2 FIELD QUALITY CONTROL

3.2.1 Inspection and Verification

3.2.1.1 Only directly prior to verification, remove smoke detector protectors, and clean smoke detectors thoroughly.

3.2.1.2 Inspect and check each individual device in entire system for proper connection, supervision and function in accordance with CAN/ULC-S537. Identify detectors, manual pull stations and signal appliances not installed within requirements of CAN/ULC-S524 in remarks column of verification report and bring to Owner's Designee's attention prior to acceptance test.

3.2.1.3 Obtain verification certificate and verification report from manufacturer showing each device checked, and that work has been carried out. Utilize standard verification forms similar to Canadian Fire Alarm Association (C.F.A.A.) forms.

3.2.1.4 Include smoke testing of each ionization or photoelectric smoke detector where installed with similar material found in area protected or as directed otherwise by Owner Designee. Submit smoke detectors sensitivity calibration reading, as read on place of installation as part of verification report.

3.2.1.5 Fire alarm manufacturer shall supply to electrical contractor reasonable

amounts of technical assistance with respect to any changes necessary to execute work to paragraphs 3.2.1.1 to 3.2.1.5 above. During period of inspection by manufacturer, electrical contractor shall make available, to manufacturer, electricians as designated by manufacturer.

3.2.1.6 Verify only when entire system is fully operational and no subsequent work will be performed.

3.2.1.7 If such subsequent work is required, entire verification must be repeated.

3.2.1.8 Issue certificate of verification only after completion of deficiencies noted during verification have been corrected and re-verified.

3.3 **Final Commissioning**

3.3.1 After completion of above inspection and verification, make arrangement with Owner Designee, manufacturer of control equipment and other installers of related and connected equipment (extinguishing systems, fans, doors, elevators and other equipment) to have final functional acceptance test, giving ample notice to parties concerned to be present.

3.3.2 **Tests may include:**

3.3.2.1 Spot check of devices to ensure proper connections and supervision.

3.3.2.2 Operation of at least 1 alarm initiating device on each detection circuit to verify required operation of alarm devices, annunciator and other installations.

3.3.2.3 Testing of signal devices for correct operation and function.

3.3.2.4 Testing of smoke detectors with similar material found in area to be protected.

3.4 **DEMONSTRATION**

3.4.1 Provide .. hrs familiarization and instruction period, to familiarize user and Owner's maintenance staff with working and function of system and equipment and to instruct maintenance personnel about proper maintenance.

3.5 **SCHEDULES**

3.5.1 Confirm wording of annunciator labels with Owner Designee.

3.5.2 INITIATING and annunciator circuits shall be identified as indicated on Drawings.

End of Section.