# Bid Documents

# St. Clair Catholic District School Board

## Gregory A. Hogan Catholic School
## 1825 Hogan Drive
## Sarnia, Ontario

## Office and Staffroom Renovations

## Project No. 615-CP1724

Prepared by:

**Randy Wilson Architect Inc.**
280 Queens Ave, Suite 1Q
London, Ontario
N6B 1X3

May 16, 2017

**Division 13 – Structural Steel**



**Division 15 – Mechanical**



**Division 16 – Electrical**

**Drawings**

A000 – Cover Sheet
D100 – Demolition Plan
A100 – Construction Floor Plan
A200 – Reflected Ceiling Plan, Schedules, Door and Screen Types
A800 – Interior Elevations
A900 – Millwork Details

S101 – Part Foundation Plan and Section
S102 – Part Roof Framing Plan and Section

M100 – Mechanical Legend, Drawing List, Schedules, Abbreviations and Details
M200 – Part Floor Plans Mechanical
M300 – Part Floor Plans Mechanical Demolition

E100 – Drawing List, Electrical Legend, Schedules and Part Electrical Plan Demolition
E200 – Part Floor Plans Electrical
E300 – Risers and Details

**End of Section**

Submitted By: _____

To: **St. Clair Catholic District School Board**

**Project: No. 615-CP1724**

**Office and Staffroom Renovations**

**Gregory A. Hogan Catholic School**
**1825 Hogan Drive**
**Sarnia, Ontario**

**1) BID PRICE**

The Drawings, Specifications and other Contract Documents for this Project have been examined, as well as the premises and job site conditions affecting the work. The undersigned hereby offers to complete the work in accordance with the Contract Documents for the following bid price, except as defined below for HST:

_____

_____ Dollars ($_____)

in Canadian funds EXCLUDING HST. HST will be added to the bid price.

In submitting this Bid, the undersigned recognizes and accepts the right of the Owner to accept any Bid, which is deemed the most advantageous to the Owner, (or any part thereof), at the price submitted, or to reject any or all Bids. Acceptance of the Bid and/or award of the contract is subject to the approval of the **St. Clair Catholic District School Board**.

In the event that a discrepancy arises between the written bid price and the associated numerical price, the written bid price will be deemed to be correct.

Harmonized Sales Tax (HST)

The bidder shall not include the applicable HST in the bid price. The successful contractor will indicate on each application for payment as a separate amount the appropriate HST the Owner is obliged to pay.

## 2) CASH ALLOWANCES

1. Include a Stipulated Sum of Five Thousand Dollar ($5,000.00) to cover costs associated with Project Contingency.

2. Include a Stipulated Sum of Five Thousand Dollar ($5,000.00) to cover costs associated with the supply of hardware (ProAble).

3. Include a Stipulated Sum of Five Thousand Dollar ($5,000.00) to cover costs associated with the supply and installation of data cabling, terminations and final set up testing (Wiring Solutions).

4. Include a Stipulated Sum of Three Thousand Dollar ($3,000.00) to cover costs associated with the supply and installation of Air Phone and Lock Down button (JPW).

5. Include a Stipulated Sum of Three Thousand Dollar ($3,000.00) to cover costs associated with the supply and installation of Security system (Damar).

6. Include a Stipulated Sum of Three Thousand Dollar ($3,000.00) to cover costs associated with the supply and installation of Intercom Speakers in Administration & Staff Room areas and Digital Clock in the Staff Room (Gordon Ruth).

Time and Materials rates to be applied against Cash Allowance work. Final reconciliation will adjust the cash allowance as credit the SCCDSB for unexpended amounts and extra to the contractor for over expenditure. The contractor shall mark-up subtrade time and materials billing for this portion of work at 10% only.

## 3) PRE-ORDERED MATERIAL SUPPLY

Due to severe time constraints, the St. Clair Catholic District School Board has pre-ordered certain items that require a long lead time for delivery. The contractor agrees to assume the materials ordered for inclusion into the work and pay for the items based upon Board purchase order and invoice. The contractor shall mark-up subtrade time and materials billing for this portion of work at 10% only.

The following items have been pre-ordered:

1. Two Heat Pumps.
2. Office Aluminium and Entry and Glass screens SC1 and SC2.

**4) INSURANCE**

The undersigned carries Policy #_____with _____ in the following amounts:

1. Comprehensive General Insurance . . . $_____

2. Automobile Liability Insurance . . . $_____

Provide a signed standard form provided by the Contractor's insurance company or broker stated its intention to provide insurance to the Bidder in accordance with the insurance requirements of the Contract Documents.

**5) BONDING**

The undersigned has provided with this bid the required Bonding and Surety as outlined in the Instruction to Bidders, Paragraph 1.08.

**6) WORKPLACE SAFETY AND INSURANCE BOARD**

The Bid package is to include a current Certificate of Good Standing from the Workplace Safety and Insurance Board (WSIB).

**7) TIME OF COMPLETION**

The undersigned hereby affirms and states that, if awarded the Contract for said work, the entire contract will be completed within the time frames as stated in the Instructions to Bidders, Paragraph 1.11.

**8) SUMMARY**

The undersigned agrees that the bid price shall remain in effect for a period of 60 (sixty) calendar days from the date of receipt of bids. The undersigned agrees to assume all increases in labour rates and material prices, taxes, duties, cost indexes, or any other rates that may develop during the life of this Contract.

**9) DOCUMENTS AND INFORMATION**

This Bid is based on the following:
1. Bid Form
2. Instructions to Bidders
3. General Conditions
4. Drawings/Sketches
5. Specifications

**10) SCOPE OF WORK**

As described in the drawings and Specifications, the Project includes but is not limited to: Demolition of existing walls, ceilings, floors, doors and fixtures as indicated in the attached drawings. Construct new gypsum partitions and infill existing openings in concrete block walls. Prepare openings in existing block walls to accept new aluminum frames glazing and entrance system.

**11) ADDENDA**

The undersigned acknowledges receipt of Addenda Numbers _____ through _____ inclusive, and that the price, or adjustment thereof, for all work required therein is included in this proposal.

**12) SEPARATE PRICES**

It is accepted that the intent of separate prices is to allow the Owner to add work outlined below, at the Owner's discretion.

**Not Applicable.**

**13) UNIT PRICES**

**Not Applicable.**

**14) ALTERNATE PRICES**

**Not Applicable.**

**15) LIST OF SUBCONTRACTORS**

The following is the list of subcontractors to which reference is made on the submitted Bid Form.

No changes to the List of Subcontractors will be allowed without the Consultant's express written permission.

List each subcontractor by his firm's proper legal designation, and indicate whether his business is carried on as an individual, partnership, or limited company.

The bidder submits that in proposing the listed subcontractors, he has consulted each and has ascertained to his complete satisfaction that those named are fully acquainted with the extent and nature of the work involved and of the proposed construction schedule, and that they will execute their work to conform to the requirements of the Contract Documents.

**List of Subcontractors:**

Demolition _____

Masonry _____

Flooring _____

Millwork _____

Structural Steel _____

Mechanical _____

Electrical _____

## 16) EXECUTION OF CONTRACT

The Contract form will be a standard Canadian Construction Documents Committee (CCDC) #2 2008 - Stipulated Sum Contract.

SIGNATURE: _____

NAME PRINTED: _____

TITLE: _____

COMPANY: _____

ADDRESS: _____

_____

PHONE: _____

FAX: _____

DATE: _____

**END OF BID FORM**

## INDEX

## 1.01 INVITATION

.1 **St. Clair Catholic District School Board** (the Owner) invites Bids from General Contractors for **Office and Staffroom Renovations** at **Gregory A. Hogan Catholic School, 1825 Hogan Drive, Sarnia, Ontario,** as described in this Specification and on Drawings.

## 1.02 FORM OF CONTRACT

.1 The following documents (all inclusive) shall form a binding Contract between the Owner and the Contractor:
CCDC #2 – 2008 Stipulated Sum Contract

1. Completed Bid Form
2. Specifications and Drawings
3. Signed Letter of Intent
4. Required Bonding
5. WSIB Clearance Certificate

.2 No payments may be made without a fully executed CCDC #2 – 2008 Stipulated Sum Contract.

## 1.03 BID DOCUMENTS

.1 Each bidder shall receive access to the Bid Documents at:

1. The Windsor & Sarnia Construction Association, The Lambton Area Builders Exchange and London & District Construction Association sites in order to access and download Bid Documents.
   1. Bid Form
   2. Instructions to Bidders
   3. General Conditions
   4. Supplementary Conditions
   5. Designated Substance Report
   6. Drawings/Sketches
   7. Specifications.

.2 Bids shall be submitted on the form provided. All blank spaces in the form must be completed in full. In addition to the signature, the name and position of the individual signing the Bid shall be printed. Bid proposals not submitted in this manner may be rejected.

.3 The Bid proposal shall be delivered to:

**St Clair Catholic District School Board**
**Catholic Education Centre,**
**420 Creek Street,**
**Wallaceburg, Ontario**

.4 Bids shall be received no later than **2:00 p.m. on Tuesday, June 6th. 2017** local time as indicated on the timeclock of the SCCDSB Reception.

## 1.04 BID INELIGIBILITY

.1 Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind may, at the discretion of the Owner, be declared informal.

.2 Bids with Bid Forms and enclosures which are improperly prepared may, at the discretion of the Owner, be declared informal.

.3 Bids that fail to include the security deposit, consent of surety, may, at the discretion of the Owner, be declared informal.

.4 Bids based upon prices seeming to be so unbalanced as to adversely affect the interests of the Owner may, at the discretion of the Owner, be declared informal.

.5 Bids based upon an unreasonable period of time for completion of the Work may, at the discretion of the Owner, be declared informal.

## 1.05 BID SUBMISSION

.1 Bidders shall be solely responsible for the delivery of their bids in the manner and time prescribed. One envelope is required for submission of tenders.

.2 Each set of documents contains 1 bid form and Appendices.

.3 Submit one copy of the Bid Form at the time of bidding in a sealed envelope identified as follows:

**BID FOR**

**Office and Staffroom Renovations**
**Gregory A. Hogan Catholic School**
**1825 Hogan Drive, Sarnia, Ontario**

## 1.06 ADDENDA

.1 If discrepancies in, or omissions from, the Drawings, Specifications or Documents are observed, or if the Bidder shall be in doubt as to their meaning, the bidder shall immediately notify:

**Tony Prizio**
**Procurement Specialist**
**420 Creek Street**
**Wallaceburg, ON.**
**N8A 4C4**
**Email:** **Tony.prizio@st-clair.net**
**CC Email:** **marcie.myers@st-clair.net**

.2 Certification thereof will be made in addendum form and distributed prior to bid due date. The Architect will not be responsible for any oral instructions or interpretations.

.3 All addenda issued during the bidding period are to be included and acknowledged in the proposals, and are to be considered part of the Contract Documents.

.4 Questions shall be received up until 48 hours before close of bid, after which no further communications shall occur between the bidding parties and the architect or representatives of the St. Clair Catholic District School Board.

.5 The architect will issue no addenda after 46 hours before the close of bid.

## 1.07 EXAMINATION OF SITE AND CONTRACT DOCUMENTS

.1 It shall be understood prior to close of bids, that each bidder has visited the site, and has carefully examined the Drawings, Specifications, and all other Contract Documents and other documents referred to therein, the existing site conditions, and thoroughly understands the conditions under which the work will be performed.

.2 Site Examination

.1 The General Contractor shall visit and examine the site and become familiar with all features, characteristics, conditions and suitability of the work affecting the work of the contract. No allowance will be made by the Owner for any errors, misjudgments and/or difficulties encountered by the General Contractor due to any features of peculiarity of the site or surrounding property which exists at the time of the General Contractor's Tender is submitted.

.2 Examination of the site is mandatory. A site walk review is scheduled for **Wednesday May 24th. 2017 @ 4:00 p.m.**

.3 All interested parties will meet at the main entrance of **Gregory A. Hogan Catholic School, 1825 Hogan Drive, Sarnia, Ontario**. The site may not be available for viewing at any other time.

.4 All General Contractors are invited. No other site review meeting will occur.

.5 Attendance will be taken and the General Contract Bidders' List prepared from attendees.

.6 Bids will not be accepted from General Contractors who do not attend the Mandatory Site Examination and Bidders Briefing.

.7 Attendance by subtrades and suppliers is recommended, but not mandatory.

## 1.08 BONDING AND SURETY REQUIREMENTS

.1 **General Requirements:**

.1 Bonding requirements are based on the total bid amount **INCLUSIVE** of **ALL** applicable taxes. Bonding requirements are not required for bids less than $100,000.00.

.2 Bid submissions that do not include the required bonding and surety submissions may be declared informal.

.2 **Performance and Surety Bonds:**

.1 For bid amounts greater than $100,000 and less than $500,000 each bid must be accompanied by agreements to provide performance and labour and materials sureties or security deposits. The agreements must indicate that the Awarded Bidder will provide either:

.1 A security deposit in the form of an irrevocable letter of credit, a certified cheque, or a money order made payable to the Board in the value of 10% of the bid amount, or

.2 A surety in the form of a 50% labour and materials and a 50% performance bond to be issued in favour of the Board at the time of contract execution. Only agreements to bond issued by insurers licensed in Canada will be accepted.

.2 For bid amounts of $500,000 and greater, each bid must be accompanied by agreements to bond for 50% performance and 50% labour and materials bonds. Any expense to be incurred must be included in the bid price. Only agreements to bond issued by insurers licensed in Canada will be accepted.

.3 The Awarded Bidder must present the bonds to Purchasing Department at the Catholic Education Center within seven (7) working days of the Proponent receiving the letter of intent. Failure to provide the proper surety within seven (7) working days will result in the rejection of that bid.

.3 **Bid Bond:**

.1 For bid amounts greater than $100,000 and less than $500,000 a security deposit in the form of an irrevocable letter of credit, a certified cheque, a bid bond or a money order in the amount of 10% of the bid amount shall be made payable to the St. Clair Catholic District School Board and must accompany the bid.

.2 For bid amounts of $500,000 and greater, a security deposit in the form of bid bond in the amount of 10% of the bid price shall be made payable to the St. Clair Catholic District School Board and must accompany the bid. Only bonds issued by insurers licensed in Canada will be accepted.

.3 The security deposit of unsuccessful Proponents will be returned without interest after the contract is awarded.

## 1.09 ACCEPTANCE OR REJECTION OF THE BID PROPOSAL

.1 In submitting this Bid, the Contractor recognizes and accepts the right of the Owner to accept any Bid which may be deemed to be most advantageous to the Owner (or any part thereof) at the price submitted, or to reject any or all Bids. Separate Prices and Alternate Prices may be considered in making final decisions.

## 1.10 GENERAL REQUIREMENTS FOR CONTRACTOR AWARDED CONTRACT

.1 Before any work may be started on the Contract, the Contractor will be required to:

.1 Supply satisfactory evidence of all current primary insurance coverage required to be supplied by the Contractor. A minimum of $2,000,000. per event is required for Liability and Automobile Policies. The Owner shall be included as co-insured.

.2 Supply a current Workplace Safety & Insurance Board Clearance Certificate.

.3 Provide within five (5) days after award of contract, a detailed work schedule including proposed phasing of work to confirm completion date.

.4 Provide information relating to construction safety measures (company Safety Policy).

## 1.11 TIMING OF PROJECT

.1 The site is available to commence work on **July 1st, 2017.**
- .1 Install construction barriers as indicated on the drawings.
- .2 Provide enclosed perimeter fencing to enclose exterior worksite.
- .3 Start work on the renovations as indicated on the drawings.

.2 The Contractor shall include all costs for labour and material to ensure that the entire scope of work for this project must be complete by **Friday, August 25, 2017.**

## 1.12 SAFETY

.1 The Contractor shall carry out this project in strict accordance with Occupational Health and Safety Acts; the regulation for construction projects, Ontario Regulation 213/91 as amended by Ontario Regulation 631/94, and other prescribed regulations as they may pertain to the work.

.2 This Contractor shall also provide full time supervision of on-site activities by all workers to ensure applicable regulations and specification requirements are followed at all times.

.3 This Contractor shall take all necessary precautions to ensure the continuous safety of the contract workers, the Owner, the architect, and general public at large on the Owner's property.

## 1.13 SITE ACCESS

.1 The Contractor shall make good any damage to roads, curbs, sidewalks, fencing or grass damaged by vehicles or equipment during the course of Construction.

## 1.14 DESIGNATED SUBSTANCES

.1 The contractor shall conduct work in recognition of the most current regulations related to Designated Substances.

## 1.15 POST BID REVIEW MEETING

.1 A Post Bid Review Meeting may be convened and chaired by the Architect who will invite the Contractor and his major Subcontractors and/or suppliers to review the Contract Documents, Bid submitted, and Schedule. This meeting will be prior to the Owner issuing a Letter of Intent or instruction to proceed. This meeting does not constitute or infer any contract award to the proposed contractor or any other contractor, or that the project will proceed.

**END OF INSTRUCTIONS TO BIDDERS**

## INDEX

## 1.0 LEGAL REQUIREMENTS, RULES AND RESTRICTIONS

### .1 Definitions

.1 **St. Clair Catholic District School Board** and the **Contractor** will be respectively referred to herein as the **Owner** and the **Contractor**. The term subcontractor, as employed herein, includes only those having a direct contract with the Contractor. It includes one who furnishes material worked to a special design according to drawings or specifications, but does not include one who merely furnishes material not so worked.

.2 These General Conditions are part of the Contract.

.3 The Supplementary General Conditions are part of the Contract.

### .2 Laws, Ordinances and Regulations

.1 The Contractor shall, in the performance of the Contract, comply with stipulations and representations required by all applicable Federal, Provincial, and Local Laws, Ordinances and Regulations.

.2 Should the Contractor fail with respect to any of these provisions, he/she shall defend, indemnify and hold harmless the Owner from any liability, damage costs or expenses resulting from such failure.

### .3 Permits, Space Fees and Taxes

.1 The contractor shall pay for the any permits required by authorities having jurisdiction including the Ministry of Labour Notice of Project. The Contractor shall submit applications for permits to the Owner for review before filing. The Contractor shall pay all Federal, Provincial and Local taxes, and duties, of whatever character and description, incident to performance of the Contract.

### .4 Municipality Inspections

.1 The Contractor will be required to complete the inspections required for this project by using the Municipality standard forms to facilitate all inspections required by the Municipality as appropriate. It should be extended to include any other inspections from any statutory authorities. The permits and list shall be displayed together on the site and copies provided to the Consultant and Owner. As each inspection is arranged and completed the process is to be recorded appropriately and copies forwarded to both the Consultant and Owner for record.

## 2.0 MATERIALS AND JOB REQUIREMENTS

### .1 Cutting and Patching Building Openings

.1 When it is necessary to cut or drill openings in walls, floors, roofs, etc. precautions shall be taken to prevent dust and falling debris from affecting adjacent areas. All openings shall be patched by the Contractor to match the original construction using workmen skilled in the required crafts.

.2 **Inserts and Attachments to Building Structures or Equipment**

.1 Any attachments or inserts in walls, ceilings, or building structural members for the support of equipment, ductwork or piping are to be provided by the Contractor. The Contractor must get permission from the Owner to make attachments to an existing structure. Such attachments must conform to all local laws and requirements.

.2 Any temporary attachments to the building or equipment for installation purposes shall be removed by Contractor upon completion of work. Any damage or defacement caused by such removal shall be repaired or replaced by and at Contractor's expense.

.3 **Interference with Owner's Work**

.1 It is the intention of the Owner to have board staff working in portions of the premises during the term of this Contract.

.2 The Contractor will be required to cooperate with Owner’s workers outside the designated construction site area.

.4 **Patching and Replacing of Damaged Work or Property**

.1 All damage to the Owner's property, including that to roadways, sidewalks, floors, fences, doorways, glass damage, etc., that is caused by Contractor's or Subcontractor’s work or workers shall be repaired by and at the expense of Contractor and the actual patching, repairing and replacement or work under the Contract shall be done by the firm which installed the work.

.5 **Storage of Materials**

.1 The Contractor shall not occupy any space on Owner's premises for storage of materials or handling and storage of materials must be done in such manner that minimum interference occurs in connection with Owner's requirements. Hazardous or dangerous materials may be stored on the premises only if prior approval is obtained from the Owner as to the method of storage and location.

.6 **Moving Materials**

.1 If it becomes necessary at any time during the performance of the work to move Contractor's facilities, materials or equipment which have been placed by the Contractor without the Owner's prior approval, the Contractor shall move them or cause them to be moved when so directed by Owner without additional charge.

.2 No materials and equipment necessary under the Contract and delivered upon the premises shall be removed from the premises without the written consent of the Owner. Refer to General Conditions, Section 3, responsibility for equipment materials, and Owner's property.

.7 **Cleaning of Premises**

.1 Each Contractor, and Subcontractor, and/or supplier shall remove rubbish and debris from the site on a daily basis or as directed by the Owner. On completion of the work, all debris shall be removed; the floor shall be thoroughly cleaned and swept; the site shall be left in a tidy condition.

.2 The Contractor is responsible for compliance with all applicable laws for the removal of waste.

.3 Do not use Owner's equipment or facilities for cleaning or for any other reason.

.8 **Owner Requirements for No Smoking**

.1 No Smoking Requirement:
Be advised that the Owner has a no Smoking Requirement on the Owners' property. Contractors are requested to ensure that employees and those of subcontractors and suppliers are advised of the Requirement.

## 3.0 CONTRACTOR'S RESPONSIBILITY, INSURANCE, PROTECTION

.1 **Contractor's Responsibility**

.1 Contractor assumes all risks of injury to persons including death and/or damage to property resulting from any action or operation under the Contract and/or in connection with the work, except for such injury to persons including death, and/or damage to property caused due to the negligence of the Owner, and undertakes to defend, indemnify and hold the Owner harmless against all such alleged injury or damage.

.2 The Contractor shall immediately notify the Owner of any workplace injury defined under the Occupational Health and Safety act as a "critical Injury" as the incident has been discovered. All other reportable incident injuries to persons or damage to property must be reported to the Owner within 2 hrs of the discovery of the incident. All reports are to be copied to the owner.

.3 The Contractor and Subcontractors and/or Suppliers will be responsible for loss of equipment or materials supplied by Contractor or Subcontractor or turned over to Contractor by Owner.

.2 **Owner's Insurance Responsibility**

.1 The Owner will maintain insurance for Fire and the Extended Coverage perils of windstorm, hail, smoke, explosion, aircraft, vehicle, riot and riot attending a strike, civil commotion including vandalism, malicious mischief and where applicable, sprinkler leakage damage, upon the entire structure on which work of this contract is done or to be done or upon the equipment and materials installed to one hundred percent of the insurable value thereof and the full value of only that equipment and materials, delivered to the site of the project and which are to be included in and remain a part of the permanent construction whether or not installed.

.2 Coverage shall protect the Owner, Contractor and Subcontractors as their interests may appear. Loss, if any, under such insurance shall be adjusted with and payable to the Owner.

.3 **Contractor's Insurance Responsibility**

.1 It shall be the Contractor's responsibility to effect and maintain adequate Fire and Extended Coverage for perils of windstorm, hail, smoke, explosion, aircraft, vehicle, riot and riot attending a strike, civil commotion and vandalism to cover loss or damage to items of Contractor's equipment including tools, scaffolding, forms and the like, sheds and other temporary structures and their contents, owned or rented by the Contractor or for which the Contractor is liable and which are not to remain as part of the permanent construction.

.4 **Construction Safety Measures**

.1 The Contractor will be responsible to take all necessary steps to protect personnel (workers, visitors, general public, etc.) and property, from any harm during the course of the Contract.

.2 All work procedures and equipment will be in accordance with the Owner and legislated standards.

.3 Only competent personnel will be permitted on site. The Owner will determine during the "site introduction" who is competent, and will cause to remove from the site any persons not observing or complying with safety requirements.

.4 The contractor shall supply competent personnel to implement their safety program and ensure that the Owner's standards, and those of the OHSA, are being complied with.

.5 The contractor will report to the Owner, and jurisdictional authorities, any accident or incident involving contractor, university or public; personnel and/or property, arising from the contractor's execution of the work.

.6 The contractor will include all provisions of this contract in any agreement with subcontractors, and hold all subcontractors equally responsible for safe work performance.

.7 If the contractor is responsible for a delay in the progress of the work due to an infraction of legislated or Owner health and safety requirements, the contractor will, with additional cost to the Owner, work such overtime, acquire and use for the execution as to be necessary, in the opinion of the Owner to avoid delay in the final; completion of the work or any operations thereof.

.5 **Internal Combustion Engines and Toxic Fumes**

.1 Before use of internal combustion engines on site or where any toxic fumes may be produced, the precautions required by law are to be in place for review, and the Owner must be advised.

.2 The duration of the work will be predetermined by the Contractor for everyone's information.

.6 **Insurance (Contractor Coverage)**

.1 The Contractor agrees to provide and maintain with responsible insurance carriers satisfactory to Owner, the following insurance:

Comprehensive Liability Insurance

.1 The Contractor shall protect himself and indemnify and save the Owner harmless from any and all claims which may arise from the Contractor's operations under the Contract where bodily injury, death, or property damage is cause and for this purpose shall, without restricting the generality of the foregoing, maintain insurance acceptance to the Owner, to the limits of not less than:

| | | |
|---|---|---|
| .1 | Injury or death to one person<br>Injury or death to more than one person | ) minimum of<br>) $2,000,000.00 |
| .2 | Automobile | ) $2,000,000.00<br>) inclusive |

Issue liability insurance in the joint names of the Owner and the Contractor.

.7 **Workplace Safety Insurance Board (WSIB)**

.1 The Contractor shall include with his bid documents a current WSIB certificate of good standing.
.2 At each progress invoice the contractor is required to provide a current WSIB certificate of good standing.

.8 **Protection of Premises and Persons**

.1 The Contractor shall properly protect Owner's and adjoining property from injury. Any damage to same shall be repaired or replaced by the Contractor without delay.

.2 The Contractor shall provide and properly maintain warning signs, dust proof barriers, welding tarpaulins, barricades and other safeguards for the protection of workmen and others around holes and openings, on, about, or adjacent to the work as required by the conditions and progress of the work or as directed by the Owner.

.3 At the end of each working day, all construction materials should be accumulated and piled in designated areas.

.9 **Non Compliance with Safety Rules and Regulations**

.1 Non-compliance of any of the safety requirements contained in this section may result in the Contractor or Subcontractor being requested to remove the offending person or persons from the Owner's premises.

.10 **Substitution of Subcontractors or Suppliers**

.1 The Contractor must submit in writing at the time of Bid the identified list of Subcontractors and/or Suppliers who will be employed on the Contract. The Contractor must also submit in writing all other sub-contractors and suppliers listed which will be employed on the Contract at the Post Bid Meeting. Substitution of named Subcontractors and Suppliers after submission of Bids will not be accepted unless a valid reason in writing is given to and approved by the Owner. The reason for substitution must be provided to the original listed Subcontractor or Supplier and the Subcontractor or Supplier given an opportunity to reply to the Contractor and Owner. Contractors are expected to be fully aware of the capability (technical, financial, etc.) of their listed Subcontractors and Suppliers and be prepared to work together prior to submission of the Bid. Similarly, the uses of the term 'own forces' and the subsequent use of unlisted Subcontractors or Suppliers is not acceptable and could result in rejection of the Bid. All Subcontractor and Supplier listings must be firm prior to the issue of a letter of intent or contract. Failure to meet these requirements will permit the Owner to cancel the contract at any stage.

.11 **Project Site Supervisor** (Site Superintendent)

.1 The designated Site Superintendent (i.e. not a replacement) is to remain full time on the project for a minimum period of 1 week after substantial completion of the project, or until all deficiencies are completed, deemed completion has been achieved and approval of the Owner and Consultant has been obtained.

.2 For the purpose of this Contract, the "Superintendent" shall mean and shall be interchangeable with the term "Supervisor."

**4.0 TEMPORARY FACILITIES** (CONTROL OF USE AND RESTRICTIONS)

.1 **Water**

.1 A source of water will be designated by the Owner. Extensions must be approved by the Owner to avoid possible accidental reverse flow.

.2 **Electric Power**

.1 A source of electric power will be designated by the Owner. The Owner will allow a tie-in connection with fuse or breaker protection for the Contractor's estimated load requirements. The Contractor must provide the power connections and all extensions from this point to the job site. All electrical connections and extensions must meet ESA requirements and must be approved by the Owner. The Contractor's estimated load requirements must not be exceeded without the Owner's permission.

.3 **Toilet Facilities**

.1 Contractor's employees shall use only those toilet and washroom facilities designated by the Owner or provide their own facilities.

.2 In the event that the contractor elects to use board facility washrooms, the contractor will be responsible for the maintenance, stocking and cleaning of the designated washroom. The designated washroom shall be returned to the board in the same condition as received by the contractor. Any and all damages to facilities while under the control of the general contractor shall be repaired at the general contractors cost.

.4 **Telephone**

.1 The Contractor will be expected to provide and pay for own telephone service as required for the job.

## 5.0 ARCHITECTS REVIEW

.1 The architect's review and those of his sub-consultants is for the purpose of assuring the Owner that the plans and specifications are being properly executed. The Owner will not supervise or give instructions to the Contractor's employees other than the Contractor's Superintendent through the architect. While the architect will give the Contractor all desired assistance in interpreting the drawings, specifications and intent, such assistance shall not relieve the Contractor from any responsibility for the work.

.2 In the event that the architect may have permitted or overlooked faulty work, or work done which is not in accordance with drawings and specifications, shall not prevent the architect from insisting that the Contractor make all work right. Any work, which proves faulty, shall be rectified by the Contractor without delay.

.3 **Contractor to Assist Architect**

.1 The Contractor shall provide sufficient, safe and proper access facilities at all times for the review of the work by the architect.

.4 **Cooperation between Contractor, Subcontractors and Trades**

.1 Anything necessary on the part of any one trade to make possible or expedite the work of other trades shall be done as part of the Contract by the Contractor without additional expenses to the Owner.

## 6.0 AS BUILT INFORMATION

.1 The General Contractor will provide As Built information in accordance with the architect's instructions.

## 7.0 PAYMENTS TO CONTRACTOR

.1 **Certificate & Payments (In General)**

.1 The Owner shall pay within forty-five (45) days after the receipt of the invoices which are received and approved by the architect.

.2 A 10% holdback of invoiced amounts, plus a 1 ½% completion retention amount will be withheld in accordance with the current provisions of the Provincial Lien Legislation and General Conditions of the contract.

.3 Upon determination of Substantial completion as certified by the architect and notification of Substantial Completion being duly advertised, the Lien period shall commence. On the 45th day, holdback monies shall be released upon clear search of title by the St. Clair Catholic District School Board.

.4 Once all as-built drawings and maintenance materials are received and vetted by the architect, the 1 ½ % completion retention shall be released for payment.

.2 **Evidence of Payment to Subcontractors**

.1 The monthly billing (progress draw) is to be accompanied by statutory declarations (affidavit) indicating payment of obligations to Subcontractors, for purchase of materials, and own payroll to the date of billing.

.3 **Change Notices, Change Orders**

The following fee percentage and overhead charges shall be applied to additional work ordered by the Owner:

.1 For those items understood to be directly part of the General Contractors work, the Contractor will be permitted to charge a maximum 10% fee.

.2 On items involving changes to work of a subcontractor, the subcontractor may charge a maximum 10% fee. The General Contractor may charge a maximum of 5% fee in addition to subcontractor's fees.

## 8.0 GUARANTEE

.1 The guarantee shall be for a period of 1 year from and after completion of the entire job and acceptance thereof by Owner unless a different period of time is specified with the Owner's approval. The Contractor's guarantee shall cover all work under the Contract whether or not any portion or trade has been sublet.

.1 The Contractor agrees to correct promptly, at the Contractor's own expense, defects or deficiencies in the Work which appear prior to and during the period of guarantee, or such longer periods as may be specified for certain products or work.

.2 If the Contractor fails to make any replacements or repairs required hereunder, after notice from Owner and reasonable opportunity to do so, Owner may have such work done at Contractor's expense, including all necessary labour costs in connection therewith. Owner shall inform Contractor in advance of the approximate cost of any such work to be done by Owner.

## 9.0 MEETINGS

### .1 POST BID REVIEW MEETING

1. A Post Bid Review Meeting may be convened and chaired by the architect who will invite Contractor and his major Subcontractors to review the Contract Documents and Bid submitted. This meeting will be prior to the Owner issuing a Letter of Intent or Contract and subject to requisite Owner approvals. This meeting does not constitute or infer any contract award to the proposed contractor or any other contractor, nor that will the project proceed.

### .2 PROGRESS MEETINGS

1. During the course of Work, schedule progress meetings as may be required and at the call of the Consultant until Project Completion.

### .3 OWNERS'S CONTRACTED SERVICES PROGRAM

1. Contractors, their employees and subtrades must complete the SCCDSB Contracted Services Program and obtain an identification badge which must be worn at all times while working on any SCCDSB project. Obtain the information regarding this program from the St. Clair Catholic District School Board's website at ***www.st-clair.net***.

**END OF GENERAL CONDITIONS**

ST. CLAIR CATHOLIC
DISTRICT SCHOOL BOARD

# CCDC 2- 2008
# Stipulated Price Contract

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# Supplementary Conditions

January 7, 2012

The Standard Construction Document CCDC 2 2008 for a Stipulated Price Contract, English version, consisting of the Agreement Between *Owner* and *Contractor*, Definitions and General Conditions of the Stipulated Price Contract, Parts 1 to 12 inclusive, governing same is hereby made part of these *Contract Documents*, with the following amendments, additions and modifications:

**AGREEMENT BETWEEN OWNER AND CONTRACTOR**

**ARTICLE A-3 – CONTRACT DOCUMENTS**

3.1 Add the following to the list of *Contract Documents* in paragraph 3.1:

- Amendments to CCDC 2 – 2008
- *Drawings*
- *Specifications*
- Performance Bond
- Labour and Material Payment Bond

**ARTICLE A-5 – PAYMENT**

5.1.3 Amend paragraph 5.1.3, in the first line, by deleting the words "…the issuance of the…" and replacing them with "…receipt of the *Consultant's*..."

5.3.1 Delete paragraph 5.3.1 in its entirety and replace it with the following:

Interest

.1 Should either party fail to make payments as they become due under the terms of the Contract or in an award by arbitration or court, interest shall also become due and payable on such unpaid amounts at 0% above the prime rate. Such interest shall be compounded on a monthly basis. The prime rate shall be the rate of interested quoted by the Bank of Canada for prime business loans, as it may change from time to time.

**ARTICLE A-9 – CONFLICT OF INTEREST**

Add new Article A-9 – Conflict of Interest:

9.1 The *Contractor*, all of the *Subcontractors* and *Suppliers* and any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall not engage in any activity or provide any services where such activity or the provision of such services creates a conflict of interest (actually or potentially, in the sole opinion of the *Owner*) with the provision of the *Work* pursuant to the *Contract*. The *Contractor* acknowledges and agrees that a conflict of interest, as described in this Article A-9, includes, but is not limited to, the use of *Confidential Information* where the *Owner* has not specifically authorized such use.

9.2 The *Contractor* shall disclose to the *Owner*, in writing, without delay, any actual or potential situation that may be reasonably interpreted as either a conflict of interest or a potential conflict of interest, including the retention of any *Subcontractor* or *Supplier* that is directly or indirectly affiliated with or related to the *Contractor*.

9.3 The *Contractor* covenants and agrees that it will not hire or retain the services of any employee or previous employee of the *Owner* where to do so constitutes a breach by such employee or previous employee of the *Owner's* conflict of interest policy, as it may be amended from time to time, until after completion of the *Work* under the *Contract*.

9.4 It is of the essence of the *Contract* that the *Owner* shall not have direct or indirect liability to any *Subcontractor* or *Supplier*, and that the *Owner* relies on the maintenance of an arm's-length relationship between the *Contractor* and its *Subcontractors* and *Suppliers*. Consistent with this fundamental term of the *Contract*, the *Contractor* will not enter into any agreement or understanding with any *Subcontractor* or *Supplier*, whether as part of any contract or any written or oral collateral agreement, pursuant to which the parties thereto agree to cooperate in the presentation of a claim for payment against the *Owner*, directly or through the *Contractor*, where such claim is, in whole or in part, in respect of a disputed claim by the *Subcontractor* or *Supplier* against the *Contractor*, where the payment to the *Subcontractor* or *Supplier* by the *Contractor* is agreed to be conditional or contingent on the ability to recover those amounts or a portion thereof from the *Owner*, failing which the *Contractor* shall be saved harmless from all or a portion of those claims. The *Contractor* acknowledges that any such agreement would undermine the required arm's-length relationship and constitute a conflict of

interest. For greater certainty, the *Contractor* shall only be entitled to advance claims against the *Owner* for amounts pertaining to *Subcontractor* or *Supplier* claims where the *Contractor* has actually paid or unconditionally acknowledged liability for those claims or where those claims are the subject of litigation or binding arbitration between the *Subcontractor* or *Supplier* and the *Contractor* has been found liable for those claims.

9.5 Notwithstanding paragraph 7.1.2 of GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, SUSPEND THE WORK OR TERMINATE THE CONTRACT, a breach of this Article by the *Contractor*, any of the *Subcontractors*, or any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall entitle the *Owner* to terminate the *Contract*, in addition to any other rights and remedies that the *Owner* has in the *Contract*, in law, or in equity.

**DEFINITIONS**

Add the following new definitions:

27. **Confidential Information**

*Confidential Information* means all the information or material of the *Owner* that is of a proprietary or confidential nature, whether it is identified as proprietary or confidential or not, including but not limited to information and material of every kind and description (such as drawings and move-lists) which is communicated to or comes into the possession or control of the *Contractor* at any time, but *Confidential Information* shall not include information that:

1) is or becomes generally available to the public without fault or breach on the part of the *Contractor*, including without limitation breach of any duty of confidentiality owed by the *Contractor* to the *Owner* or to any third party, but only after that information becomes generally available to the public;

2) the *Contractor* can demonstrate to have been rightfully obtained by the *Contractor* from a third party who had the right to transfer or disclose it to the *Contractor* free of any obligation of confidence;

3) the *Contractor* can demonstrate to have been rightfully known to or in the possession of the *Contractor* at the time of disclosure, free of any obligation of confidence; or

4) is independently developed by the *Contractor* without use of any *Confidential Information*.

**28. Construction Schedule**

*Construction Schedule* means the schedule for the performance of the *Work* provided by the *Contractor* pursuant to GC 3.5, including any amendments to the *Construction Schedule* made pursuant to the *Contract Documents*.

**29. Force Majeure**

*Force Majeure* means any cause, beyond the *Contractor's* control, other than bankruptcy or insolvency, which prevents the performance by the *Contractor* of any of its obligations under the *Contract* and the event of *Force Majeure* was not caused by the *Contractor's* default or active commission or omission and could not be avoided or mitigated by the exercise of reasonable effort or foresight by the *Contractor*. *Force Majeure* includes *Labour Disputes*, fire, unusual delay by common carriers or unavoidable casualties, civil disturbance, acts, orders, legislation, regulations or directives of any government or other public authority, acts of a public enemy, war, riot, sabotage, blockage, embargo, lightning, earthquake, or acts of God.

**30. Install**

*Install* means install and connect. *Install* has this meaning whether or not the first letter is capitalized.

**31. Labour Dispute**

*Labour Dispute* means any lawful or unlawful labour problems, work stoppage, labour disruption, strike, job action, slow down, lock-outs, picketing, refusal to work or continue to work, refusal to supply materials, cessation or work or other labour controversy which does, or might, affect the *Work*.

**32. Overhead**

*Overhead* means all site and head office operations and facilities, all site and head office administration and supervision; all duties and taxes for permits and licenses required by the authorities having jurisdiction at the *Place of the Work*; all requirements of Division 1, including but not limited to submittals, warranty, quality control, insurance and bonding; calculations, testing and inspections; meals and accommodations; and, tools, expendables and clean-up costs.

**33. Request for Information/RFI**

*Request for Information* or *RFI* means written documentation sent by the *Contractor* to the *Owner* or to the *Owner's* representative or the *Consultant* requesting written clarification(s) and/or interpretation(s) of the *Drawings* and/or *Specifications*, *Contract* requirements and/or other pertinent information required to complete the *Work* of the *Contract* without applying for a change or changes to the *Work*.

**4.** Amend Definition 4 by adding the following to the end of the Definition:

For the purposes of the *Contract*, the terms "*Consultant"*, "Architect" and "Engineer" shall be considered synonymous.

**16.** Amend Definition 16 by adding the following to the end of the Definition:

*Provide* has this meaning whether or not the first letter is capitalized.

**GENERAL CONDITIONS OF THE STIPULATED PRICE CONTRACT**

1.0 Where a General Condition or paragraph of the General Conditions of the *Contract* is deleted by these amendments, the numbering of the remaining General Conditions or paragraphs shall remain unchanged, unless stated otherwise herein, and the numbering of the deleted item will be retained, unused.

**GC 1.1 CONTRACT DOCUMENTS**

1.1.6 Add the following to the end of paragraph 1.1.6:

The *Specifications* are divided into divisions and sections for convenience but shall be read as a whole and neither such division nor anything else contained in the *Contract Documents* will be construed to place responsibility on the *Owner* or the *Consultant* to settle disputes among the *Subcontractors* and *Suppliers* with respect to such divisions. The *Drawings* are, in part, diagrammatic and are intended to convey the scope of the *Work* and indicate general and appropriate locations, arrangements and sizes of fixtures, equipment and outlets. The *Contractor* shall obtain more accurate information about the locations, arrangements and sizes from study and coordination of the *Drawings*, including *Shop Drawings* and shall become familiar with conditions and spaces affecting those matters before proceedings with the *Work*. Where site conditions require reasonable minor changes in indicated locations and arrangements, the *Contractor* shall make such changes at no additional cost to the *Owner*. Similarly, where known conditions or existing conditions interfere with new installation and require relocation, the *Contractor* shall include such relocation in the *Work*. The *Contractor* shall arrange and install fixtures and equipment in such a way as to conserve as much headroom and space as possible. The schedules are those portions of the *Contact Documents*, wherever located and whenever issued, which compile information of similar content and may consist of drawings, tables and/or lists.

1.1.7 Amend paragraph 1.1.7.1 by adding "Amendments to CCDC 2 – 2008" before "the Agreement between the Owner and the Contractor" and deleting the reference to "Supplementary Conditions".

Add new paragraphs 1.1.7.5, 1.1.7.6, 1.1.7.7, 1.1.7.8, 1.1.7.9 and 1.1.7.10 as follows**:**

.5 noted materials and annotations on the *Drawings* shall govern over the graphic representation of the *Drawings.*

.6 finishes in the room finish schedules shall govern over those shown on the *Drawings.*

.7 Schedules of Division 01 – General Requirements of the *Specifications* shall form part of and be read in conjunction with the technical specification section as listed in the table of contents of the *Specifications.*

.8 architectural drawings shall have precedence over structural, plumbing, mechanical, electrical and landscape drawings insofar as outlining, determining and interpreting conflicts over the required design intent of all architectural layouts and architectural elements of construction, it being understood that the integrity and installation of the systems designed by the *Consultant* or its sub-*Consultants* are to remain with each of the applicable drawing disciplines.

.9 fixturing drawings provided by the *Owner* shall have precedence over architectural drawings insofar as outlining, determining and interpreting conflicts over the required design intent of all architectural layouts.

.10 should reference standards contained in the *Specifications* conflict with the *Specifications*, the *Specifications* shall govern. Should reference standards and *Specifications* conflict with each other or if certain requirements of the *Specifications* conflict with other requirements of the *Specifications*, the more stringent requirements shall govern.

1.1.8 Delete paragraph 1.1.8 in its entirety and substitute as follows:

The *Consultant*, on behalf of the *Owner* shall provide the *Contractor* without charge, twelve ( 12 ) copies of the *Contract Documents*, exclusive of those required by jurisdictional authorities and the executed *Contract Documents*. Additional copies can be purchased by the *Contractor* at the *Consultant's* cost of reproduction, handling and sales tax.

1.1.11 Add new paragraph 1.1.11 as follows:

The *Contract Documents* shall be signed in triplicate (3) by the *Owner* and the *Contractor*, and each of the *Contractor*, the Owner and the *Consultant* shall retain one set of signed and sealed (if required by the governing law of the *Contract*) *Contract Documents*.

**GC 1.3 RIGHTS AND REMEDIES**

1.3.2 Delete the word "No" from the beginning of paragraph 1.3.2 and substitute the words:

"Except with respect to the requirements set out in paragraphs 2.2.13, 6.4.1, 6.5.4, 6.6.1 and 8.2.2, no…"

**GC 1.4 ASSIGNMENT**

Delete paragraph 1.4.1 in its entirety and replace with the following:

1.4.1 The *Contractor* shall not assign the *Contract*, or any portion thereof, without the prior written consent of the *Owner*, which consent may be unreasonably withheld. The *Owner* shall be entitled to assign the *Contract* to a corporation, partnership or other entity (the "Assignee"). Upon the assumption by the Assignee of the *Owner's* obligations under the *Contract*, the *Owner* shall be released from its obligations under the *Contract*.

**GC 1.5 EXAMINATION OF DOCUMENTS AND SITE**

Add new GC 1.5 – EXAMINATION OF DOCUMENTS AND SITE as follows:

1.5.1 The *Contractor* declares and represents that in tendering for the *Work*, and in entering into a *Contract* with the *Owner* for the performance of the *Work*, it has either investigated for itself the character of the *Work* to be done and all local conditions, including the location of any utility which can be determined from the records or other information available at the offices of any person, partnership, corporation, including a municipal corporation and any board or commission thereof having jurisdiction or control over the utility that might affect its tender or its acceptance of the *Work*, or that, not having so investigated, the *Contractor* has assumed and does hereby assume all risk of conditions now existing or arising in the course of the *Work* which might or could make the *Work*, or any items thereof more expensive in character, or more onerous to fulfil, than was contemplated or known when the tender was made or the *Contract* signed.

1.5.2 The *Contractor* also declares that in tendering for the *Work* and in entering into this *Contract*, the *Contractor* did not and does not rely upon information furnished by the *Owner* or any of its agents or servants respecting the nature or confirmation of the ground at the site of the *Work*, or the location, character, quality or quantity of the materials to be removed or to be employed in the construction of *Work*, or the character of the construction machinery and equipment or facilities needed to perform the *Work*, or the general and local performance of the work under the *Contract* and expressly waives and releases the *Owner* from all claims with respect to the said information with respect to the *Work*.

**GC 1.6 TIME IS OF THE ESSENCE OF THE CONTRACT**

Add new GC 1.6 - TIME IS OF THE ESSENCE OF THE CONTRACT as follows:

1.6.1 All time limits stated in the *Contract Documents* are of the essence of the *Contract*.

**GC 2.2 ROLE OF THE CONSULTANT**

2.2.7 Delete the words "Except with respect to GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER" .

2.2.13 Amend paragraph 2.2.13 by the addition of the following to the end of that paragraph:

If, in the opinion of the *Contractor*, the *Supplemental Instruction* involves an adjustment in the *Contract Price* or in the *Contract Time*, it shall, within ten (10) *Working Days* of receipt of a *Supplemental Instruction*, provide the *Consultant* with a notice in writing to that effect. Failure to provide written notification within the time stipulated in this paragraph 2.2.13 shall be deemed an acceptance of the *Supplemental Instruction* by the *Contractor*, without any adjustment in the *Contract Price* or *Contract Time*.

2.2.19 Add new paragraph 2.2.1.9 as follows:

The *Consultant* or the *Owner*, acting reasonably, may from time to time require the *Contractor* to remove from the *Project* any personnel of the *Contractor*, including project managers, superintendents or *Subcontractors*. Such persons shall be replaced by the *Contractor* in a timely fashion to the satisfaction of the *Consultant* or the *Owner*, as the case may be, at no cost to the *Owner*.

**GC 2.3 REVIEW AND INSPECTION OF THE WORK**

2.3.2 Amend paragraph 2.3.2 by adding the words "and *Owner*" after the words "*Consultant*" in the second and third lines.

2.3.3 Delete paragraph 2.3.3 in its entirety and replace it with the following:

The *Contractor* shall furnish promptly two copies to the *Consultant* and one copy to the *Owner* of all certificates and inspection reports relating to the *Work*.

2.3.4 Insert the word "review" after the word "inspections" in the first line of paragraph 2.3.4.

2.3.5 In the first line after "*Consultant*", add "or the *Owner*".

2.3.8 Add a new paragraph 2.3.8 as follows:

The *Consultant* will conduct periodic reviews of the *Work* in progress, to determine general conformance with the requirements of the *Contract Documents*. Such reviews, or lack thereof, shall not give rise to any claims by the *Contractor* in connection with construction means, methods, techniques, sequences and procedures, nor in connection with construction safety at the *Place of Work*, responsibility for which belongs exclusively to the *Contractor*.

**GC 2.4 DEFECTIVE WORK**

2.4.1 Amend GC 2.4.1 by inserting ", the *Owner* and/or its agent" in the first sentence following "rejected by the *Consultant*".

Add new paragraphs 2.4.1.1 and 2.4.1.2:

2.4.1.1 The *Contractor* shall rectify, in a manner acceptable to the *Owner* and the *Consultant*, all defective work and deficiencies throughout the *Work*, whether or not they are specifically identified by the *Consultant*.

2.4.1.2 The *Contractor* shall prioritize the correction of any defective work, which, in the sole discretion of the *Owner*, adversely affects the day to day operations of the *Owner* or which, in the sole discretion of the *Consultant*, adversely affects the progress of the *Work*.

2.4.2 Delete paragraph 2.4.2 in its entirety and replace it with the following:

The *Contractor* shall promptly pay the *Owner* for costs incurred by the *Owner*, the *Owner's* own forces or the *Owner's* other contractors, for work destroyed or damaged or any alterations necessitated by the *Contractor's* removal, replacement or re-execution of defective work. The *Owner* may request that the *Contractor* rectify any such deficiencies to other contractors' work, at the *Contractor's* expense.

Add new paragraph 2.4.4 as follows:

2.4.4 Neither acceptance of the *Work* by the *Consultant* or the *Owner*, nor any failure by the *Consultant* or the *Owner* to identify, observe or warn of defective *Work* or any deficiency in the *Work* shall relieve the *Contractor* from the sole responsibility for rectifying such defect or deficiency at the *Contractor's* sole cost, even where such failure to identify, observe or warn is negligent.

**GC 3.1 CONTROL OF THE WORK**

3.1.3 Add a new paragraph 3.1.3 as follows:

Prior to commencing individual procurement, fabrication and construction activities, the *Contractor* shall verify at the *Place of the Work*, all relevant measurements and levels necessary for proper and complete fabrication, assembly and installation of the *Work* and shall further carefully compare such field measurements and conditions with the requirements of the *Contract Documents*. Where dimensions are not included or exact locations are not apparent, the *Contractor* shall immediately notify the *Consultant* in writing and obtain written instructions from the *Consultant* before proceedings with any part of the affected *Work*.

3.1.4 Add a new paragraph 3.1.4 as follows:

Notwithstanding the provisions of paragraphs 3.1.1 and 3.1.2, the *Owner* shall have access to the site at all times to monitor all aspects of construction. Such access shall in no circumstances affect the obligations of the *Contractor* to fulfill its contractual obligations.

**GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS**

3.2.2.1 Delete paragraph 3.2.2.1 in its entirety.

3.2.2.2 Delete paragraph 3.2.2.2 in its entirety.

3.2.2.3 Delete paragraph 3.2.2.3 in its entirety.

3.2.2.4 Delete paragraph 3.2.2.4 in its entirety.

3.2.3.2 Delete paragraph 3.2.3.2 and replace it with the following:

Co-ordinate and schedule the activities and work of other contractors and *Owner's* own forces with the *Work* of the *Contractor* and connect as specified or shown in the *Contract Documents*.

3.2.3.4 Add new paragraph 3.2.3.4 as follows:

Subject to GC 9.4 CONSTRUCTION SAFETY, for the *Owner's* own forces and for other contractors, assume overall responsibility for compliance with all aspects of the applicable health and safety legislation in force at the *Place of the Work*, including all of the responsibilities of the "constructor", pursuant to the *Occupational Health and Safety Act* (Ontario)...

**GC 3.3 TEMPORARY WORK**

3.3.2 In paragraph 3.3.2, in the second line after the words "where required by law", insert "or the *Consultant*".

**GC 3.4 DOCUMENT REVIEW**

3.4.1 Delete paragraph 3.4.1 in its entirety and substitute new paragraph 3.4.1:

The *Contractor* shall review the *Contract Documents* and shall report promptly to the *Consultant* any error, inconsistency, or omission the *Contractor* may discover. Such review by the *Contractor* shall be undertaken with the standard of care described in paragraph 3.14.1 of the *Contract*. Except for its obligation to make such review and report the result, the *Contractor* does not assume any responsibility to the *Owner* or to the *Consultant* for the accuracy of the *Contract Documents*. Provided it has exercised the degree of care and skill described in this paragraph 3.4.1, the *Contractor* shall not be liable for damage or costs resulting from such errors, inconsistencies, or omissions in the *Contract Documents*, which the *Contractor* could not reasonably have discovered through the exercise of the required standard of care.

3.4.2 Add new paragraph 3.4.2. as follows:

If, at any time, the *Contractor* finds errors, inconsistencies, or omissions in the *Contract Documents* or has any doubt as to the meaning or intent of any part thereof, including laying out of the Work, the *Contractor* shall immediately notify the *Consultant*, and request instructions, a *Supplemental Instruction*, *Change Order*, or *Change Directive*, as the case may require, and the *Contractor* shall not proceed with the work affected until the *Contractor* has received such instructions, a *Supplemental Instruction*, *Change Order* or *Change Directive*. Neither the *Owner* nor the *Consultant* will be responsible for the consequences of any action of the *Contractor* based on oral instructions.

3.4.3 Add new paragraphs 3.4.3 and 3.4.4 as follows:

Errors, inconsistencies and/or omissions in the *Drawings* and/or *Specifications* which do not allow completion of the *Work* of the *Contract* shall be brought to the *Consultant's* attention prior to the execution of the *Contract* by means of an *RFI*.

3.4.4 Notwithstanding the foregoing, errors, inconsistencies, discrepancies and/or omissions shall not include lack of reference on the *Drawings* or in the *Specifications* to labour and/or *Products* that are required or normally recognized within respective trade practices as being necessary for the complete execution of the *Work*. The *Contactor* shall not use subsequent *RFIs*, issued during execution of the *Work* to establish a change and/or changes in the *Work* pursuant to Part 6 – CHANGES IN THE WORK.

**GC 3.5 CONSTRUCTION SCHEDULE**

3.5.1 Delete paragraph 3.5.1 in its entirety and replace with the following:

The *Contractor* shall:

.1 within five (5) calendar days of receiving written confirmation of the award of the Contract, prepare and submit to the *Owner* and the *Consultant* for their review and acceptance, a construction schedule in the format indicated below that indicates the timing of the activities of the *Work* and provides sufficient detail of the critical events and their inter-relationship to demonstrate the *Work* will be performed in conformity with the *Contract Time* and in accordance with the *Contract Documents*. Such schedule is to include a delivery schedule for *Products* whose delivery is critical to the schedule for the *Work* or are required by the *Contract* to be included in a *Products* delivery schedule. The *Contractor* shall employ construction scheduling software, being the latest version of "Microsoft Project", that permits the progress of the *Work* to be monitored in relation to the critical path established in the schedule. The *Contractor* shall provide the schedule and any successor or revised schedules in both electronic format and hard copy. Once accepted by the *Owner* and the *Consultant*, the construction schedule submitted by the *Contractor* shall become the baseline construction schedule; and,

.2 provide the expertise and resources, such resources including manpower and equipment, as are necessary to maintain progress under the accepted baseline construction schedule or revised schedule accepted by the *Owner* pursuant to GC 3.5 CONSTRUCTION SCHEDULE; and,

.3 monitor the progress of the *Work* on a weekly basis relative to the baseline construction schedule, or any revised schedule accepted by the *Owner* pursuant to GC 3.5 CONSTRUCTION SCHEDULE, update and submit to the *Consultant* and *Owner* the electronic and hard copy schedule on a monthly basis, at a minimum, or as required by the *Consultant* and advise the *Consultant* and the *Owner* weekly in writing of any variation from the baseline or slippage in the schedule; and,

.4 provide overtime work without change to the *Contract Price* if such work is deemed necessary to meet the schedule; and,

.5 ensure that the *Contract Price* shall include all costs required to phase or stage the *Work*.

3.5.2 Add new paragraph 3.5.2 as follows:

If, at any time, it should appear to the *Owner* or the *Consultant* that the actual progress of the *Work* is behind schedule or is likely to become behind schedule, or if the *Contractor* has given notice of such to the *Owner* or the *Consultant* pursuant to subparagraph 3.5.1.3, the *Contractor* shall, either at the request of the *Owner* or the *Consultant*, or following giving notice pursuant to subparagraph 3.5.1.3, take appropriate steps to cause the actual progress of the *Work* to conform to the schedule or minimize the resulting delay. Within five (5) calendar days of the request by the *Owner* or the *Consultant* or the notice being given pursuant to subparagraph 3.5.1.3, the *Contractor* shall produce and present to the *Owner* and the *Consultant* a plan demonstrating how the *Contractor* will achieve the recovery of the last accepted schedule.

3.5.3 The *Contractor* is responsible for performing the *Work* within the *Contract Time*. Any schedule submissions revised from the accepted baseline construction schedule or revised schedule accepted by the *Owner* pursuant to GC 3.5 CONSTRUCTION SCHEDULE, during construction are not deemed to be approved extensions to the *Contract Time.* All extensions to the *Contract Time* must be made in accordance with the *Contract Documents*.

**GC 3.6 SUPERVISION**

Delete paragraph 3.6.1 in its entirety and replace with the following:

3.6.1 The *Contractor* shall employ a competent full-time superintendent, acceptable to the *Owner* and *Consultant*, who shall be in full time attendance at the *Place of Work* while the *Work* is being performed. The superintendent shall not be changed by the *Contractor* without valid reason which shall be provided in writing and shall not be changed without prior consultation with and agreement by the *Owner* and the *Consultant*. The *Contractor* shall replace the superintendent within 7 *Working Days* of the *Owner's* written notification, if the superintendent's performance is not acceptable to the *Owner*. The *Contractor* shall provide the *Owner* and the *Consultant* with the names, addresses and telephone numbers of the superintendent referred to in this paragraph 3.6.1 and other responsible persons who may be contacted for emergency and other reasons during non-working hours.

Delete paragraph 3.6.2 in its entirety and replace with the following:

3.6.2 The superintendent, and any project manager appointed by the *Contractor*, shall represent the *Contractor* at the *Place of Work* and shall have full authority to act on written instructions given by the *Consultant* and/or the *Owner*. Instructions given to the superintendent or the project manager shall be deemed to have been given to the *Contractor* and both the superintendent and any project manager shall have full authority to act on behalf of the *Contractor* and bind the *Contractor* in matters related to the *Contract*.

3.6.3 Add new paragraph 3.6.3, 3.6.4, 3.6.5 and 3.6.6 as follows:

The *Owner* may, at any time during the course of the *Work*, request the replacement of the appointed representative(s). Immediately upon receipt of the request, the *Contractor* shall make arrangements to appoint an acceptable replacement, which is approved by the *Owner*.

3.6.4 The supervisory staff assigned to the *Project* shall also be fully competent to implement efficiently all requirements for scheduling, coordination, field engineering, reviews, inspections and submittals defined in the *Specifications*, and have minimum 5 years documented "Superintendent/Project Management" experience.

3.6.5 The *Consultant and Owner* shall reserve the right to review the record of experience and credentials of supervisory staff assigned to the *Project* prior to commencement of the *Work*.

3.6.6 A superintendent assigned to the *Work* shall be "Gold Seal Certified" as per the Canadian Construction Association; or a superintendent that can demonstrate the requisite experience and success related to the *Project* to the sole satisfaction of the *Owner*.

**GC 3.7 SUBCONTRACTORS AND SUPPLIERS**

3.7.1.1 In paragraph 3.7.1.1 add to the end of the second line "including any warranties and service agreements which extend beyond the term of the *Contract*."

3.7.1.2 In subparagraph 3.7.1.2 after the words "the *Contract Documents*" insert the words "including any required surety bonding".

Delete paragraph 3.7.2. in its entirety and replace with the following:

3.7.2 Substitution of any *Subcontractor* and/or *Suppliers* after submission of the *Contractor's* bid will not be accepted unless a valid reason is given in writing to and approved by the *Owner*, whose approval may be arbitrarily withheld. The reason for substitution must be provided to the *Owner* and to the original *Subcontractor* and/or *Supplier* and the *Subcontractor* and/or *Supplier* shall be given the opportunity to reply to the *Contractor* and *Owner.* The *Contractor* shall be fully aware of the capability of each *Subcontractor* and/or *Supplier* included in its bid, including but not limited to technical ability, financial stability and ability to maintain the proposed construction schedule.

3.7.4 Change the word "shall" to "may" in the second line.

Add new paragraphs 3.7.7 and 3.7.8 as follows:

3.7.7 Where provided in the *Contract*, the *Owner* may assign to the *Contractor*, and the *Contractor* agrees to accept, any contract procured by the *Owner* for *Work* or services required on the *Project* that has been pre-tendered or pre-negotiated by the *Owner*, and upon such assignment, the *Owner* shall have no further liability to any party for such contract.

3.7.8 The *Contractor* covenants that each subcontract or supply contract which the *Contractor* enters into for the purpose of performing the *Work* shall expressly provide for the assignment thereof to the *Owner* (at the option of the *Owner*) and the assumption by the *Owner* of the obligations of the *Contractor* thereunder, upon the termination of the *Contract* and upon written notice by the *Owner* to the other parties to such subcontracts or supply contracts, without the imposition of further terms or conditions; provided, however, that until the *Owner* has given such notice, nothing herein contained shall be deemed to create any contractual or other liability upon the *Owner* for the performance of obligations under such subcontracts or supply contracts and the *Contractor* shall be fully responsible for all of its obligations and liabilities (if any) under such subcontracts and supply contracts.

**GC 3.8 LABOUR AND PRODUCTS**

3.8.2 Delete paragraph 3.8.2 and substitute with the following:

*Products* provided shall be new and shall conform to all current applicable specifications of the Canadian Standards Association, Canadian Standards Board or General Standards Board, ASTM, National Building Code, provincial and municipal building codes, fire safety standards, and all governmental authorities and regulatory agencies having jurisdiction at the *Place of the Work*, unless otherwise specified. *Products* which are not specified shall be of a quality consistent with those specified and their use acceptable to the *Consultant*. *Products* brought on to the *Place of the Work* by the *Contractor* shall be deemed to be the property of the *Owner*, but the *Owner* shall be under no liability for loss thereof or damage thereto arising from any cause whatsoever. The said *Products* shall be at the sole risk of the *Contractor*. Workmanship shall be, in every respect, first class and the *Work* shall be performed in accordance with the best modern industry practice.

3.8.3 Amend paragraph 3.8.3 by adding the words, "…, agents, *Subcontractors* and *Suppliers*…" after the word "employees" in the first line.

Add new paragraphs 3.8.4, 3.8.5, 3.8.6, 3.8.7, 3.8.8, 3.8.9 and 3.8.10 as follows:

3.8.4 Upon receipt of a written notice from the *Consultant*, the *Contractor* shall immediately dismiss, from the *Place of the Work*, tradesmen and labourers whose *Work* is unsatisfactory to the *Consultant* or who are considered by the *Consultant* to be unskilled or otherwise objectionable.

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3.8.5 The *Contractor* shall cooperate with the *Owner* and its representatives and shall take all reasonable and necessary actions to maintain stable and harmonious labour relations with respect to the *Work* at the *Place of the Work*, including cooperation to attempt to avoid *Work* stoppages, trade union jurisdictional disputes and other *Labour Disputes*. Any costs arising from labour disputes shall be at the sole expense of the *Contractor*.

3.8.7 The cost for overtime required beyond the normal *Working Day* to complete individual construction operations of a continuous nature, such as pouring or finishing of concrete or similar work, or *Work* that the *Contractor* elects to perform at overtime rates without the *Owner* requesting it, shall not be chargeable to the *Owner*.

3.8.8. All manufactured *Products* which are identified by their proprietary names or by part or catalogue number in the *Specifications* shall be used by the *Contractor*. No substitutes for such specified *Products* shall be used without the written approval of the *Owner* and the *Consultant*. Substitutes will only be considered by the *Consultant* when submitted in sufficient time to permit proper review and investigation. When requesting approval for the use of substitutes, the *Contractor* shall include in its submission any proposed change in the *Contract Price*. The *Contractor* shall use all proprietary *Products* in strict accordance with the manufacturer's directions. Where there is a choice of proprietary *Products* specified for one use, the *Contractor* may select any one of the *Products* so specified for this use.

3.3.9 No consideration will be given to claims by the *Contractor* of unsuitability or unavailability of any *Products*, nor to the *Contractor's* unwillingness to use, or to produce first class work with, any *Products*, or to provide the specified warranties or guarantees.

3.8.10 Materials, appliances, equipment and other *Products* are sometimes specified by reference to brand names, proprietary names, trademarks or symbols. In such cases, the name of a manufacturer, distributor, *Supplier* or dealer is sometimes given to assist the *Contractor* to find a source *Supplier*. This shall not relieve the *Contractor* from its responsibility from finding its own source of supply even if the source names no longer supplies the *Product* specified. If the *Contractor* is unable to obtain the specified *Product*, the *Contractor* shall supply a substitute product equal to or better than the specified *Product*, as approved by the *Consultant* with no extra compensation. Should the *Contractor* be unable to obtain a substitute *Product* equal to or superior to the specified *Product* and the *Owner* accepts a different Product, the *Contract Price* shall be adjusted accordingly, as approved by the *Consultant*.

**GC 3.9 DOCUMENTS AT THE SITE**

3.9.1 Delete paragraph 3.9.1 in its entirety and substitute the following:

The *Contractor* shall keep one copy of the current *Contract Documents*, *Supplemental Instructions*, contemplated *Change Orders*, *Change Orders*, *Change Directives*, cash allowance disbursement authorizations, reviewed *Shop Drawings*, submittals, reports and records of meeting at the *Place of the Work*, in good order and available to the *Owner* and *Consultant*.

**GC 3.10 SHOP DRAWINGS**

3.10.1 Delete paragraph 3.10.1 in its entirety and replace with the following:

The *Contractor* shall provide shop drawings as described in the *Contract Documents* and as the *Consultant* may reasonably request

3.10.9 Delete paragraph 3.10.9 in its entirety and substitute the following:

At the time of providing *Shop Drawings*, the *Contractor* shall advise the *Consultant* in writing of any deviations in *Shop Drawings* from the requirements of the *Contract Documents*. The *Consultant* shall indicate the acceptance of such deviation expressly in writing. Where manufacturers' literature is submitted in lieu of scaled drawings, it shall be clearly marked in ink, to indicate the specific items for which review is requested.

Add new paragraphs 3.10.13, 3.10.14, 3.10.15, 3.10.16, 3.10.17 and 3.10.18 as follows:

3.10.13 Reviewed *Shop Drawings* shall not authorize a change in the *Contract Price* and/or the *Contract Time*.

3.10.14 The *Contractor* shall prepare a *Shop Drawings* schedule acceptable to the *Owner* and the *Consultant* prior to the first application for payment. A draft of the proposed *Shop Drawings* schedule shall be submitted by the *Contractor* to the *Consultant* and the *Owner* for approval. The draft *Shop Drawings* schedule shall clearly indicate the phasing of *Shop Drawings* submissions. The *Contractor* shall periodically re-submit the *Shop Drawings* schedule to correspond to changes in the construction schedule.

3.10.15 Except where the parties have agreed to a different *Shop Drawings* schedule pursuant to paragraph 3.10.3, the *Contractor* shall comply with the requirements for *Shop Drawings* submissions stated in the *Specifications*.

3.10.16 The *Contractor* shall not use the term "by others" on *Shop Drawings* or other submittals. The related trade, *Subcontractor* or *Supplier* shall be stated.

3.10.17 Certain *Specifications* sections require the *Shop Drawings* to bear the seal and signature of a professional engineer. Such professional engineer must be registered in the jurisdiction of the *Place of the Work* and shall have expertise in the area of practice reflected in the *Shop Drawings*.

3.10.18 The *Consultant* will review and return *Shop Drawings* and submittals in accordance with the schedule agreed upon in paragraph 3.10.3, The *Contractor* shall allow the *Consultant* a minimum of 14 days to review *Shop Drawings* from the date of receipt. If resubmission of *Shop Drawings* is required, a further 14 day period is required for the *Consultant's* review.

**GC 3.11 USE OF THE WORK**

3.11.1 In the second line between the words "permits and "or" add", by direction of the *Owner* or *Consultant.*

3.11.3 Add new paragraph 3.11.3 as follows:

The *Owner* shall have the right to enter or occupy the *Work* in whole or in part for the purpose of placing fittings and equipment, or for other use before *Substantial Performance of the Work*, if, in the opinion of the *Consultant*, such entry and occupation does not prevent or substantially interfere with the *Contractor* in the performance of the *Contract* within the *Contract Time*. Such entry or occupation shall neither be considered as acceptance of the *Work*, nor in any way relieve the *Contractor* from its responsibility to complete the *Contract*.

**GC 3.12 CUTTING AND REMEDIAL WORK**

Add new paragraphs 3.12.5 and 3.12.6 as follows:

3.12.5 Unless specifically stated otherwise in the *Specifications*, the *Contractor* shall do all cutting and making good necessary for the proper installation and performance of the *Work.*

3.12.6 To avoid unnecessary cutting, the *Contractor* shall lay out its work and advise the *Subcontractors*, when necessary, where to leave holes for installation of pipes and other work.

**GC 3.13 CLEAN UP**

3.13.1 At the end of the paragraph 3.13.1, add the following:

Remove accumulated waste and debris at least once a week as a minimum or as required by the nature of the *Work.*

3.13.2 In paragraph 3.13.2, in the fourth line add the word "materials" between the word "tools" and the words "*Construction Equipment*".

3.13.3 In paragraph 3.13.3, in the first and second lines add the word "materials" between the word "tools" and the words "*Construction Equipment*".

Add new paragraphs 3.13.4, 3.13.5, 3.13.6 and 3.13.7 as follows:

3.13.4 In the event that the *Contractor* fails to remove waste and debris as provided in this GC 3.13, then the *Owner* or the *Consultant* may give the *Contractor* twenty-four (24) hours written notice to meet its obligations respecting clean up. Should the *Contractor* fail to meet its obligations pursuant to this GC 3.13 within the twenty-four (24) hour period next following delivery of the notice, the *Owner* may remove such waste and debris and deduct from payments otherwise due to the *Contractor*, the *Owner's* costs for such clean up, including a reasonable mark-up for administration costs.

3.13.5 The *Contractor* shall clean up garbage during and after construction, and maintain the site in a neat and orderly condition on a daily basis. Prior to leaving the site at the end of construction, the *Contractor* shall make good all damage to the building and its components caused by the performance of the *Work* or by any *Subcontractor* or *Supplier*. The *Contractor*

shall leave the site in a clean and finished state; remove all equipment and materials; remove all paint, stains, labels, dirt, etc. from the *Work*; and touch up all damaged painted areas.

3.13.6 Without limitation to or waiver of the *Owner's* other rights and remedies, the *Owner* shall have the right to back charge to the *Contractor* the cost of damage to the site caused by transportation in and out of the site by the *Contractor*, *Subcontractors* or *Suppliers*, if not repaired before final payment.

3.13.7 The *Contractor* shall dispose of debris at location and in a manner acceptable to the *Owner*, and authorities having jurisdiction in the area of the *Work* and the disposal area, and cover containers with tarpaulins tied in place to prevent scattering of debris on site and during transport.

**GC 3.14 CONTRACTOR STANDARD OF CARE**

Add a new General Condition 3.14 – CONTRACTOR STANDARD OF CARE as follows:

3.14.1 In performing its services and obligations under the *Contract*, the *Contractor* shall exercise the standard of care, skill and diligence that would normally be provided by an experienced and prudent contractor supplying similar services for similar projects. The *Contractor* acknowledges and agrees that throughout the *Contract*, the performance of the *Contractor's* obligations, duties and responsibilities shall be judged against this standard. The *Contractor* shall exercise the same standard of care, skill and diligence in respect of any *Products*, personnel or procedures which it may recommend to the *Owner*.

3.14.2 The *Contractor* further represents, covenants and warrants to the *Owner* that:

.1 the personnel it assigns to the *Project* are appropriately experienced;

.2 it has a sufficient staff of qualified and competent personnel to replace any of its appointed representatives, subject to the *Owner's* approval, in the event of death, incapacity, removal or resignation; and

.3 there are no pending, threatened or anticipated claims, liabilities or contingent liabilities that would have a material effect on the financial ability of the *Contractor* to perform its work under the *Contract*.

**GC 3.15 OCCUPANCY OF THE WORK**

3.15.1 The *Owner* reserves the right to take possession of and use for any intended purpose any portion or all of the undelivered portion of the *Project* even though the *Work* may not be substantially performed, provided that such taking possession and use will not interfere, in any material way, with the progress of the *Work*. The taking of possession or use of any such portion of the *Project* shall not be deemed to be the *Owner's* acknowledgement or acceptance of the *Work* or the *Project*, nor shall it relieve the *Contractor* of any of its obligations under the *Contract*.

3.15.2 Whether the *Project* contemplates *Work* by way of renovations in buildings which will be in use or be occupied during the course of the *Work* or where the *Project* involves *Work* that is adjacent to a structure which is in use or is occupied, the *Contractor*, without in any way limiting its responsibilities under the *Contract*, shall take all reasonable steps to avoid interference with fire exits, building access and egress, continuity of electric power and all other utilities, to suppress dust and noise and to avoid conditions likely to propagate mould or fungus of any kind and all other steps reasonably necessary to promote and maintain the safety and comfort of the users and occupants of such structures or adjacent structures.

**GC 4.1 CASH ALLOWANCES**

4.1.1 Delete the second sentence in paragraph 4.1.1

4.1.4 Delete paragraph 4.1.4 in its entirety and substitute the following:

Where the actual cost of the *Work* under any cash allowance exceeds the amount of the allowance, any unexpended amounts from other cash allowances shall be reallocated, at the *Consultant's* direction, to cover the shortfall, and, in that case, there shall be no additional amount added to the *Contract Price* for overhead and profit. Only where the actual cost of the *Work* under all cash allowances exceeds the total amount of all cash allowances shall the *Contractor* be compensated for the excess incurred and substantiated, plus an amount for overhead and profit on the excess only, as set out in the *Contract Documents*.

4.1.5 Delete paragraph 4.1.5 in its entirety and substitute the following:

The net amount of any unexpended cash allowances, after providing for any reallocations as contemplated in paragraph 4.1.4, shall be deducted from the *Contract Price* by *Change Order* without any adjustment for the *Contractor's* overhead and profit on such amount.

Add new paragraphs 4.1.8 and 4.1.9 as follows:

4.1.8 The *Owner* reserves the right to call, or to have the *Contractor* call, for competitive bids for portions of the *Work*, which are to be paid for from cash allowances.

4.1.9 Cash allowances cover the net cost to the *Contractor* of services, *Products*, *Construction Equipment*, freight, unloading, handling, storage, installation, provincial sales tax, and other authorized expenses incurred in performing any *Work* stipulated under the cash allowances but does not include any *Value Added Taxes* payable by the *Owner* and the *Contractor.*

**GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER**

5.1.1 Delete paragraph 5.1.1 in its entirety.

5.1.2 Delete paragraph 5.1.2 in its entirety.

**GC 5.2 APPLICATIONS FOR PROGRESS PAYMENT**

Delete paragraph 5.2.2 in its entirety and substitute the following:

5.2.2 Applications for payment shall be dated the last day of each payment period, which is the last day of the month or an alternative day of the month agreed in writing by the parties. The amount claimed shall be for the value, proportionate to the amount of the *Contract*, or work performed and *Products* delivered and incorporated into the *Work* at that date. No amount claimed shall include products delivered and incorporated into the work, unless the products are free and clear of all security interests, liens and other claims of third parties.

Each application for payment, except the first, shall include a statutory declaration, in the CCDC 9A – 2001 form, up to the date of the application for payment, in a form approved by the Consultant. Each application for payment (including the first),shall also include:

.1 A certificate, issued by an agency or firm providing workers' compensation insurance to the *Contractor*, verifying that coverage is in force at the time of making the application for payment, and that coverage will remain in force for at least sixty (60) days thereafter.

.2 A declaration by the *Contractor* , in a form approved by the *Consultant*, verifying that the performance of the *Work* is in compliance with all applicable regulatory requirements respecting environmental protection, first safety, public safety and occupational health and safety.

.3 A pre-approved schedule of values, supplied by the *Contractor*, for Divisions 1 through 14 of the *Work*, aggregating the total amount of the *Contract Price.*

.4 A separate pre-approved schedule of values, supplied by each *Subcontractor*, for each of Division 15, 16, and 17 of the *Work*, aggregating the total amount of the *Contract Price.*

.5 Invoices to support all claims against the cash allowance.

.6 An acceptable construction schedule pursuant to GC 3.5.

5.2.3 Amend paragraph 5.2.3 by adding the following to the end of that paragraph:

No amount claimed shall include *Products* delivered to the *Place of the Work* unless the *Products* are free and clear of all security interests, liens, and other claims of third parties.

5.2.7 Delete existing paragraph 5.2.7:

Add new paragraphs 5.2.7, and 5.2.8 as follows:

5.2.7 The *Contractor* shall prepare and maintain current as-built drawings which shall consist of the *Drawings* and *Specifications* revised by the *Contractor* during the *Work*, showing changes to the *Drawings* and *Specifications*, which current as-built drawings shall be maintained by the *Contractor* and made available to the *Consultant* for review with each application for progress payment. The *Consultant* shall retain a reasonable amount for the value of the as-built drawings not presented for review.

5.2.8 Prior to each application for payment, the *Contractor* and the *Consultant* shall jointly review the progress of the *Work*.

**GC 5.3 PROGRESS PAYMENT**

**5**.3.1.2 In the first sentence amend as follows: After the words "issue to the *Owner*" delete "and copy to the *Contractor*". After the words "after the receipt of the" add "complete".

5.3.1.3 Delete subparagraph 5.3.1.3 in its entirety and substitute as follows:

the *Owner* shall make payment to the *Contractor* on account as provided in Article A-5 of the Agreement – PAYMENT no later than 30 calendar days after the date of a complete certificate of payment is issued by the *Consultant*

Add new paragraphs 5.3.2 and 5.3.3 as follows:

5.3.2 If the *Contractor* fails to provide all documentation as required by GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT, the *Contractor* or *Owner* shall be entitled to return the application for progress payment to the *Contractor* for completion. The 10 day review period by the *Consultant* and 30 day payment period by the *Owner* will commence upon receipt of a complete application for progress payment.

5.3.3 Payment will be mailed to the *Contractor*. The payment date shall be the date the cheque is mailed. Delay resulting from mail shall not be used in calculating payment date.

**GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK**

5.4.2 Delete paragraph 5.4.2 in its entirety and substitute the following:

The *Consultant* will review the *Work* to verify the validity of the application and shall promptly, and in any event, no later than 30 calendar days after receipt of the *Contractor's* complete deficiency list and application, the *Consultant* shall:

.1 prepare a final deficiency list incorporating all items to be completed or corrected. Each item is to have an indicated value for correction or completion. Determination of the value is defined in GC 5.10 – DEFICIENCY HOLDBACK. The final deficiency list complete with values is to be included with the *Consultant's* draft verification and shall be reviewed with the *Owner* prior to 5.4.2.2.

.2 having completed 5.4.2.1, the *Consultant* shall:

.1 advise the *Contractor* in writing that the *Work* or the designated portion of the *Work* is not substantially performed and give reasons why, or

.2 state the date of *Substantial Performance of the Work* in a certificate and issue a copy of that certificate to each the *Owner* and the *Contractor*.

5.4.3 Delete paragraph 5.4.3 in its entirety and substitute the following:

Following the issuance of the certificate of *Substantial Performance of the Work*, the following shall apply to completing the *Work*:

.1 *Contractor* is to complete the *Work* within sixty (60) calendar days.
.2 No payments will be processed between *Substantial Performance of the Work* and the completion of the *Work*.

.3 The *Owner* reserves the right to contract out any or all unfinished *Work* if it has not been completed within sixty (60) days of *Substantial Performance of the Work* without prejudice to any other right or remedy and without affecting the warranty period. The cost of completing the *Work* shall be deducted from the *Contract Price.*

Add new paragraphs 5.4.4, 5.4.5 and 5.4.6:

5.4.4 Within the time prescribed by the construction/builder's lien legislation in force at the *Place of the Work*, or where there is no legislation or no time prescribed, within a reasonable time of receiving a copy of the certificate of *Substantial Performance of the Work* signed by the *Consultant*, the *Contractor* shall take whatever steps are required to publish or post a signed copy of the certificate, as is required by such legislation. If the *Contractor* fails to comply with this provision, the *Owner* may take the required steps pursuant to the legislation and charge the *Contractor* for any costs so incurred.

5.4.5 Prior to submitting its written application for *Substantial Performance of the Work*, the *Contractor* shall submit to the *Consultant* all:

.1 guarantees;
.2 warranties;
.3 certificates;
.4 final testing and balancing reports;
.5 distribution system diagrams;
.6 spare parts;
.7 maintenance manuals;
.8 samples;
.9 reports and correspondence from authorities having jurisdiction in the *Place of the Work*;
.10 shop drawings;
.11 inspection certificates;
.12 marked-up record or as-built drawings from the construction trailer.

and other materials or documentation required to be submitted under the *Contract*, together with written proof acceptable to the *Owner* and the *Consultant* that the *Work* has been substantially performed in conformance with the requirements of municipal, governmental, and utility authorities having jurisdiction in the *Place of the Work*. The *Consultant* shall refuse to certify *Substantial Performance of the Work* if the submittals referred to in this paragraph 5.4.5 are not provided by the *Contractor*.

5.4.6 The *Contractor* shall submit full and complete digital record or as-built drawings to the *Consultant* within forty-five (45) days of the issuance of the certificate of *Substantial Performance of the Work* and the *Owner* shall be at liberty to withhold, from amounts otherwise payable to the *Contractor*, an amount not to exceed one (1) percent of the *Contract Price* as security for the obligation of the *Contractor* to deliver such digital record or as built drawings.

**GC 5.5 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK**

5.5.1.1. Add to end of sentence ", and the application by the *Contractor* shall be accompanied by:

.1 a certificate, issued by an agency or firm providing workers' compensation insurance to the *Contractor*, verifying that coverage is in force at the time of making application for payment, and that coverage will remain in force for at least sixty (60) days thereafter; and,

.2 a declaration by the *Contractor*, in a form approved by the *Consultant*, verifying performance of the *Work* in compliance with all applicable regulatory requirements respecting environmental protection, fire safety, public safety and occupational health and safety.

Add new subparagraph 5.5.1.3 as follows

5.5.1.3 submit a statement that no written notices of liens have been received by it

5.5.2 Amend paragraph 5.5.2 by adding the following sentence to the end of that paragraph:

A reserve fund may be retained by the *Owner* to secure the correction of deficiencies and/or warranty claims. Included in the reserve fund would be all *Consultant* and *Owner* costs related to the correction of deficiencies and/or warranty claims.

5.5.3 Delete paragraph 5.5.3 in its entirety.

5.5.5 Delete paragraph 5.5.5 in its entirety.

**GC 5.6 PROGRESSIVE RELEASE OF HOLDBACK**

Delete GC 5.6 in its entirety.

**GC 5.7 FINAL PAYMENT**

5.7.1 Delete paragraph 5.7.1 in its entirety and substitute as follows:

When the *Contractor* considers that the *Work* is completed, as defined in the lien legislation applicable to the *Place of the Work* or if such definition does not exist, in accordance with other applicable legislation, industry practice or provisions which may be agreed to between the parties, the *Contractor* shall submit an application for final payment. The *Contractor's* application for final payment shall be accompanied by any documents or materials not yet delivered pursuant to paragraph 5.4.5, together with complete and final as-built drawings and:

.1 the Contractor's written request for release of the deficiency holdback, including a statement that no written notices of lien have been received by it;

.2 a Statutory Declaration CCDC 9A-2001;

.3 the evidence of workers' compensation compliance required by GC 10.4.1.

The *Work* shall be deemed not to be completed until all of the aforementioned documents have been delivered, and the *Owner* may withhold payment in respect of the delivery of any documents in an amount determined by the *Consultant* in accordance with the provisions of GC 5.8 - WITHHOLDING OF PAYMENT.

5.7.2 Delete from the first line of paragraph 5.7.2 the words, "calendar days" and substitute the words "*Working Days*".

5.7.4 Delete from the second line of paragraph 5.7.4 the words, " 5 calendar days after the issuance" and substitute the words "30 calendar days after receipt of".

**GC 5.8 WITHHOLDING OF PAYMENT**

Delete paragraph 5.8.1 and replace with the following:

5.8.1 If because of conditions reasonably beyond the control of the *Contractor*, there are items of work that cannot be performed, payment in full for that portion of the *Work* which has been performed as certified by the *Consultant* shall not be withheld or delayed by the *Owner* on account thereof, but the *Owner* may withhold, until the remaining portion of the *Work* is finished, only such an amount that the *Consultant* determines is sufficient and reasonable to cover the cost of performing such remaining work.

**GC 5.10 DEFICIENCY HOLDBACK**

Add a new General Condition 5.10 as follows:

5.10.1 Notwithstanding any provisions contained in the *Contract Documents* concerning certification and release of monies to the *Contractor*, the *Owner* reserves the right to establish a deficiency holdback, at the time of the review for *Substantial Performance*, based on a 200% dollar value of the deficiencies listed by the *Consultant*. The value of work outstanding for the calculation of *Substantial Performance of the Work* under the *Construction Lien Act* (Ontario) shall utilize the 100% dollar value. No individual deficiency will be valued at less than two hundred dollars ($200.00). The *Owner* shall retain the entire deficiency holdback amount until completion of all of the deficiencies listed by the *Consultant* to the satisfaction of the *Consultant*.

## GC 6.1 OWNER'S RIGHT TO MAKE CHANGES

Add new paragraphs 6.1.3, 6.1.4, 6.1.5, 6.1.6, 6.1.7 and 6.1.8 as follows:

6.1.3 The *Contractor* agrees that changes resulting from construction coordination, including but not limited to, site surface conditions, site coordination, and *Subcontractor and Supplier* coordination are included in the *Contract Price* and the *Contractor* shall be precluded from making any claim for a change in the *Contract Price* as a result of such changes.

6.1.4 Labour costs shall be actual, prevailing rates at the *Place of the Work* paid to workers, plus statutory charges on labour including WSIB, unemployment insurance, Canada pension, vacation pay, hospitalization and medical insurance. The *Contractor* shall provide these rates, when requested by the *Consultant*, for review and/or agreement.

6.1.5 Quotations for changes to the *Work* shall be accompanied by itemized breakdowns together with detailed, substantiating quotations or cost vouchers from *Subcontractors* and *Suppliers*, submitted in a format acceptable to the *Consultant* and including any costs associated with extensions in *Contract Time.*

6.1.6 When both additions and deletions covering related *Work* or substitutions are involved in a change to the *Work*, payment, including *Overhead* and profit, shall be calculated on the basis of the net difference, if any, with respect to that change in the *Work.*

6.1.7 No extension to the *Contract Time* shall be granted for changes in the *Work* unless the *Contractor* can clearly demonstrate that such changes significantly alter the overall construction schedule submitted at the commencement of the *Work.* Extensions of *Contract Time* and all associated costs, if approved pursuant to GC 3.4.2, are to be included in the relevant *Change Order.*

6.1.8 When a change in the *Work* is proposed or required, the *Contractor* shall within 10 calendar days submit to the *Consultant* for review a claim for a change in *Contract Price* and/or *Contract Time.* Should 10 calendar days be insufficient to prepare the submission, the *Contractor* shall within 5 calendar days, advise the *Consultant* in writing of the proposed date of submission of the claim. Claims submitted after the dates prescribed herein will not be considered.

## GC 6.2 CHANGE ORDER

6.2.1 Add after the last sentence in the paragraph:

The adjustment in the *Contract Time* and the *Contract Price* shall include an adjustment, if any, for delay or for the impact that the change in the *Work* has on the *Work* of the *Contractor*, and once such adjustment is made, the *Contractor* shall be precluded from making any further claims for delay or impact with respect to the change in the *Work.*

Add new paragraph 6.2.3 as follows:

6.2.3 The value of a change shall be determined in one or more of the following methods as directed by the *Consultant*.

.1 by estimate and acceptance of a lump sum;

.2 by negotiated unit prices which include the *Contractor's Overhead* and profit, or;

.3 by the actual cost to the *Owner*, such costs to be the actual cost after all credits included in the change have been deducted, plus the following ranges of mark-up on such costs:

.1 for *Change Orders* with a value of $0 to $15,000 the total *Subcontractor/Supplier* mark-up including *Overhead* and profit shall be 10% and the total *Contractor* mark-up including overhead and profit shall be 5%.

.2 For *Change Orders* in excess of $15,000, the total *Subcontractor/Supplier* mark-up including *Overhead* and profit shall be 5% and the total *Contractor* mark-up including *Overhead* and profit shall be 3%.

Add new paragraph 6.2.4 as follows:

6.2.4 All quotations will be submitted in a complete manner listing:

.1 quantity of each material,
.2 unit cost of each material,
.3 man hours involved,
.4 cost per hour,
.5 *Subcontractor* quotations submitted listing items 1 to 4 above and item 6 below.
.6 mark-up

Add new paragraph 6.2.5 as follows:

6.2.5 The *Owner* and the *Consultant* will not be responsible for delays to the *Work* resulting from late, incomplete or inadequately broken down valuations submitted by the *Contractor.*

**GC 6.3 CHANGE DIRECTIVE**

6.3.6.1 Amend paragraph 6.3.6.1 by deleting the final period and adding as follows:

.1 Ten percent (10%) for profit plus five percent (5%) for overhead on work by the *Contractor's* own forces up to the value of $15,000 and five percent (5%) for profit plus three percent (3%) for *Overhead* on work by the *Contractor's* own forces in excess of $15,000 and,

.2 Ten percent (10%) fee on amounts paid to *Subcontractors* or *Suppliers* under subparagraph 6.3.7.9 for changes up to the value of $15,000 and five percent (5%) on changes over $15,000.

Unless a *Subcontractor's* or *Supplier's* price has been approved by the *Owner*, the *Subcontractor* or *Supplier* shall be entitled to its actual net cost as determined in accordance with paragraph 6.3.7, plus ten percent (10%) for profit and five percent (5%) for *Overhead* on such actual net cost for changes in the *Work*, up to the value of $15,000 and five percent (5%) for profit and three percent (3%) for overhead on such actual net cost changes in the *Work* in excess of $15,000.

6.3.6.2 Delete paragraph 6.3.6.2 and replace it with the following:

If a change in the *Work* results in a net decrease in the *Contract Price* in excess of $15,000 the amount of the credit shall be the net cost, with deduction for *Overhead* and profit. If a change in the *Work* results in a net decrease in the *Contract Price* of $15,000 or less, the amount of the credit shall be the net cost, without deduction for *Overhead* or profit.

6.3.7.1 In subparagraph 6.3.7.1 insert "while directly engaged in the work attributable to the change" after the words "in the direct employ of the *Contractor*".

6.3.7 At the end of paragraph 6.3.7 add the following:

All other costs attributable to the change in the *Work* including the costs of all administrative or supervisory personnel are included in *Overhead* and profit calculated in accordance with the provisions of paragraph 6.1.5 of GC6.1 – OWNER'S RIGHT TO MAKE CHANGES.

**GC 6.4 CONCEALED OR UNKNOWN CONDITIONS**

6.4.1 Delete paragraph 6.4.1 and replace with the following:

6.4.1.1 Prior to the submission of the bid on which the *Contract* was awarded, the *Contractor* confirms that it carefully investigated the *Place of the Work* and carried out such tests as it deemed appropriate and, in doing so, applied to that investigation the degree of care and skill required by paragraph 3.14.1.

6.4.1.2 The *Contractor* is deemed to assume all risk of conditions or circumstances now existing or arising in the course of the *Work* which could make the work more expensive or more difficult to perform than was contemplated at the time the *Contract* was executed. No claim by the *Contractor* will be considered by the *Owner* or the *Consultant* in connection with

conditions which could reasonably have been ascertained by such investigation or other due diligence undertaken prior to the execution of the *Contract*.

6.4.2 Amend paragraph 6.4.2 by adding a new first sentence as follows:

Having regard to paragraph 6.4.1, if the *Contractor* believes that the conditions of the *Place of the Work* differ materially from those reasonably anticipated, differ materially from those indicated in the *Contract Documents* or were concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.1, it shall provide the *Owner* and the *Consultant* with *Notice in Writing* no later than five (5) *Working Days* after the first observation of such conditions.

Amend the existing second sentence of paragraph 6.4.2 in the second line, following the word "materially" by adding the words "or were concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.1,"

6.4.3 Delete paragraph 6.4.3 in its entirety and substitute the following:

If the *Consultant* makes a finding pursuant to paragraph 6.4.2 that no change in the *Contract Price* or the *Contract Time* is justified, the *Consultant* shall report in writing the reasons for this finding to the *Owner* and the *Contractor*.

Add new paragraph 6.4.5 as follows:

6.4.5 No claims for additional compensation or for an extension of *Contract Time* shall be allowed if the *Contractor* fails to give *Notice in Writing* to the *Owner* or *Consultant*, as required by paragraph 6.4.2.

**GC 6.5 DELAYS**

6.5.1 Delete the words after the word "for" in the fourth line of paragraph 6.5.1, and add the words "…reasonable direct costs directly flowing from the delay, but excluding any consequential, indirect or special damages (including, without limitation, loss of profits, loss of opportunity or loss of productivity)."

6.5.2 Delete the words after the word "for" in the fourth line of paragraph 6.5.2, and add the words "…reasonable direct costs directly flowing from the delay, but excluding any consequential, indirect or special damages (including, without limitation, loss of profits, loss of opportunity or loss of productivity)."

6.5.3 Delete paragraph 6.5.3 in its entirety and replace with the following:

If the *Contractor* is delayed in the performance of the *Work* by *Force Majeure*, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The extension of time shall not be less than the time lost as a result of the event causing the delay, unless the *Contractor* agrees to a shorter extension. The *Contractor* shall not be entitled to payment for costs incurred by such delays unless such delays result from the actions of the *Owner*.

Delete paragraph 6.5.4 in its entirety and replace with the following:

6.5.4 No extension or compensation shall be made for delay or impact on the *Work* unless notice in writing of a claim is given to the *Consultant* not later than ten (10) *Working Days* after the commencement of the delays or impact on the *Work*, provided however, that, in the case of a continuing cause of delay or impact on the *Work*, only one notice of claim shall be necessary.

Add new paragraphs 6.5.6, 6.5.7 and 6.5.8 as follows:

6.5.6 If the *Contractor* is delayed in the performance of the *Work* by an act or omission of the *Contractor* or anyone directly or indirectly employed or engaged by the *Contractor*, or by any cause within the *Contractor's* control, then the *Contract Time* may be extended for such reasonable time as the *Owner* may decide in consultation with the *Consultant* and the *Contractor*. The *Owner* shall be reimbursed by the *Contractor* for all reasonable costs incurred by the *Owner* as the result of such delay, including, but not limited to, the cost of all additional services required by the *Owner* from the *Consultant* or any sub-consultants, project managers, or others employed or engaged by the *Owner*, and in particular, the costs of the *Consultant's* services during the period between the date of *Substantial Performance of the Work* stated in Article A-1 herein, as the same may be extended through the provision of these General Conditions, and any later or actual date of *Substantial Performance of the Work* achieved by the *Contractor*.

6.5.7 Without limiting the obligations of the *Contractor* described in GC 3.2 – CONSTRUCTION BY OWNER OR OTHER CONTRACTORS or GC 9.4 – CONSTRUCTION SAFETY, the *Owner* or *Consultant* may, by notice in writing, direct the *Contractor* to stop the *Work* where the *Owner* or *Consultant* determines that there is an imminent risk to the safety of persons or property at the *Place of the Work*. In the event that the *Contractor* receives such notice, it shall immediately stop the *Work* and secure the site. The *Contractor* shall not be entitled to an extension of the *Contract Time* or to an increase in the *Contract Price* unless the resulting delay, if any, would entitle the *Contractor* to an extension of the *Contact Time* or the reimbursement of the *Contractor's* costs as provided in paragraphs 6.5.1, 6.5.2 or 6.5.3.

6.5.8 No claim for delay shall be made and the *Contract Time* shall not be extended due to climatic conditions or arising from the *Contractor's* efforts to maintain the *Contract* schedule.

**GC 6.6 CLAIMS FOR A CHANGE IN THE CONTRACT PRICE**

Delete GC 6.6 in its entirety.

**GC 7.1 OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK OR TERMINATE THE CONTRACT**

Revise the heading to read **"OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, SUSPEND THE WORK OR TERMINATE THE CONTRACT"**

Delete paragraph 7.1.2 and replace with the following:

7.1.2 If the *Contractor* should neglect to prosecute the *Work* properly, fails or neglects to maintain the latest schedule provided pursuant to GC 3.5, or otherwise fails to comply with the requirements of the *Contract*, and if the *Consultant* has given a written statement to the *Contractor* that sufficient cause exists to justify such action, the *Owner* may notify the *Contractor*, in writing, that the *Contractor* is in default of the *Contractor's* contractual obligations and instruct the *Contractor* to correct the default in the five (5) *Working Days* immediately following the receipt of such notice.

Add a new subparagraph 7.1.3.4 as follows:

7.1.3.4 An "acceptable schedule" as referred to in subparagraph 7.1.3.2. means a schedule approved by the *Consultant* and the *Owner* wherein the default can be corrected within the balance of the *Contract Time* and shall not cause delay to any other aspect of the *Work* or the work of other contractors, and in no event shall it be deemed to give a right to extend the *Contract Time*.

7.1.4.1 Delete sentence and replace with the following:

Correct such default and deduct the cost, including *Owner's* expenses, thereof from any payment then or thereafter due the *Contractor*.

7.1.5.3 In subparagraph 7.1.5.3 delete the words: "however, if such cost of finishing the *Work* is less than the unpaid balance of the *Contract Price*, the *Owner* shall pay the *Contractor* the difference;"

Delete paragraph 7.1.6 in its entirety and add new paragraphs 7.1.6, 7.1.7, 7.1.8, 7.1.9 and 7.1.10 as follows:

7.1.6 In addition to its right to terminate the Contract set out herein, the *Owner* may terminate this *Contract* at any time for any other reason and without cause upon giving the *Contractor* fifteen (15) *Working Days Notice in Writing* to that effect. In such event, the *Contractor* shall be entitled to be paid for all *Work* performed including reasonable profit, for loss sustained upon *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a result of the termination of the *Contract*, but in no event shall the *Contractor* be entitled to be compensated for any loss of profit on unperformed portions of the *Work*, or indirect, special, or consequential damages incurred.

7.1.7 The *Owner* may suspend *Work* under this *Contract* at any time for any reason and without cause upon giving the *Contractor Notice in Writing* to that effect. In such event, the *Contractor* shall be entitled to be paid for all *Work* performed to the date of suspension and be compensated for all actual costs incurred arising from the suspension, including reasonable profit, for loss sustained upon *Products* and *Construction Equipment*, and such other damages as the *Contractor*

may have sustained as a result of the suspension of the *Work*, but in no event shall the *Contractor* be entitled to be compensated for any indirect, special, or consequential damages incurred. In the event that the suspension continues for more than thirty (30) calendar days, the *Contract* shall be deemed to be terminated and the provisions of paragraph 7.1.6 shall apply.

7.1.8 In the case of either a termination of the *Contract* or a suspension of the *Work* under GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, SUSPEND THE WORK, OR TERMINATE THE CONTRACT or GC 7.2 - CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* shall use its best commercial efforts to mitigate the financial consequences to the *Owner* arising out of the termination or suspension, as the case may be.

7.1.9 Upon the resumption of the *Work* following a suspension under GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, SUSPEND THE WORK OR TERMINATE THE CONTRACT or GC 7.2 - CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* will endeavour to minimize the delay and financial consequences arising out of the suspension.

7.1.10 The *Contractor's* obligations under the *Contract* as to quality, correction, and warranty of the *Work* performed by the *Contractor* up to the time of termination or suspension shall continue after such termination of the *Contract* or suspension of the *Work*.

**GC 7.2 CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT**

7.2.2 Delete paragraph 7.2.2 in its entirety.

7.2.3.1 Delete subparagraph 7.2.3.1 in its entirety.

7.2.3.2 Delete subparagraph 7.2.3.2 in its entirety

7.2.3.3 Delete subparagraph 7.2.3.3 in its entirety.

7.2.3.4 In subparagraph 7.2.3.4, delete the words "except for GC 5.1 - FINANCING INFORMATION REQUIRED OF THE OWNER".

Renumber paragraph 7.2.5 as paragraph 7.2.6. Add a new paragraph 7.2.5 as follows:

7.2.5 If the default cannot be corrected within the 5 *Working Days* specified in paragraph 7.2.4, the *Owner* shall be deemed to have cured the default if it:

.1 commences correction of the default within the specified time;

.2 provides the *Contractor* with an acceptable schedule for such correction; and,

.3 completes the correction in accordance with such schedule.

Delete paragraph 7.2.6 entirely and replace with the following:

7.2.6 If the *Contractor* terminates the *Contract* under the conditions described in GC 7.2 – CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* shall be entitled to be paid for all *Work* performed to the date of termination, as determined by the *Consultant*. The *Contractor* shall also be entitled to recover the direct costs associated with termination, including the costs of demobilization and losses sustained on *Products* and *Construction Equipment*. The *Contractor* shall not be entitled to any recovery for any special, indirect or consequential losses, including loss of profit.

Add new paragraphs 7.2.7, 7.2.8 and 7.2.9 as follows

7.2.7 The *Contractor* shall not be entitled to give notice of the *Owner's* default or terminate the *Contract* in the event the *Owner* withholds certificates or payment or both in accordance with the *Contract* because of:

(a) the *Contractor's* failure to pay all legitimate claims promptly, or
(b) the failure of the *Contractor* to discharge construction liens which are registered against the title to the *Place of the Work.*

7.2.8 The *Contractor's* obligations under the *Contract* as to quality, correction and warranty of the *Work* performed by the *Contractor* up to the effective date of termination shall continue in force and shall survive termination by the *Contractor* in accordance with paragraph 7.2.4.

7.2.9 If the *Contractor* suspends the *Work* or terminates the *Contract* as provided for in GC 7.2 – CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* shall ensure the site and the *Work* are left in a safe, secure condition as required by authorities having jurisdiction at the *Place of the Work* and the *Contract Documents*.

**GC 8.1 AUTHORITY OF THE CONSULTANT**

Delete paragraph 8.3.1 in its entirety and substitute as follows:

8.1.3 If a dispute is not resolved promptly, the *Consultant* will give such instruction as in the Consultant's opinion are necessary for the proper performance of the Work and to prevent delays pending settlement of the dispute. The parties shall act immediately according to such instructions, it being understood that by doing so neither party will jeopardize any claim the party may have.

**GC 8.2 NEGOTIATION, MEDIATION AND ARBITRATION**

8.2.1 Amend paragraph 8.2.1 by changing part of the second line from "shall appoint a *Project Mediator*" to "may appoint a *Project Mediator,* except that such an appointment shall only be made if both the *Owner* and the *Contractor* agree."

8.2.4 Amend paragraph 8.2.4 by changing part of the second line from "the parties shall request the *Project Mediator"* to "and subject to paragraph 8.2.1 the parties may request the *Project Mediator"*.

Delete paragraphs 8.2.6, 8.2.7 and 8.2.8 in their entirety.

Add new paragraph 8.2.6 as follows:

8.2.6 The dispute may be finally resolved by arbitration under the Rules for Arbitration of Construction Disputes as provided in CCDC 40 in effect at the time of bid closing, provided that both the *Contractor* and the *Owner* agree. If the *Contractor* and the *Owner* agree to resolve the dispute by arbitration, the arbitration shall be conducted in the jurisdiction of the *Place of the Work*.

**GC 9.1 PROTECTION OF WORK AND PROPERTY**

Delete subparagraph 9.1.1.1 in its entirety and substitute the following:

9.1.1.1 errors in the *Contract Documents* which the *Contractor* could not have discovered applying the standard of care described in paragraph 3.14.1;

Delete paragraph 9.1.2 in its entirety and substitute as follows:

9.1.2 Before commencing any *Work*, the *Contractor* shall determine the locations of all underground or hidden utilities and structures indicated in or inferable from the *Contract Documents*, or that are inferable from an inspection of the *Place of the Work* exercising the degree of care and skill described in paragraph 3.14.1.

Add new paragraph 9.1.5 as follows:

9.1.5 With respect to any damage to which paragraphs 9.1.3 or 9.1.4 apply, the *Contractor* shall neither undertake to repair or replace any damage whatsoever to the work of other contractors, or to adjoining property, nor acknowledge that the same was caused or occasioned by the *Contractor*, without first consulting the *Owner* and receiving written instructions as to the course of action to be followed from either the *Owner* or the *Consultant*. Where, however, there is danger to life, the environment, or public safety, the *Contractor* shall take such emergency action as it deems necessary to remove the danger.

**GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES**

Add a new subparagraph 9.2.5.5 as follows:

9.2.5.5 in addition to the steps described in subparagraph 9.2.5.3, take any further steps it deems necessary to mitigate or stabilize any conditions resulting from encountering toxic or hazardous substances or materials.

9.2.6 Add the following to paragraph 9.2.6, after the word "responsible" in the second line:

…or whether any toxic or hazardous substances or materials already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damages to the property of the *Owner* or others**,…**

9.2.8 Add the following to paragraph 9.2.8, after the word "responsible" in the second line:

…or whether any toxic or hazardous substances or materials already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damages to the property of the *Owner* or others**,…**

Add new paragraphs 9.2.10 and 9.2.11 as follows:

9.2.10 The *Contractor*, *Subcontractors* and *Suppliers* shall not bring on to the *Place of the Work* any toxic or hazardous substances and materials except as required in order to perform the *Work*. If such toxic or hazardous substances or materials are required, storage in quantities sufficient to allow work to proceed to the end of any current work week only shall be permitted. All such toxic and hazardous materials and substances shall be handled and disposed of only in accordance with all laws and regulations that are applicable at the *Place of the Work*.

9.2.11 The *Contractor* shall indemnify and hold harmless the *Owner*, its parent, subsidiaries and affiliates, the *Consultant* and their respective partners, officers, directors, agents and employees from and against any and all liabilities, costs, expenses, and claims resulting from bodily injury, including death, and damage to property of any person, corporation or other body politic, that arises from the use by the *Contractor*, *Subcontractors* and *Suppliers* of any toxic or hazardous substances or materials at the *Place of the Work*.

**GC 9.4 CONSTRUCTION SAFETY**

Delete paragraph 9.4.1 in its entirety and substitute as follows:

9.4.1 The *Contractor* shall be solely responsible for construction safety at the *Place of the Work* and for compliance with the rules, regulations, and practices required by the applicable construction health and safety legislation and shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the *Work*.

Add new paragraphs 9.4.2 to 9.4.10 as follows:

9.4.2 Prior to the commencement of the *Work*, the *Contractor* shall submit to the *Owner*:

.1 the evidence of workers' compensation compliance required by GC 10.4.1;

.2 copies of the *Contractor's* insurance policies having application to the *Project* or certificates of insurance, at the option of the *Owner*;

.3 documentation setting out the *Contractor's* in-house safety programs;

.4 copies of any documentation or notices to be filed or delivered to the authorities having jurisdiction for the regulation of occupational health and safety at the *Place of the Work*.

9.4.3 The *Contractor* shall indemnify and save harmless the *Owner*, its agents, trustees, officers, directors, employees, consultants, successors, appointees, and assigns from and against the consequences of any and all safety infractions committed by the *Contractor* under the occupational health and safety legislation in force at the *Place of the Work* including the payment of legal fees and disbursements on a substantial indemnity basis.

9.4.4 The *Owner* undertakes to include in its contracts with other contractors and in its instructions to its own forces the requirement that the other contractor or its own forces, as the case may be, comply with the policies and procedures of and the directions and instructions from the *Contractor* with respect to occupational health and safety and related matters.

9.4.5 If the *Owner* is of the reasonable opinion that the *Contractor* has not taken such precautions as are necessary to ensure compliance with the requirements of paragraph 9.4.1, the *Owner* may take any remedial measures which it deems necessary, including stopping the performance of all or any portion of the *Work*, and the *Owner* may use its employees, the *Contractor*, any *Subcontractor* or any other contractors to perform such remedial measures.

9.4.6 The *Contractor* shall file any notices or any similar document required pursuant to the *Contract* or the safety regulations in force at the *Place of the Work*. This duty of the *Contractor* will be considered to be included in the *Work* and no separate payment therefore will be made to the *Contractor*.

9.4.7 Unless otherwise provided in the *Contract Documents*, the *Contactor* shall develop, maintain and supervise for the duration of the *Work* a comprehensive safety program that will effectively incorporate and implement all required safety precautions. The program shall, at a minimum, respond fully to the applicable safety regulations and general construction practices for the safety of persons or property, including, without limitation, any general safety rules and regulations of the *Owner* and any workers' compensation or occupational health and safety statutes or regulations in force at the *Place of the Work*.

9.4.8 The Contractor shall provide a copy of the safety program described in paragraph 9.4.7 hereof to the *Consultant* for delivery to the *Owner* prior to the commencement of the *Work*, and shall, ensure, as far as it is reasonably practical to do so, that every employer and worker performing work in respect of the *Project* complies with such program.

9.4.9 The *Contractor* shall arrange regular safety meetings, and shall supply and maintain, at its own expense, at its office or other well-known place at the job site, safety equipment necessary to protect the workers and general public against accident or injury as prescribed by the authorities having jurisdiction at the *Place of the Work*, including, without limitation, articles necessary for administering first-aid to any person and an emergency procedure for the immediate removal of any inured person to a hospital or a doctor's care.

9.4.10 The *Contractor* shall promptly report in writing to the *Owner* and the *Consultant* all accidents of any sort arising out of or in connection with the performance of the *Work*, whether on or adjacent to the job site, giving full details and statement of witnesses. If death or serious injuries or damages are caused, the accident shall be promptly reported by the *Contractor* to the *Owner* and the *Consultant* by telephone or messenger in addition to any reporting required under the applicable safety regulations.

**GC 9.5 MOULD**

Delete subparagraph 9.5.3.3 and replace with the following:

9.5.3.3 extend the *Contract Time* for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor* and the *Owner*. If, in the opinion of the *Consultant*, the *Contractor* has been delayed in performing the *Work* and/or has incurred additional costs under paragraph 9.5.1.2, the *Owner* shall reimburse the *Contractor* for the reasonable costs incurred as a result of the delay and as a result of taking those steps, and

**GC 10.1 TAXES AND DUTIES**

10.1.2 Amend paragraph 10.1.2 by adding the following sentence to the end of the paragraph:

For greater certainty, the *Contractor* shall not be entitled to any mark-up for overhead or profit on any increase in such taxes and duties and the *Owner* shall not be entitled to any credit relating to mark-up for overhead or profit on any decrease in such taxes. The *Contractor* shall provide a detailed breakdown of additional taxes if requested by the *Owner* in a form satisfactory to the Owner.

Add new paragraph 10.1.3 as follows:

10.1.3 Where the *Owner* is entitled to an exemption or a recovery of sales taxes, customs duties, excise taxes or *Value Added Taxes* applicable to the *Contract*, the *Contractor* shall, at the request of the *Owner*, assist with the application for any exemption, recovery or refund of all such taxes and duties and all amounts recovered or exemptions obtained shall be for the sole benefit of the *Owner*. The *Contractor* agrees to endorse over to the *Owner* any cheques received from the federal or provincial governments, or any other taxing authority, as may be required to give effect to this paragraph.

**GC 10.2 LAWS, NOTICES, PERMITS, AND FEES**

10.2.5 Amend paragraph 10.2.5 by addition the words "Subject to paragraph 3.4" at the beginning of the paragraph. Add the following to the end of the second sentence:

…and no further *Work* on the affected components of the *Contract* shall proceed until these directives have been obtained by the *Contractor* from the *Consultant*.

10.2.6 Amend paragraph 10.2.6 by adding the following sentence to the end of the paragraph:

In the event the *Owner* suffers loss or damage as a result of the *Contractor's* failure to comply with paragraph 10.2.5 and notwithstanding any limitations described in paragraph 12.1.1, the *Contractor* agrees to indemnify and to hold harmless the *Owner* and the *Consultant* from and against any claims, demands, losses, costs, damages, actions suits or proceedings resulting from such failure by the *Contractor*.

Add new paragraph 10.2.8 as follows:

10.2.8 The *Contractor* shall furnish all certificates that are required or given by the appropriate governmental authorities as evidence that the *Work* as installed conforms with the laws and regulations of authorities having jurisdiction, including certificates of compliance for the *Owner's* occupancy or partial occupancy. The certificates are to be final certificates giving complete clearance of the *Work*, in the event that such governmental authorities furnish such certificates.

**GC 10.4 WORKERS' COMPENSATION**

10.4.1 Delete paragraph 10.4.1 and replace with the following:

Prior to commencing the *Work*, and with each and every application for payment thereafter, including the *Contractor's* application for payment of the holdback amount following *Substantial Performance of the Work* and again with the *Contractor's* application for final payment, the *Contractor* shall provide evidence of compliance with workers' compensation legislation in force at the *Place of the Work*, including payments due thereunder.

**GC 11.1 INSURANCE**

Delete entirety of general condition and CCDC 41 and replace with the following**:**

**11.1** Without restricting the generality of GC 12 – INDEMNIFICATION, the *Contractor* shall provide, maintain, and pay for the insurance coverages specified in GC 11.1 – INSURANCE. Unless otherwise stipulated, the duration of each insurance policy shall be from the date of commencement of the *Work* until the expiration of the warranty periods set out in the *Contract Documents*. Prior to commencement of the *Work* and upon the placement, renewal, amendment, or extension of all or any part of the insurance, the *Contractor* shall promptly provide the *Owner* with confirmation of coverage and, if required, a certified true copy of the policies certified by an authorized representative of the insurer together with copies of any amending endorsements.

.1 **General Liability Insurance**

General liability insurance shall be in the name of the *Contractor*, with the *Owner* and the *Consultant* named as additional insureds, with limits of not less than $5,000,000.00 inclusive per occurrence for bodily injury, death, and damage to property, including loss of use thereof, for itself and each of its employees, *Subcontractors* and/or agents. The insurance coverage shall not be less than the insurance required by IBC Form 2100, or its equivalent replacement, provided that IBC Form 2100 shall contain the latest edition of the relevant CCDC endorsement form. To achieve the desired limit, umbrella,

or excess liability insurance may be used. All liability coverage shall be maintained for completed operations hazards from the date of *Substantial Performance of the Work*, as set out in the certificate of *Substantial Performance of the Work*, on an ongoing basis for a period of 6 years following *Substantial Performance of the Work*. Where the *Contractor* maintains a single, blanket policy, the addition of the *Owner* and the *Consultant* is limited to liability arising out of the *Project* and all operations necessary or incidental thereto. The policy shall be endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of any cancellation and of change or amendment restricting coverage.

.2 **Automobile Liability Insurance**

Automobile liability insurance in respect of licensed vehicles shall limits of not less than $2,000,000.00 inclusive per occurrence for bodily injury, death and damage to property, covering all licensed vehicles *owned* or leased by the *Contractor*, and endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of any cancellation, change or amendment restricting coverage. Where the policy has been issued pursuant to a government-operated automobile insurance system, the *Contractor* shall provide the *Owner* with confirmation of automobile insurance coverage for all automobiles registered in the name of the *Contractor*.

.3 **Aircraft and Watercraft Liability Insurance [NTD: This can come out if N/A]**

Where determined necessary by the *Contractor*, acting reasonably, aircraft and watercraft liability insurance will be obtained in accordance with the provisions of paragraph 11.1.3. Aircraft and watercraft liability insurance with respect to owned or non-owed aircraft and watercraft if used directly or indirectly in the performance of the *Work*, including use of additional premises, shall be subject to limits of not less than $2,000,000.00 inclusive per occurrence for bodily injury, death and damage to property, including loss of use thereof and limits of not less than $2,000,000.00 for aircraft passenger hazard. Such insurance shall be in a form acceptable to the *Owner*. The policies shall be endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of cancellation, change or amendment restricting coverage.

**.4 Property and Boiler and Machinery Insurance**

(1) Builder's Risk property insurance shall be in the name of the *Contractor* with the *Owner* and the *Consultant* named as additional insureds. The policy shall insure against all risks of direct physical loss or damage to the property insured which shall include all property included in the *Work*, whether owned by the *Contractor* or the owner or owned by others, so long as the property forms part of the *Work*. The property insured also includes all materials and supplies necessary to complete the work, whether installed in the work temporarily or permanently, in storage on the project site, or in transit to the project site, as well as temporary buildings, scaffolding, falsework forms, hoardings, excavation, site preparation and similar work. The insurance shall be for not less than the sum of the amount of the contract price and the full value of products that are specified to be provided by the owner for incorporation into the work, if applicable, with the deductible of $10,000.00 payable by the contractor. The insurance shall include the foregoing and, otherwise, shall not be less than the insurance required by IBC Form 4042 or its equivalent replacement provided that the IBC Form 4042 shall include the latest addition of the relevant CCDC endorsement form. The coverage shall be based on a completed value form and shall be maintained continuously until ten (10) days after the date of the final certificate of payment.

(2) Boiler and machinery insurance shall be in the name of the *Contractor*, with the *Owner* and the *Consultant* named as additional insureds, for not less than the replacement value of the boilers, pressure vessels and other insurable objects forming part of the *Work*. The insurance provided shall not be less than the insurance provided by the "Comprehensive Boiler and Machinery Form" and shall be maintained continuously from commencement of use or operation of the property insured and until 10 days after the date of the final certificate for payment.

(3) The policies shall allow for partial or total use or occupancy of the *Work*.

(4) The policies shall provide that, in the case of a loss or damage, payment shall be made to the *Owner* and the *Contractor* as their respective interests may appear. The *Contractor* shall act on behalf of the *Owner* for the purpose of adjusting the amount of such loss or damage payment with the insurers. When the extent of the loss or damage is determined, the *Contractor* shall proceed to restore the *Work*. Loss or damage shall not affect the rights and obligations of either party under the *Contract* except that the *Contractor* shall be entitled to such reasonable extension of the *Contract Time*, relative to the extent of the loss or damage, as determined by the *Owner*, in its sole discretion.

(5) The *Contractor* shall be entitled to receive from the *Owner*, in addition to the amount due under the *Contract*, the amount at which the *Owner's* interest in restoration of the *Work* has been appraised, such amount to be paid as the restoration of the *Work* proceeds and as provided in GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT and GC 5.3

– PROGRESS PAYMENT. In addition, the *Contractor* shall be entitled to receive from the payments made by the insurer the amount of the *Contractor's* interest in the restoration of the *Work.*

(6) In the case of loss or damage to the *Work* arising from the work of other contractors, or the *Owner's* own forces, the *Owner*, in accordance with the *Owner's* obligations under paragraph 3.2.2.4 of GC 3.2 – CONSTRUCTION BY OWNER OR OTHER CONTRACTORS, shall pay the *Contractor* the cost of restoring the *Work* as the restoration of the *Work* proceeds and as provided in GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT and GC 5.3 – PROGRESS PAYMENT.

**.5 Contractors' Equipment Insurance**

"All risks" contractors' equipment insurance covering construction machinery and equipment used by the *Contractor* for the performance of the *Work*, excluding boiler insurance, shall be in a form acceptable to the *Owner* and shall not allow subrogation claims by the insurer against the *Owner.* The policies shall be endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of cancellation, change or amendment restricting coverage. Subject to satisfactory proof of financial capability by the *Contractor* for self-insurance of his equipment, the *Owner* agrees to waive the equipment insurance requirement.

11.1.2 The *Contractor* shall be responsible for deductible amounts under the policies except where such amounts may be excluded from the *Contractor's* responsibility by the terms of GC 9.1 - PROTECTION OF WORK AND PROPERTY and GC 9.2 - DAMAGES AND MUTUAL RESPONSIBILITY.

11.1.3 Where the full insurable value of the *Work* is substantially less than the *Contract Price*, the *Owner* may reduce the amount of insurance required to waive the course of construction insurance requirement.

11.1.4 If the *Contractor* fails to provide or maintain insurance as required by the *Contract Documents*, then the *Owner* shall have the right to provide and maintain such insurance and provide evidence of same to the *Contractor*. The *Contractor* shall pay the costs thereof to the *Owner* on demand, or the *Owner* may deduct the amount that is due or may become due to the *Contractor*.

11.1.5 All required insurance policies shall be with insurers licensed to underwrite insurance in the jurisdiction of the *Place of the Work*.

**GC 11.2 CONTRACT SECURITY**

11.2.2 Delete paragraph after the word "provided" and replace with the following:

Such bonds shall be issued by a duly licensed surety company, which has been approved by the *Owner*, authorized to transact a business of suretyship in the province or territory of the *Place of the Work* and shall be maintained in good standing until the fulfillment of the *Contract*, including all warranty and maintenance periods set out in the *Contract Documents.*

Add new paragraph 11.2.3 as follows:

11.2.3 It is the intention of the parties that the performance bond shall be applicable to all of the *Contractor's* obligations in the *Contract Document* and, wherever a performance bond is provided with language which conflicts with this intention, it shall be deemed to be amended to comply. The *Contractor* represents and warrants to the *Owner* that it has provided its surety with a copy of the *Contract Documents* prior to the issuance of such bonds.

**GC 12.1 INDEMNIFICATION**

Delete General Condition 12.1 – INDEMNIFICATION in its entirety and substitute as follows:

12.1.1 The *Contractor* shall indemnify and hold harmless the *Owner*, its parent, subsidiaries and affiliates, the *Consultant* and their respective partners, trustees, officers, directors, agents and employees from and against any and all claims, liabilities, expenses, demands, losses, damages, actions, costs, suits, or proceedings (hereinafter called "claims"), whether in respect of claims suffered by the *Owner* or in respect of claims by third parties, that directly or indirectly arise out of, or are attributable to, the acts or omissions of the *Contractor*, its employees, agents, *Subcontractors*, *Suppliers* or any other persons for whom it is in law responsible (including, without limitation, claims that directly or indirectly arise out of, or are

attributable to, loss of use or damage to the *Work*, the *Owner's* property or equipment, the *Contractor's* property or equipment or equipment or property adjacent to the *Place of the Work* or death or injury to the *Contractor's* personnel).

12.1.2 The provisions of GC 12.1 - INDEMNIFICATION shall survive the termination of the *Contract*, howsoever caused and no payment or partial payment, no issuance of a final certificate of payment and no occupancy in whole or in part of the *Work* shall constitute a waiver or release of any of the provisions of GC 12.1.

**GC 12.2 WAIVER OF CLAIMS**

12.2.1 In the fourth line, add the words "claims for delay pursuant to GC 6.5 DELAYS" after the word "limitation". Add the words "(collectively "Claims")" after "*Substantial Performance of the Work*" in the sixth line.

12.2.1.1 Change the word "claims" to "Claims" and change the word "claim" to "Claim".

12.2.1.2 Change the word "claims" to "Claims".

12.2.1.3 Delete paragraph in its entirety.

12.2.1.4 Change the word "claims" to "Claims".

12.2.2 Change the words "in paragraphs 12.2.1.2 and 12.2.1.3" to "in paragraph 12.2.1.2".Change the word "claims" to "Claims" in both instances and change the word "claim" to "Claim".

12.2.3 Delete paragraph in its entirety.

12.2.4 Delete paragraph in its entirety.

12.2.5 Delete paragraph in its entirety.

12.2.6 Change the word "claim" to "Claim" in all instances in the paragraph.

12.2.7 Change "The party" to "The *Contractor*. Change the word "claim" to "Claim" in all instances in the paragraph.

12.2.8 Change "under paragraphs 12.2.1 or 12.2.3" to "under paragraph 12.2.1". Change both instances of the words "the party" to "the *Contractor*". Change the word "claim" to "Claim" in all instances in the paragraph.

12.2.9 Delete paragraph 12.2.9 in its entirety.

12.2.10 Delete paragraph 12.2.10 in its entirety.

**GC 12.3 WARRANTY**

12.3.2 Delete from the first line of paragraph 12.3.2 the word, "The" and substitute the words "Subject to paragraph 3.4.1, the…"

Add new paragraphs 12.3.7 to 12.3.12 as follows:

12.3.7 Where required by the *Contract Documents*, the *Contractor* shall provide a maintenance bond as security for the performance of the *Contractor's* obligations as set out in GC 12.3 WARRANTY.

12.3.8 The *Contractor* shall provide fully and properly completed and signed copies of all warranties and guarantees required by the *Contract Documents*, containing:

.1 the proper name of the *Owner*;
.2 the proper name and address of the *Project*;
.3 the date the warranty commences, which shall be at the "date of *Substantial Performance of the Work*" unless otherwise agreed upon by the *Consultant* in writing.
.4 a clear definition of what is being warranted and/or guaranteed as required by the *Contract Documents*; and
.5 the signature and seal (if required by the governing law of the *Contract*) of the company issuing the warranty, countersigned by the *Contractor*.

12.3.9 Should any *Work* be repaired or replaced during the time period for which it is covered by the specified warranty, a new warranty shall be provided under the same conditions and for the same period as specified herein before. The new warranty shall commence at the completion of the repair or replacement.

12.3.10 The *Contractor* shall ensure that its *Subcontractors* are bound to the requirements of GC 12.3 – WARRANTY for the *Subcontractor's* portion of the *Work.*

12.3.11 The *Contractor* shall ensure that all warranties, guarantees or other obligations for *Work*, services or *Products* performed or supplied by any *Subcontractor, Supplier* or other person in connection with the *Work* are obtained and available for the direct benefit of the *Owner.* In the alternative, the *Contractor* shall assign to the *Owner* all warranties, guarantees or other obligations for *Work*, services or *Products* performed or supplied by any *Subcontractor, Supplier* or other person in connection with the *Work* and such assignment shall be with the consent of the assigning party, where required by law, or by the terms of that party's contract. Such assignment shall be in addition to, and shall in no way limit, the warranty rights of the *Owner* under the *Contract Documents.*

12.3.12 The *Contractor* shall commence or correct any deficiency within 2 Working Days after receiving a notice from the *Owner* or the *Consultant*, and shall complete the *Work* as expeditiously as possible, except in the case where the deficiency prevents maintaining security or where basic systems essential to the ongoing business of the *Owner* and/or its tenants cannot be maintained operational as designed. In those circumstances all necessary corrections and/or installations of temporary replacements shall be carried out immediately as an emergency service. Should the *Contractor* fail to provide this emergency service within 8 hours of a request being made during the normal business hours of the *Contractor*, the *Owner* is authorized, notwithstanding GC 3.1, to carry out all necessary repairs or replacements at the *Contractor's* expense.

## PART 13 OTHER PROVISIONS

Add new Part 13 OTHER PROVISIONS as follows:

### GC 13.1 OWNERSHIP OF MATERIALS

13.1.1 Unless otherwise specified, all materials existing at the *Place of the Work* at the time of execution of the *Contract* shall remain the property of the *Owner*. All *Work* and *Products* delivered to the *Place of the Work* by the *Contractor* shall be the property of the *Owner*. The *Contractor* shall remove all surplus or rejected materials as its property when notified in writing to do so by the *Consultant*.

### GC 13.2 CONSTRUCTION LIENS

13.2.1 In the event that a claim for lien is registered against the *Project* by a *Subcontractor, Sub-subcontractor* or *Supplier*, and provided the *Owner* has paid all amounts properly owing under the *Contract*, the *Contractor* shall, at its own expense:

.1 within 10 calendar days, ensure that any and all claims for lien and certificates of action are discharged, released, or vacated by the posting of security or otherwise; and

.2 in the case of written notices of lien, ensure that such notices are withdrawn, in writing.

13.2.2 In the event that the *Contractor* fails to conform with the requirements of paragraph 13.2.1, the *Owner* may fulfil those requirements without *Notice in Writing* to the *Contractor* and set off and deduct from any amount owing to the *Contractor*, all costs and associated expenses, including the costs of posting security and all legal fees and disbursements associated with discharging or vacating the claim for lien or certificate of action and defending the action. If there is no amount owing by the *Owner* to the *Contractor*, then the *Contractor* shall reimburse the *Owner* for all of the said costs and associated expenses.

13.2.3 Notwithstanding any other provision in the *Contract*, the *Consultant* shall not be obligated to issue a certificate and the *Owner* shall not be obligated to make payment to the *Contractor* if, at the time such certificate or payment was otherwise due:

.1 a claim for lien has been registered against the *Project* lands, or

.2 if the *Qwner* or mortgagee of the *Project* lands has received written notice of a lien or

.3 the *Owner* or *Consultant* reasonably believe that any party has purported to retain title to *Products* or materials in respect of which an application for payment has been made.

13.2.4 Without limiting the foregoing, the *Contractor* shall, if requested by the *Owner*, defend, indemnify and save the *Owner* harmless from the amount of all such claims and the costs of defending any and all actions commenced against the *Owner* pursuant to the construction/builder's lien legislation in force at the *Place of the Work*, including the legal costs of the *Owner*, unless the lien was a direct result of a breach of the *Contract* by the *Owner* or the non-payment by the *Owner* of a valid charge or claim under the *Contract*.

13.2.5 GC 13.2 – CONSTRUCTION LIENS does not apply to construction/builder's liens claimed by the *Contractor*.

**END OF AMENDMENTS TO CCDC 2 - 2008**

**1.0 GENERAL**

.1 **Related Work**

.1 Hoarding and Protection due to Excavation, included in this Section.

.2 **Shop Drawings**

.1 Indicate & describe in detail complete perimeter hoarding and side walk protection. Include all means of access/vehicular entrances.

.2 Provide Shop Drawings to and obtain from, approval from both the Consultant and the authorities having jurisdiction. Make all revisions as required by these authorities at no additional cost to the Owner.

.3 **Permits and Fees**

.1 Apply for, obtain and pay for all necessary permits required by authorities having jurisdiction for the Work of this Section.

.4 **By-laws**

.1 Comply with the By-laws of the City of Sarnia, and all others having jurisdiction over the Work of this Section including the Occupational Health and Safety Act and Regulations for Construction Projects

**2.0 PRODUCTS**

.1 **Materials – For Internal Barriers**

.1 Plywood 13 mm minimum thickness Douglas Fir exterior grade plywood "B" or better for paint finish.

.2 Structural Lumber: Rafters, posts, planking and bracing, N.L.G.A. No. 2 grade minimum.

.3 Waterproof Membrane: "Bituthene" Regular by W.R. Grace Materials Ltd., or approved alternative.

.4 Exterior alkyd paint to approved manufacturer.

.5 Interior fire retardant paint to approved manufacturer.

.6 Steel Studs: 0.55 mm thick, wipe coated galvanized, having knurled flanges 32 mm wide with edges doubled back at least 4.8 mm, with girts as required.

.7 Gypsum Board: To meet specified requirements of CAN/CSA-A82.27-M91; **fire rated board classified for hazard by ULC and labelled as such.**

.2 **Chain-Link Fencing: For Exterior Site Enclosures**

.1 Galvanized Link Fabric: 50mm mesh, No. 9 gauge woven steel wire, zinc coated after weaving, to meet specified requirements of ASTM A392.

.2 Tube: 90mm diameter for end posts, 45mm for top rail, 60mm for line posts, standard, butt welded steel, galvanized, Schedule 40, to meet specified requirements of ASTM A120. Hollow metal structural steel tubing with minimum wall thickness of 0.100" and meeting specified requirements of CSA G40.21, Grade 50W.

.3 Tension Wire: No. 6 gauge single strand, finished to match fabric.

.4 Fabric Bands: Galvanized steel to fit tubing.

.5 Rail Fittings: Galvanized steel for caps, top tails guides.

.6 Galvanizing: Galvanize fittings, accessories and steel tube by hot dip method after fabrication to meet specified requirements of CSA Standard G164.

.7 Approved manufacturers: Frost Fencing, Lundy Steel Fencing, Donald Greening or other approved alternate. Materials need not be new however, they must be able to remain in place and perform as required for the duration of the Project.

.8 Fence height: 1830mm high unless noted otherwise.

.9 **Commercially available temporary construction fencing may be approved at the discretion of the architect.**

**3.0 EXECUTION**

.1 **Fabrication and Installation**

.1 **Hoarding**

.1 Install hoarding, fencing and sidewalk protection to the exterior of the building in accordance with approved Shop Drawings and By-laws of the City of Sarnia, and in accordance with documents.

.2 Provide posts, planking and plywood.

.3 Provide pedestrian and vehicular entrances as required, complete with swing or sliding gates, screened openings and all necessary hardware including locks.

.4 Paint complete hoarding in colour selected by Consultant.

.5 Maintain hoarding in good condition at all times.

.6 Repair any hoarding removed or damaged, to satisfaction of the Consultant and authorities.

.7 Wash all hoarding at least every two months.

.8 Remove hoarding and fencing from site only when authorized by the Consultant.

.2 **Barrier**

.1 Install barrier within the existing building to separate a work area from the remainder of the building.

.2 Barrier shall be erected such that it is self-supporting and braced on work area side.

.3 Erect a barrier of one hour fire rated drywall construction and to meet the requirements of Section 09250 and ULC Design No.W408 or W409

.4 Barrier shall not allow for the passage of airborne dust.

.5 Maintain minimum clearance for exits and access to exits.

.6 Relocate, temporarily any existing life safety devices which may become hidden or obscure due to the erection of barrier.

.7 Maintain barriers in good stable condition at all times.

.3 **Chain Link Fencing**

.1 Posts shall be spaced at 3000mm on centre maximum and shall be driven into the ground a minimum of 1200mm deep.

.2 Install at 40mm above grade, a single strand of tension wire with turnbuckles at each end.

.3 Install at top of fabric, a 45mm diameter top rail with appropriate caps and holders.

.4 Install fabric under tension under anchor to the posts, top rail and bottom tension wire at 450mm on centre.

.5 At end post, attach fabric and 6mm x 19mm tension bands at 300mm on centre.

.6 Provide a 45mm diameter brace between end posts at mid height.

.7 At completion of project, completely remove temporary fencing and patch all disturbed areas to match existing.

.8 All fencing and components will remain the property of the Contractor.

.2 **Exception**

.1 Temporary/movable perimeter fencing barriers for site work is may be approved by the consultant where construction activities require staged construction perimeters.

.2 Where permanent hoarding is not specifically indicated, provide safety fencing at perimeter of property adjacent of streets and adjacent residential properties, separating public access areas from the work site, where no other barrier is present.

**End of Section**

## PART 1 - GENERAL

**1.1 Related Sections**

.1 Comply with Division One as applicable.

.2 Restrictions on noise, dust, interference, obstructions, access, and hours of work as described in the Instructions to Bidders and General Conditions.

.3 Temporary facilities, public safety, weather and dust barriers or partitions: General Instructions, and Section 01530.

.4 Work described in Division 15000 and 16000.

.5 The requirements of this Section apply to all other Sections of the specifications.

**1.2 References**

.1 CSA S350-M1980, Code of Practice of Safety in Demolition of Structures.

**1.3 Existing Conditions**

.1 Examine areas to be selectively demolished or dismantled, and confirm that their condition is substantially the same as the date on which bids closed, and as indicated in the Contract Documents. Advise the Consultant of any conditions that vary from this.

.2 Be familiar with structural system of the building, and the elements being demolished or dismantled. Ensure that all temporary measures of support are implemented in areas of demolition and reconstruction as noted on drawings.

.3 Inspect site and verify with Consultant items designated for removal and items to remain. Protect existing items designated to remain and materials designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Consultant and at no cost to Owner.

.4 Demolition of spray or trowel-applied asbestos can be hazardous to health. Should material resembling spray or trowel-applied asbestos be encountered in the course of demolition work stop work and notify the Consultant immediately. Do not proceed until written instructions have been received from the Consultant.

.5 Demolition of applied asbestos materials can be hazardous to health. Should material resembling asbestos be encountered in the course of demolition work, stop work and notify the Consultant immediately. Do not proceed until written instructions have been received from the Consultant.

**1.4 Extent of Demolition**

.1 Drawings showing extent of selective demolition are intended to be schematic and do not indicate full extent of all selective demolition work. Examine all Documents to determine complete scope of selective demolition, removals and re-instatement, repair and make good required to complete the Work.

**1.5 Protection**

.1 Prevent movement, settlement or damage of existing structures, services, walks, paving, trees, landscaping, adjacent grades and parts of existing building to remain.

.2 Provide bracing, shoring and underpinning as required. Make good damage caused by demolition.

.3 Take precautions to support affected structures and, if safety of building being demolished appears to be endangered, cease operations and notify Consultant.

.4 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.

.5 Provide bracing, shoring, or needling as required to support portions of existing structure or building to remain, where demolition or dismantling, cutting out, or partial removal of any elements, as specified in other Sections degrades the structural integrity of the structure to a point where it will not support all imposed loads. All bracing, shoring, and needling shall be designed to cause no damage to existing surfaces upon which the bracing, shoring or needling bears.

.6 Shoring, bracing, or needling of structural items shall be designed by a Professional Engineer registered in the Province of Ontario, and drawings shall bear the seal of this Engineer. Submit drawings of shoring, bracing, or needling to the Consultant prior to installing.

.7 Maintain temporary supports in place until permanent structure is able to fully support all imposed loads.

.8 Make good damage to existing elements to remain caused by demolition.

.9 Prevent debris from blocking surface drainage system, and obstructing mechanical and electrical systems which must remain in operation.

.10 Protect salvaged elements from damage. Provide protective coverings and storage.

**PART 2 – PRODUCTS**

Not used.

**PART 3 - EXECUTION**

**3.1 Work**

.1 Dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction and in accordance with the Specifications.

.2 Remove materials and equipment as indicated in the documents. Salvage, and store, protect, and reinstall to suit execution of other parts of the Work as indicated in the documents.

.3 Items for Demolition: Refer to drawings for specific details.
.1 Portions of existing VCT.

.2 Door and window openings in walls, overhead lintels, portions of masonry walls.
.3 Miscellaneous plumbing, mechanical and electrical items.
.4 Windows as indicated.
.5 Ceiling systems as indicated.
.6 All other elements required to allow the Work to be completed, whether specifically indicated, or not.

.4 Carefully dismantle items containing materials for salvage and stockpile salvaged materials on site at locations as indicated or as directed by Consultant.

.5 Temporarily re-route service lines entering building or on the building in accordance with authorities having jurisdiction, and to suit the Work of this Contract. Post warning signs on electrical lines and equipment that must remain energized during period of work.

.6 Do not disrupt active or energized utilities designated to remain undisturbed, without Consultant's consent.

.7 Reference the demolition of specific Mechanical and Electrical as documented in drawings and Specifications.

**3.2 Safety Code**

.1 Comply with all applicable legislation.

**3.3 Dismantling and Demolition**

.1 Do all work in a manner to prevent endangering safety of building or occupants.

.2 Selectively dismantle parts of the building as required to suit installation of new work and remedial work. Salvage and reinstall elements unless otherwise indicated. Make good disturbed surfaces.

.3 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.

.4 Do not disturb adjacent items designated to remain in place.

.5 At end of each day's work, leave work in safe condition so that no part is in danger of toppling or falling. Protect interiors of parts not to be demolished from exterior elements at all times.

.6 Demolish to minimize dusting. Keep materials wetted as directed by Consultant.

.7 Do not throw or allow debris to fall uncontrolled from heights. Use chutes and other controls.

**3.4 Restoration**

.1 Upon completion of work, remove debris, trim surfaces and leave work site clean.

.2 Reinstate areas and existing works outside areas of demolition to conditions that existed prior to commencement of work.

**End of Section**

## PART 1 - GENERAL

### .1 Description

#### .1 General Instructions

Division 1 and General Requirements are a part of this section and shall apply as if repeated here.

#### .2 Related Work Specified Elsewhere

Division 4 - Masonry
Division 9 - Floor Finishes

#### .3 Work Installed But Furnished by Other Sections

### .2 Applicable Standards

.1 All standards to be latest issue with amendments.
.2 Ontario Building Code.
.3 CSA Standard CAN3-A23.1, A23.2 and A23.3.
.4 ACI Standard 302, "Recommended Practice for Concrete Floor and Slab Contraction".
.5 ACI Standard 347, "Formwork for Structural Concrete".

### .3 Shop Drawings

.1 Examine all drawings forming a part of this contract and conform to the requirements of all such drawings.
.2 Prepare reinforcing steel placing drawings and detailed bending lists to supplement the drawings prepared by the Architect. Show sizes, position, extent, type and arrangement of bars and their steel grades. Scale of plans to be a minimum of 1:100; sections/details minimum 1:50.
.3 Submit shop drawings in accordance with the General Instructions.
.4 Do not cut or fabricate reinforcing steel material until the Engineer and Architect have reviewed and approved the shop drawings.

.5 The Engineer and Architect's review will cover the general arrangement of the reinforcing steel, but the responsibility for errors in sizes, spacings, dimensions and details shall remain with the contractor.

## .4 Coordination and Cooperation

.1 Coordinate the work of this section with the General Contractor's scheduling in accordance with the General Instructions.
.2 Coordinate the work of this section with the work of other sections and advise other trades when materials to be built into concrete will be required.
.3 Install any items furnished by others, miscellaneous iron work, anchors, anchor bolts, pipe sleeves, etc., that are to be built into any part of the concrete work. Form all holes and openings required to accommodate the work of other trades.
.4 Make good all openings left in construction around pipes, pockets for anchorages, etc., for other trades for where existing concrete must be broken out.
.5 Examine Mechanical/Electrical drawings for housekeeping pads, inertia slabs and bases.

## .5 Design and Detailing Criteria

.1 Formwork - in accordance with CAN3-A23.1 and the recommendations of A.C.I. Standard 347.
.2 Concrete - design concrete mixes for the compressive strengths, workability requirements, etc., specified in Article 2.2 of this section in accordance with CAN3-A23.1. Submit mix designs for the review of the consultant, if requested, prior to commencement of construction.
.3 Reinforcing - detail all reinforcing bends, hooks, splices, and anchorages in accordance with CAN3-A23.1 and the standards of the Reinforcing Steel Institute of Ontario.
.4 Shoring of the composite metal floor deck will not be required.

## PART 2 - PRODUCTS

### .1 Materials

.1 Cement - in accordance with CSA Standard CAN3-A5, "Portland Cement", Type 10. Consultant approved cementitious substitutes permitted to a maximum of 10% of the total cement mass.

.2 Aggregates
  .1 Fine and coarse aggregate materials and grading in accordance with Section 5 of CSA Standard CAN3-A23.1.

.3 Reinforcing Steel - new deformed bars in accordance with CSA Standard G30.8, G30.12-M or G30.13 with a guaranteed yield stress of 400 MPa. (58,000 psi.)

.4 Welded Wire Fabric - in accordance with CSA Standard G30.5-1967. Supply in sheets only.

.5 Concrete Admixtures - type 1, water reducing admixtures currently approved for use by the Ontario Ministry of Transport in accordance with O.P.S.S. Form 1303, "Material Specification for Air Entraining Agents and Chemical Admixtures".

.6 Premoulded Filler - 10 mm thick, asphalt impregnated Flexcell as manufactured by G.F. Sternson or approved equal.

.7 Spray-Applied Membrane - in accordance with ASTM Standard C309, Type 1, Class B - VOCOMP-20 by Meadows.

.8 Vapour Barrier - 10 mil polyethylene to CAN/CGSB 51.34.

.9 Floor Sealer - 1 part moisture-cured (non-staining) acrylic - VOCOMP-25 by Meadows.

.10 Grout - non-ferrous, non-shrink grout.

.11 Superplasticizer - Melment by Sternson or Conchem S.P.N.

.12 Circular Column Forms - fibre glass without spiral pattern. Steel forms are not acceptable for this project.

.13 Carborundum Grits - 8/16 (rice size) grits.

.14 Non-Metallic Integral Hardener - pre-mixed Colorcron by Master Builders (colours to be selected later).

.15 Plywood - in accordance with CSA A23.1.

.16 Form Ties - for general wall areas, removable snap-off metal ties that, after removal of forms, no metal is within 25 mm of the finished surface.

.17 Structural steel support angles. – Pre-manufactured galvanized steel support shelf angles as detailed on drawings

### .2 Concrete Mixes

.1 Job-mixed concrete will not be allowed on this project.

.2 Provide mixed-in transit, ready-mixed concrete in accordance with

CSA Standard CAN3-A23.1 obtained from a supplier approved by the Engineer for use on this project.

.3 Mix all concrete with materials so graded and proportioned produce a plastic mass of such consistency that it will flow slowly under its own weight and which can be readily worked into corners of forms and under and around reinforcing without forming voids or honeycombed surfaces.

.4 Furnish to the contractor, a 'delivery ticket' for each batch of concrete delivered to the site, which shall be kept on record for the inspection of the Engineer. Each ticket shall show the following.

.1 Date and truck number.
.2 Contractor's name.
.3 Job designation.
.4 Specified concrete strength, slump, air content and admixture.
.5 Batch volume.
.6 Time of batching.

.5 Proportion the materials in accordance with the mix designs supplied under Article 1.7 of this section to provide the following specified design strengths and slumps.

| MIX LOCATION | SPECIFIED 28 DAY COMPRESSIVE STRENGTH MPa. | SLUMP (m.m.) | ENTRAINED AIR |
|---|---|---|---|
| Lean Fill | 15 | 125 | nil |
| Footings, Interior Walls and Piers | 25 | 75 ± 25 | nil |
| Interior Slabs, Slabs-on-Deck | 25 | 75 ± 25 | nil |
| Exterior Slabs, Piers, Ramps and Perimeter Foundation Walls | 30 | 75 ± 25 | 6% ± 1% |

.6 Fine and coarse aggregate grading in accordance with CSA Standard CAN3-A23.1-M77.

.7 Chemical admixtures if used shall be used in strict accordance with the manufacturer's directions. The use of calcium chloride or any other type of accelerating chemical admixture will not be allowed.

.8 Note that the required average compressive strength must be greater than the specified compressive strength to allow for the appropriate standard deviation of the particular batch plant.

### .3 Fabrication of Reinforcing Steel

.1 All reinforcing steel shall be provided and bent by a supplier approved by the Engineer.

.2 Fabrication of bends, hooks and other shapes in accordance with CSA Standard CAN3-A23.3-M and the Reinforcing Steel Institute of Ontario Standards.

.3 Fabrication and detailing of splices and laps in accordance with CSA Standard CAN3-A23.3-M for the appropriate specified yield strengths except that all lapped splices in welded wire fabric shall be lapped on full mesh plus 50 mm.

### .4 Quality Control

.1 Provide such samples of materials and mill test reports as may be required by the Architect at no cost to the Owner.

## PART 3 - EXECUTION

### .1 Examination

.1 Examine and obtain all necessary measurements of previously executed work which may affect the work of this section prior to commencing operations.

.2 Report any discovered discrepancies to the Architect so that instructions can be given for the necessary remedial action.

### .2 Workmanship

#### .1 Formwork

.1 Construct all forms to have sufficient strength, stability and rigidity to prevent bulging or deflection under the liquid weight of concrete and to support in addition, all construction loads to which they may be subjected.

.2 Erect forms to the lines, dimensions and elevations shown on the drawings such that the completed work is within the tolerance limits for reinforced concrete buildings in accordance with ACI Standard 347. Note that dimensional tolerances for anchor bolt locations is more restrictive. Conform to erection diagrams and CISC Code of Standard Practice.

.3 Immediately prior to concreting, inspect all forms to ensure that they are properly placed, sufficiently rigid and tight, thoroughly clean, properly treated and free from snow, ice, or other foreign materials.

.4 Provide for all openings, offsets, risers, brackets, haunches, depressions and curbs as shown or required in the formwork.

.5 For interior columns exposed to view in the completed structure, horizontal construction joints are to be at least 2800 above the floor. For exterior columns, no horizontal construction joints are to be visible in the completed structure. For exposed circular columns, forms must not leave spiral appearance.

.6 For typical wall surfaces, arrange form ties such that after removal of the forms, no metal is within 25 of the finished surface.

.7 Clean forms of all debris prior to concreting. Provide temporary openings at the base of walls, column forms and at other locations where necessary to facilitate cleaning and inspection. Place openings so that 'wash water' will have a clear run to the outside of the forms.

.8 Provide 25 x 25 chamfers on all corners of concrete, exposed to view in the finished structure.

.9 Coat forms with a non-staining mineral oil prior to the placing of reinforcing steel in accordance with CSA Standard CAN3-A23.1. Where concrete surfaces are to receive a final coat of paint, plaster, etc., omit the form oil and wet down the forms just prior to concreting.

.10 Place <u>continuous</u> dovetail anchor slots (supplied by Division 4) as required to support the ends of abutting masonry walls and vertically at 6000 o.c. (maximum) on concrete surfaces which are faced with masonry, including walls and column faces.

.11 Place anchors required for the support of mechanical or electrical equipment, structural steel, and miscellaneous iron which is to be cast into the concrete as supplied by other Divisions.

.12 Place continuous pre-manufactured Galvanized steel support shelf angles as detailed on drawings. Anchor steel tails to reinforcing steel to prevent rotation during pours.

.13 Immediately prior to concreting, inspect all forms to ensure that they are properly placed, sufficiently rigid and tight, thoroughly clean, properly treated and free of snow, ice or other foreign materials. Do not use chemicals for snow/ice control.

.14 Composite steel deck will not require shoring.

.15 Formwork approved for concreting shall be properly protected until concrete is placed.

.16 Exercise particular care in stripping the tops of foundation walls and piers to avoid chipping, spalling, or gouging of concrete edges.

.17 Stripping of forms shall be in accordance with Section 11 of CSA Standard CAN3-A23.1 and subject to the approval of the Consultant.

## .2 Reinforcing Steel

.1 Placing, spacing, splicing and protection of reinforcement in accordance with CSA Standard CAN3-A23.3

.2 Maintain the cover required for reinforcement as shown on the drawings. Where not specifically shown, refer to CSA Standard CAN3-A23.1

.3 Supply and install 100 x 100 x 75 brick chairs for the support of reinforcing in slabs-on-grade of a type and in a manner which will not puncture the vapour barrier. Space chairs 1200 on centre each way. Lap welded wire fabric at least one mesh plus 50 mm at all splices.

## .3 Vapour Barrier

.1 After all subgrade work is complete and approved, place vapour barrier for slabs on grade.

.2 Lap sheeting minimum 150 at all joints and turn up at perimeter walls and piers 100 min.

## .4 Concrete Placing

.1 All conveying, depositing and compaction of concrete in accordance with CSA Standard CAN3-A23.1-M.

.2 Maximum elapse of time between mixing and placing shall not exceed 1 1/2 hours. In hot weather, this time period may be reduced, or the use of a retarding admixture may be authorized by the Consultant to ensure satisfactory concreting.

.3 Thoroughly compact all concrete during placing by the use of electrical internal vibrators to be a type and design approved by the Engineer to ensure that the finished concrete is free of voids or other defects.

.4 Maintain sufficient vibrators on site to keep pace with the rate of pouring but in any case, not less than two shall be available at the site for any pour.

.5 Carefully concrete in all piping, sleeves, conduits, etc., furnished by the Mechanical and Electrical trades.

.6 Where concrete is placed on a membrane vapour barrier, take any necessary precautions to ensure that the membrane is not damaged by screeding, reinforcing or concreting operations. Place concrete for slab-on-grade from buggies properly supported on runways and not run directly on the reinforcing and/or membrane.

.7 Strike off floor surfaces at the level shown on the drawings by means of previously set, continuous pipe screeding, set on adequate supports.

.8 Notify the Engineer at least 24 hours in advance of any scheduled pour so that reinforcing and forms may be reviewed as determined by the Engineer.

.9 Ensure that reinforcement, inserts, etc., are not disturbed during concrete placement.

## .5 Concrete Protection and Curing

.1 Protection and curing of concrete in accordance with Section 21 of CSA Standard CAN-A23.1. Note that wet curing of all elements is required for a period of 7 days or until the concrete reaches the design strength.

.2 Maintain all equipment and materials for the protection and curing of concrete on site, ready to use before concrete placing is started.

.3 Completely cover slabs with 4 mil polyethylene sheeting, properly lapped at side and edge laps and weighted down.

.4 A sprayed-on membrane curing compound may be used for surfaces listed under paragraph 3 in lieu of polyethylene sheeting for concrete poured between April 1 and October 14. Sprayed-on curing compounds must be of a type which will not affect the adhesive of flooring materials and must be approved for use by the Engineer. Apply in strict accordance with the manufacturer's directions.

.6 **Cold Weather Requirements**

.1 All concreting operations during cold weather in accordance with Section 21 of CSA Standard CAN3-A23.1.

.2 Remove and replace all concrete damaged by frost or freezing at the direction of the Engineer at no cost to the Owner.

.3 Accelerating chemical admixtures or calcium chloride shall **not** be used.

.7 **Hot Weather Concreting**

.1 All concreting operations during hot weather in accordance with Section 21 of CSA Standard CAN3-A23.1.

.2 The use of a water reducing-retarding chemical admixture in the concrete mix may be required at the Engineer's discretion.

.3 **Finishing of Horizontal Surfaces**

.1 **Floors**

.1 Refer to ACI Standard 302 for recommended procedures for concrete floor and slab construction and finishing and to ACI Standard 301, Specification for Structural Concrete. Maintain surface tolerances in accordance with Section 11.9 of that ACI 301 for Class A tolerance.

.2 Concrete floors which are to receive carpet, resilient flooring, mosaic tile, or be left exposed shall be steel floated with a disc type power floating machine, have a 600 mm disc, and weighing at least 135 kg. Continue the floating operation until sufficient moisture is brought to the surface to fill all voids. After floating when the floor has hardened sufficiently so that excess fines will be brought to the surface, trowel with a steel trowel to a surface free of all pin holes. The floor must not be used for seven (7) days after completion of trowelling, and only light use shall be permitted for an additional seven (7) days.

.3 Concrete floors shall be sloped where required to floor drains at 1:50 and/or as directed by the ARCHITECT.

.4 Concrete floor areas designated in the room schedule to be left exposed shall be finished as per Items 2 and 3 above with the addition of a factory pre-mixed non-metallic hardener. Apply in two separate shakes in strict accordance with the manufacturer's instructions for a combined application of 3.5 kg/m². Following finishing operations, apply unthinned

sprayed-on curing and sealing compound in strict accordance with the manufacturer's instructions. Just prior to turn-over, clean these areas and apply one coat of compatible floor sealer in strict accordance with the manufacturer's instructions.

.5 Exposed concrete stairs and slabs shall receive two 1.3 kg/m² "shakes" of carborundum grits in accordance with the manufacturer's directions, followed by a light broom finish to provide a neat, non-slip surface.

## .4 Construction Joints

.1 Construction joints shall only be placed in locations approved by the Engineer or as shown on the drawings.

.2 Construction joints shall be keyed and dowelled to the adjoining pour as detailed on the drawings.

.3 Before placing adjoining concrete at construction joints, clean the existing surface of dirt, laitance and loose aggregate.

## .5 Isolation Joints

.1 Provide asphalt-impregnated fibreboard as follows:

.1 At locations shown and noted on the drawings.

.2 Isolation joints in the walls shall be as shown on the drawings.

## .6 Control Joints

.1 Provide control joints as follows:

.1 Where shown and noted on the drawings in walls and in floor slabs. Control joints in floor slabs shall be sawcut to the depth shown as soon after placing the concrete as the surface will allow without chipping but not later than 24 hours after placing.

.2 In general, control joints will be required in foundation walls, approximately 3000 each way from corners and intersections, and spaced not further than 9,000.

## .7 Corrections and Remedial Work

.1 The contractor will immediately correct by remedial work or replacement of the work, any items which do not conform with the Contract Documents or which are not within the specified dimensional tolerances.

.8 **Field Quality Control**

.1 All materials and workmanship shall be subject to test and inspection by a testing and inspection company appointed by the Architect.

.2 The cost of all inspection and testing except as noted hereafter will be paid for by the Owner in accordance with the General Conditions.

.3 Provide unhindered access to the project for the purposes of inspection and testing. Provide storage space and the necessary protection for test specimens against damage or loss while on site.

.4 Provide representative samples of the materials as required by the testing and inspection company at no cost to the Owner.

.5 All field tests for concrete quality and all criteria relating to failure to meet test requirements in accordance with CSA Standard CAN3-A23.1, Section 17, except as follows:

.1 Each test shall consist of three standard cylinders accompanied by a slump test and measurement of air content (where applicable). Unless otherwise directed by the Engineer, one cylinder shall be tested in 7 days and the remaining two at 28 days.

.2 The inspection company shall take concrete tests for:

.1 Not less than one test for each class of concrete placed each day, and

.2 Not less than one test for each 100 yards or portion thereof placed in any day.

.6 The cost of any additional testing and/or the cost of replacement of any part of the structure, resulting from failure of the concrete to meet the test requirements shall be borne by the contractor.

.7 Notify the testing company of the pouring schedule sufficiently in advance so that tests may be made.

.9 **Clean-up**

.1 At the completion of the work of this section, remove any excess materials, debris and equipment from the site.

**End of Section**

## PART 1 – GENERAL

.1 **Description**

.1 **General Requirements**

Division 1 and General Requirements, is a part of this Section and shall apply as if repeated here.

.2 **Work Performed by Other Sections Related to This Section**

Section 03300: Concrete grout

.3 **Work Specified by This Section Performed by Other Sections**

Section 04200: Unit Masonry

.2 **Quality Assurance**

.1 **Requirements of Regulatory Agencies:**

Modify requirements of the Specifications only as jurisdictional authorities may direct.

.3 **References**

.1 **Reference Standards**

ASTM C207, Specification for Hydrated Lime.
ASTM C270, Specification for Unit Masonry.
CAN/CSA-A5/A8/A362-M88, Portland Cements.
CAN3-A371-M84, Masonry Construction for Buildings.
CAN3-S304-M84, Masonry Design for Buildings.
CSA Standard A82.30-M1980, Interior Furring, Lathing and Gypsum Plastering.
CSA Standard A179-94, Aggregate for Masonry Mortar.
CSA Standard A179-94, Mortar and Grout for Unit Masonry.

.4 **Submittals**

.1 **Affidavits**

Submit to Architect affidavits of an inspection company that mortar materials conform to requirements of the Specifications, if requested.

.5 **Delivery, Storage and Handling**

.1 Handle and store cementitious materials protected against moisture.
.2 Handle and store all mortar materials to prevent contamination by foreign materials, and damage by freezing or excessively high temperatures.

.6 **Site Conditions**

.1 Environmental Requirements:
When air temperature is less than 5 °C, mix mortar as specified in the applicable reference standard.

.2 When outside temperature is below or likely to drop below 4°C the temperature of materials and surrounding air shall be heated to maintain at least 10°C during period of laying and for 72 hours thereafter. Submit for approval methods for protecting masonry against low temperatures. Do not add salt or anti-freeze to mortar to lower freezing point. Work to be executed in enclosure heated by smokeless means when temperature drops below -1°C.

## PART 2 - PRODUCTS

.1 **Materials**

.1 Use materials only as specified in CSA Standard A179 referenced from CAN/CSA-A371-M84 and CAN/CSA-S304-M84. Ensure that water and aggregate used in mortar, other than in walls buried in earth, will cause no efflorescence.

.2 **Cement:**
Portland Cement; Type 10, to meet specified requirements of CAN/CSA A5-M83.

.3 **Sand Aggregate**

.1 **For Normal Mixes**
A clean, masonry type, free of iron compounds in accordance with CSA A179-94, not less than 100% passing a No.8 sieve.

.4 **Lime**
A Dolomitic lime, Type S conforming to ASTM C207 and CSA Standard A179-94.

.5 **Water**
Verify that water used contains no salts to cause efflorescence.

.6 **Mortar Colouring**

.1 Lime and alkali-proof, non-fading, mineral oxide pigments manufactured especially for mortar use.

.2 For "white" mortar, use Federal White.

.7 **Non-Shrink Grout**
Embeco Pre-mixed Grout as manufactured by The Master Builders Company, or In Pakt as manufactured by C.C. Chemicals Limited, or Tartan Grout by Webster & Sons Ltd.,V1,2 or3 manufactured by W.R. Meadows .

.2 **Mixes**

.1 Mix mortars as specified in CSA Standard A179. Use only dry aggregate. Test for bulking to determine accurate proportioning.

.2 Only pre-mixed portland cement/lime mortar mixes will be acceptable for this Project. Materials may be pre-bagged or shipped in bulk containers.

.3 Acceptable suppliers shall include "Betomix Plus by Daubois Inc.", "Mega Mix Canada" by Macdonald Aggregates Inc., “Jiffy Mortar Systems “ by Jiffy Concrete Products, “Maxi-Mix “ dry pre-blended mortar system by Maxi-Mix Corp., or an approved alternative.

.4 Use grey mortar unless otherwise specified.

.5 **Match colour of mortar to existing concrete masonry units where exposed to view by incorporation of suitable cement and aggregate and colouring.**

.6 At glass unit masonry blocks, use "super" white sand and Federal White.

.7 Limit quantity of mortar colour to following percentages of cement content by weight.
: 15% for mineral oxides
: 3% for carbon black.

.8 Concrete Grout: (for reinforced masonry)
Mix one part portland cement with three parts sand with water.

## PART 3 - EXECUTION

### .1 Preparation

#### .1 Protection

Provide waterproof protection over construction surfaces at mixing areas to prevent deposit on them of mortar and mortar materials.

### .2 Mortar Types

.1 For laying masonry use portland cement/lime mortar types as follows:
: "M" in masonry walls in contract with earth.
: "S" for exterior masonry veneer including load-bearing back-up block.
: "N" unless otherwise specified.

**End of Section**

## PART 1 - GENERAL

.1 **Description**

.1 **General Requirements**

Division 1 and General Requirements, is a part of this Section and shall apply as if repeated here.

.2 **Work Performed by Other Sections Related to This Section**

Section 07920: Caulking and Sealants
Section 09250: Gypsum board closers at steel joists.
Section 09900: Painting and Finishing

.3 **Supply of Work Installed by This Section but Specified Elsewhere**

Section 03300: To furnish reinforcing steel for masonry lintels and reinforced masonry walls
Section 05120: To furnish bearing plates
Section 05120: To furnish masonry anchors attached to steel structure
Section 05120: To furnish loose lintels

Masonry inserts and attachment devices to support the installations of other Sections, frames, and miscellaneous metal work.

.4 **Performance of Work Included in This Section, Specified in Other Sections**

Section 04100: Mortar

.2 **System Description**

.1 **Tolerances**

Lay masonry to tolerances specified in CAN/CSA-A371-M84 and:

.1 Level within 6 mm in any bay or 6m maximum distance, and 13 mm in 12 m or more.
.2 Located from position shown, and from related position of columns, walls and partitions within 13 mm in any bay or 6 m maximum distance, and 19 mm in 12 m or more.
.3 Opening sizes within 6 mm of designated dimension.
.4 Columns and wall cross-section dimensions within minus 6 mm and plus 13 mm.
.5 With joints to dimensions indicated, but in no case greater than 13 mm.

.3 **Quality Assurance**

.1 **Requirements of Regulatory Agencies**

.1 Construct masonry as required by jurisdictional authorities.
.2 Before commencing masonry work, verify that site conditions will allow construction of masonry within required limitations for wall heights, wall thicknesses, openings, bond, anchorage, lateral support, and compressive strengths of masonry units and mortars.

.3 Construct masonry fire rated assemblies, which are validated by ULI, ULC, or NRC fire tests, in complete accordance with the test design specification. Fire rated assemblies constructed otherwise shall be approved only on presentation of affidavits that they are acceptable to the authorities having jurisdiction.

.4 **References**

.1 **Reference Standards**

.1 Conform to CAN3-S304-M84 for Masonry Design and CAN3-A370-M84 and CAN3-A371-M84 for Masonry Construction specified in this Section.

.2 Reference standards quoted in Contract Documents refer to:
ASTM A116-81, Specification for Zinc Coated (Galvanized) Iron or Steel Farm-Field and Railway Right-of-Way Wire Fencing.
ASTM A153-80, Specification for Zinc-Coating (Hot-Dip) on Iron and Steel Hardware.
CGSB Specification 1-GP-109M, Paint, Acid and Alkali Resistant, Black.
CAN3-A165 Series-M85, Concrete Masonry Units
CAN3-A370-M84, Connectors for Masonry.
CAN3-A371-M84, Masonry Construction for Buildings.
CSA Standard G30.12-M1977, Billet-Steel Bars for Concrete Reinforcement.
CAN/CSA-S304-M84, Masonry Design for Buildings.
CSA Standard G42-1962, Galvanized (Zinc-coated) Steel Farm-Field Wire Fencing
CAN/CSA-G164-M92, Hot Dipped Galvanizing of Irregularly Shaped Articles.

.5 **Submittals**

.1 **Shop Drawings**

Submit shop drawings of masonry reinforcement.

.2 **Samples**

Submit samples of each type of masonry unit specified, and of accessories, if requested.

.6 **Delivery, Storage, and Handling**

.1 Isolate masonry units from contact with ground and other materials until laid, to prevent staining.
.2 Ensure that moisture content of concrete masonry units is maintained within specified limits from time of shipment from plant to time of installation.
.3 Cover masonry unit stockpiles while stored to prevent exposure to weather. Keep water out of all holes and reglets in units during freezing weather.
.4 Handle and store masonry units to prevent soiling and chipping.
.5 Deliver products to the place on site as directed, and to meet installation schedule.

.7 **Environmental Conditions**

.1 **Environmental Requirements**

.1 When outside temperature is below or likely to drop below 4°C, materials and surrounding air shall be heated to maintain at least 10°C during period of laying and for 72 hrs. thereafter. Submit for approval methods for protecting masonry against low temperatures. All masonry units must be free from frost. Work to be executed in enclosure heated by smokeless means when temperature drops below 1°C.

.2 Do not lay masonry units when air temperature is below -1° C.

.3 Do not lay masonry during rain unless work is protected by sufficient enclosure.

.4 Protect new masonry work from direct rays of sun to prevent fast drying and shrinkage.

.5 Protect tops of all unfinished walls with weatherproof coverings at the end of each day's work, or upon stoppage of the work for any reason, or during rain, snow or sleet.

.6 When air temperature is above 38 deg. C, or 32 deg. C with wind velocity greater than 13 km/hour, the spread of mortar beds shall be limited to 1200 mm and the masonry units shall be set within 1 minute of spreading the mortar.

## PART 2 - PRODUCTS

.1 **Materials**

.1 Meet specified requirements of CAN/CSA-A370-M84 and CAN/CSA-A371-M84 for materials unless specified otherwise.

.2 **Damp-proof Flashing**

Polyvinyl chloride flexible flashing membrane, 20mil thick, black; Rodoply by Sternson or Sealtight Flexguard by W.R. Meadows.

.3 **Damp-proofing Flashing Lap Cement**

To meet specified requirements of flashing manufacturer.

.4 **Joint Packing at Walls**

.1 Expansion Joint Packing: Glass fibre insulation, rigid board, density of 48 kg/cu.m.

.5 **Joint Reinforcement**

.1 For Single Wythe Walls: Minimum 3.8 mm dia. side and cross rods, welded steel rod, galvanized, ladder design, DW 200 Dur-O-Wal Laudur by Dur-O-Wal Ltd. or Blok-Lok BL 10 ladder design by Blok-Lok Limited.

.2 For Combination (Double Wythe) Solid Walls: 5 mm side and cross rods, welded steel rod, galvanized, ladder design, 4 wire, DW 220 Type by Dur-O-Wal ltd., Blok-Lok BL 32 by Blok-Lok Limited.

.3 For Cavity Walls: Interior wythe shall be single wythe ladder type; hot dipped galvanized.
Exterior wythe shall be "Fero's" Block Shear Assembly. Shear connector plate shall be stainless steel: extruded polyethylene insulation support: Stainless Steel Vee-Tie. Spacing shall be 600 mm vertical and 800 mm horizontal. Fero Block Shear Anchor may be replaced with approval.

.4 For Masonry at Steel Columns: 5.21 mm diameter wire with 1.19 mm

diameter wire and 10 mm x 10 mm openings.

.5 For Type A and B masonry, use stainless steel joint reinforcement. For exterior masonry use stainless steel reinforcement. For interior use mill galvanized.

.6 Brick Wythe with Metal Stud framing. Bailey Brick Connector ESS-2 with Triangle V Stainless Steel wire min 3/16" diameter. (or approved equal.)

.6 **Dovetail Anchor**

25.5 mm x 2 mm steel dovetail anchor, galvanized, with end crimped and bent.

.7 **Dovetail Anchor Slots**

Fabricated of minimum .55 mm metal, galvanized after fabrication, minimum 27 mm depth, with cellular foam filler; by Richmond Acryo or "Beehive".

.8 **Flexible Anchor**

To suit conditions and to allow for differential movement between the structure and masonry. Flex-O-Lok or Column-Lok by Blok-Lok Limited or similar anchor by Duro-O-Wal Ltd. of size and type to suit conditions and adequately anchor masonry.

.9 **Weep Holes**

DA 1069 Cell vent by Dur-O-Wal Ltd. or Weephole Ventilator by Blok-Lok Limited.

.10 **Cavity Sealer**

Closed cell Neoprene, or Ethofoam polystyrene by Dow Chemical of Canada Limited, continuous strip to fit tightly between inner and outer wythes of wall.

.11 **Sheet Metal**

.1 Expansion Joint: 0.55 mm thick cold rolled copper to meet specified requirements of ASTM Specification B370, formed with 63.5 mm deep bellows and 75 mm wide flanges with hemmed or offset edges to form anchorage in mortar joint.

.2 Through Wall Flashing Support: 0.55 mm thick cold rolled copper to meet specified requirements of ASTM Specification B370, formed with 75 mm wide flanges with hemmed or offset edges to form anchorage in mortar joint.

.12 **Through Wall Flashing**

.1 Polyvinyl chloride flexible membrane, 20 mil thick, black; Rodoply by Sternson or Sealtight Flexguard by W.R. Meadows.

.13 **Bituminous Paint**

.1 To meet specified requirements of CSGB Specification 1-GP-108.

.14 **Concrete Masonry Units**

.1 To meet specified requirements of CSA Standard A165-M83.

.2 Include all special shapes, such as end, bond, sash groove and lintel units, required for complete masonry installation indicated on Drawings. Use bullnose corner block at all door jambs, vertical external corners and where otherwise indicated on Drawings.

.3 For the purposes of this project, the mason is to source **American Imperial Unit** sizes for continuation and infill of existing adjacent conditions and **Metric Modular Units** for new construction. Coordinate with architect in advance if there is question.
.4 Provide 100% solid units where required by jurisdictional authorities.
.5 Moisture controlled ("M") units as approved by Architect.
.6 **Lightweight Units**
Of slag aggregate manufacture. For use in all exposed partitions and exterior wall backup.
Hollow Units: H/7.5/C/M
Solid Units: S/15/A/M
American Imperial and Metric as indicated in .3
Colour: Grey

.7 **Face Block Units**
**CMU 1** : Standard Smooth Face to match existing block in texture density and Colour.

.15 **Architectural Masonry Units**

**BR-1**
Existing to be reused or match existing if available.

.16 **Precast Concrete Sill Unit**

Provide new precast sill unit to match existing adjacent sill units.

## PART 3 - EXECUTION

### .1 Preparation

#### .1 Shelf Angles

Install shelf angles supplied by Sections 05100 and 05500. Level, adjust and secure angles permanently in place.

#### .2 Protection

.1 Cover exposed tops of masonry walls when laying is not in progress and until protected by completed construction. Cover with non-staining waterproof material to overhang top edges of wall by 600 mm minimum and secured to prevent dislodgement.
.2 Protect exposed external corners of masonry with materials which will not damage or soil finished surfaces.
.3 Protect all finished surfaces from mortar droppings.
.4 Take particular care to protect faces of concrete unit masonry from mortar droppings and smears as laying proceeds.
.5 Turn over or cover scaffolds and mortar board at completion of each day's work to avoid staining of finished surfaces by splashed rain.

### .2 Laying Masonry

.1 Lay masonry to meet specified requirements of CAN/CSA-A370-M84 and CAN/CSA-A371-M84, unless otherwise specified.
.2 Lay masonry as shown on Drawings, and to minimize cutting of units.
.3 Coordinate coursing of dissimilar sized units only as approved by Architect.
.4 Use only dry and unfrozen materials.

.5 Remove sections of masonry which have been frozen before laying of masonry continues.

.6 Lay masonry in running bond with vertical joints of alternate courses in line and as indicated on drawings.

.7 Align webs of concrete unit masonry vertically and with thick ends on top.

.8 **Joints**

.1 Make joints of uniform thickness with vertical joints from course to course maintained plumb.

.2 Provide full bed and head joints for shear walls.

.3 When laying is resumed on walls previously laid with mortar either partially or totally set, remove loose units and mortar from top and adjoining surfaces. Remove mortar completely when masonry is removed and replaced with new.

.4 Form tooled concave joints wherever exposed to view, whether behind cabinets, fitments, and wall accessories, or not. When mortar has become "thumb-print" hard, tool joints and clean off burrs with trowel or burlap. Use a tool with a bearing surface of 550 mm minimum length on horizontal joints to avoid uneven depressions.

.5 Trowel point joints in unparged masonry in contract with earth.

.6 Rake out joints of masonry exposed to view to provide for caulking:
: at juncture of interior and exterior walls with columns.
: at interior with exterior walls.
: intersections of walls and partitions where joint reinforcement is installed.
: at caulked joints where indicated typically.

.7 Cut joints off flush where thin-set tile will be applied, and where treatment is not otherwise specified.

.8 Ensure that no mortar protrudes from joints on wall surfaces to which insulation vapour retarder or air barrier will be applied.

.9 Stop off horizontal runs of walls by racking back 1/2 unit in each horizontal course; do not tooth.

.10 Wet clay masonry units before placing. Wet faces of masonry in place before laying new masonry. Ensure that units have no water adhering to their surfaces when laid; but shall be wet only to ensure that complete hydration takes place during hot drying weather, and when unit absorption rates are greater than 0.11 ml/sq.cm/minute, so that the initial rate of absorption does not exceed above rate when laid.

.11 Do not wet concrete units or existing brick units.

.12 Distribute masonry units of varying colours and textures to avoid spotty appearance over wall surfaces exposed to view. Do not use units which contrast too greatly with overall range.

.13 Use chipped and blemished concrete or brick units only where concealed. Do not use defective or broken units. Do not lay concrete units with markedly smooth face that will appear slick where exposed to view, whether painted or not.

.14 Maintain continuous walls/piers bracing during construction until structure provides support.

.15 **Lintels**

Build in lintels supplied by Section 05100. Set and level lintels on a bed of mortar.

.16 **Built In Items**

.1 Verify that built-in items specified in other Sections are available for building in before laying of masonry commences. Cooperate in the setting and aligning of built-in items and provide for later installation of items which are installed by other Sections, to avoid cutting, fitting, and patching.

.2 Build masonry around pressed steel door frames supplied and set as specified in other Sections. Ensure that anchors are well secured and that frames are true and plumb. Completely fill frames with mortar as each course is laid. Maintain protective frame covering and ensure that no mortar is left on frame faces.

.3 All structural steel columns which require masonry shall be built in solid with masonry.

.17 Cope, cut and split concrete masonry units and brick with power driven abrasive discs. Cut units wherever electrical outlets, grilles, and pipes occur. Allow 3.2 mm clearance around items which are incorporated in walls.

.18 Do not expose open cells, cores or frogs of masonry units to view.

.19 Flush surface smooth with mortar masonry against which flashing rests to ensure that it is not punctured.

.20 Extend all walls and partitions to underside of deck, slab or structural members, as applicable, except where otherwise noted on Drawings. Incorporate both lateral support and deflection space at termination of walls as required by this Section. Use 90 mm min. block to extend by steel joists and beams to deck. If 90 mm block cannot bypass steel terminate wall at underside of steel.

.21 **Bonding**

Where bond pattern is indicated on Drawings use masonry bonding, or clip headers and install metal bond anchors.

.22 **Masonry Anchorage**

.1 Use dovetail anchors for slots at concrete construction.

.2 Use flexible anchors at steel structure.

.3 Build masonry tight to faces of structural members or as indicated on Drawings.

.4 Bed anchors solidly in mortar joints.

.5 Coordinate with Section 03300 to ensure that dovetail anchor slots in concrete are located correctly. Assist in their installation if requested.

.23 **Lateral Support**

.1 Lateral support clips are specified in Section 05500.

.2 Coordinate with Section 05500 to ensure that lateral supports are located correctly. Assist in their installation if requested.

.24 **Joint Reinforcement**

.1 Install joint reinforcement in:

: solid walls and partitions, including foundation walls, constructed of concrete masonry units.

: single wythes of concrete masonry units in cavity walls.

: single wythe concrete masonry walls and partitions.

: Combination solid walls and partitions incorporating concrete masonry unit backup.

: single wythes of brick masonry in exterior cavity walls.

.2 Place reinforcement continuously in horizontal joints at 400 mm o.c., beginning with course 400 mm above bearing, unless otherwise specified or indicated.

.3 Place reinforcement additionally in courses 200 mm, 400 mm and 800 mm above and below openings, and extending 600 mm beyond jambs of openings.

.4 Where changes in wall thickness occur, extend reinforcement of lesser width 450 mm beyond changes of width.

.5 Lap reinforcement a minimum of 150 mm at splices.

.6 Do not run reinforcement through control or expansion joints.

.7 Wherever walls and partitions intersect one another, or each other, continue reinforcement through. Do not carry reinforcement through intersections where lateral support anchors are installed or at intersections of walls and partitions with solid piers.

.8 At masonry cladding for protected steel columns, lay specified reinforcement at every second course. Ensure that reinforcing is lapped to wall reinforcement and columns ties at least 150 mm.

.25 **Deflection Space**

.1 Incorporate a deflection space between tops of non load bearing walls and partitions and structure to prevent transference of structural loads to masonry.

.2 Fill deflection space with glass fibre board compressed to 50% of original thickness to completely seal space.

.3 Coordinate laying of masonry with installation of lateral support specified in this Section and as provided by Section 05500.

.26 **Cavity Walls**

.1 Bond cavity wall wythes with joint reinforcement.

.2 Where exterior walls change direction, fill cavity solid with cavity sealer for full height of wall. Set sealer in mortar bed and butter with mortar in contact with masonry wythe which is laid later. Install cavity sealer to ensure that it is secured in place and that it completely separates one cavity space form another by an airtight seal.

.3 Keep cavity space completely free of mortar. Keep space free by drawing up a wood board the width of the cavity as masonry is laid. Alternatively, omit masonry units in bottom course at approximately 1 m.o.c. to provide access holes for visual inspection of bottom of cavity after wall has been completed. If inspection reveals an accumulation of mortar droppings, clean out cavity through access holes. Install omitted masonry units with joints filled with mortar when approval is given that cavity space is clear of mortar.

.4 Install weep holes in vertical joints at 600 mm o.c. in courses immediately above flashings, or at bottom of cavities, or as otherwise may be suitable to ensure that weep holes provide drainage of the cavity space.

.27 **Through Wall Flashings**

.1 Install flashing at locations indicated on Drawings.

.2 Place flashing over sheet metal for support.

.2 Coat surface of flashing in contact with masonry with two coats of adhesive.

.3 Lap joints between lengths of flashing a minimum of 100 mm and seal with adhesive.

.28 **Penetration of Masonry**

.1 Fill voids of masonry to within 19 mm of structural members, pipes, ducts and conduit that penetrate masonry walls and partitions, unless otherwise indicated.

.2 Keep masonry units similarly clear of such penetrations.

.3 Finish mortar smooth at face of masonry.

.4 Pack remainder of annular void surrounding penetrating item with fire separation packing to within 12.7 mm of face of masonry to allow for sealant.

.29 **Shrinkage Control Joints**

.1 Incorporate vertical shrinkage control joints in walls of which concrete masonry units are a part.

.2 Install control joints at junctions of walls and columns, at intersections of unit concrete masonry load-bearing walls, and wherever indicated on Drawings, and otherwise in walls with no openings, at a maximum spacing of 10.5 m o.c. Carry joints full height of walls.

.3 Ensure complete vertical separation through walls incorporating control joints. Make control joints 9.5 mm wide, rake back 19 mm at junctures with concrete, and leave joints free and clear for caulking, as specified in Section 07920.

.4 Construct control joints of standard block and fill void between block with 20 MPa concrete grout to form a continuous key full height of joint. Maintain separation between walls on each side of joint by installation of continuous building paper between concrete key and block on one side of joint.

.30 **Expansion Joints**

.1 Incorporate expansion joints in walls where indicated on Drawings.

.2 Build in metal bellows with joints between lengths lapped a minimum of 50 mm and flanges anchored in joint between wythes.

.3 Maintain expansion joints free of mortar with temporary filler when laying masonry. Pack joints full height with glass fibre board compressed to 50% of original thickness.

.4 Leave clean space in joints for caulking as specified in Section 07920.

.31 **Fire Separations**

.1 Construct fire separation walls tightly to construction at perimeter, and without openings or voids.

.2 Do not reduce the thickness of masonry fire separations to less than the thickness indicated for the required fire separation rating.

.32 **Fire Protection**

.1 Install masonry fire protection of structural steel columns as indicated on Drawings, for fire ratings indicated.

.2 Completely enclose structural steel columns with masonry for their entire length. Do not fill webs.

.33 **Grouted Reinforced Masonry**

.1 Incorporate reinforcing steel and construct masonry to meet specified requirements of CAN/CSA-A371-M84 and CAN/CSA-S304-M84, and as indicated on Structural Drawings.

## .3 Field Quality Control

.1 An inspection and testing company will be selected to inspect and report on masonry installed by this Section as required by jurisdictional authorities and as directed.

.2 The inspection and testing company will inspect and report on compressive strength of mortar samples as laying of masonry progresses. Provide six 50 mm cubes of mortar from samples taken randomly at the site, for each test, as directed.

.3 Payment for inspection and testing will be made from cash allowance specified in Section 01020.

## .4 Adjustment and Cleaning

.1 Patch damaged masonry walls which have been rejected.

.2 Point all holes in mortar joints except weepholes.

.3 Point all voids in concrete unit masonry faces.

.4 Cut out defective mortar joints to a minimum depth of 13 mm and repoint.

.5 Wash down and brush masonry to remove mortar and stains. Use only detergents, or proprietary masonry cleaners as recommended by brick manufacturer.

.6 Clean concrete masonry units with brushes and as otherwise recommended by the supplier to remove mortar and stains.

.7 Do not use wire brushes for cleaning.

.8 Should specified cleaning methods be insufficient, proceed with other methods only with approval.

.9 Protect adjacent materials, construction and finished surfaces from damage while cleaning.

.10 Ensure that all efflorescence and mortar deposits are removed from surfaces to receive coating.

**End of Section**

## PART 1 - GENERAL

.1 **Description**

.1 **General Requirements**

Division 1 and General Requirements, is a part of this Section and shall apply as if repeated here.

.2 **Work Related to This Section Performed by Other Sections**

Section 06200: Finish Carpentry

.3 **Installation of Work Supplied by This Section, Specified in Other Sections**

Section 03300: To install bolts, inserts, etc.
Section 04200: To install bolts, inserts, etc.

.2 **Quality Assurance**

.1 **Requirements of Regulatory Agencies**

Mark each piece of wood, which is rated non-combustible by fire retardant pressure treatment, with ULC Fire Hazard Classification label.

.3 **References**

.1 **Reference Standards**

.1 Grade lumber in accordance with rules and regulations of the National Lumber Grades Authority.
.2 Dimensions of lumber shall conform to dressed sizes specified in CSA Standard O141-91.
.3 Reference standards quoted in Contract Documents refer to:
ASTM E84-81a, Test for Surface Burning Characteristics of Building Materials.
CAN/CSA O80 Series-M89, Wood Preservation.
CAN/CSA O141-91, Softwood Lumber.
CSA Standard B111-1974, Wire Nails, Spikes and Staples.
CSA Standard O121-M1978, Douglas Fir Plywood.

.4 **Site Conditions**

.1 **Environmental Conditions**

When it is required that wood maintain dimensional stability and tolerances to ensure accurate installation of later work, store and install it only in dry areas, and where no further installation of moist materials is contemplated.

## PART 2 - PRODUCTS

.1 **Materials**

.1 For lumber and fastenings conform to Ontario Building Code, Section 4.3.
.2 Grade mark lumber by the appropriate association under authority of the National Lumber Grades Authority.
.3 Moisture content of lumber at time of building-in shall not exceed 19%.
.4 **Lumber**
.1 Spruce-Pine-Fir Species Group Designation, framing lumber, with no more than 15% of next lesser of specified grade included.
.2 For utility use where concealed: sound and free of imperfections or deficiencies making unsuitable for use.
.5 **Plywood**
.1 Douglas Fir, in conformance with CSA Standard 0121-M1978.
.2 For utility use: Unsanded Sheathing Grade.
.6 **Nails, Spikes and Staples**
In conformance with CSA Standard B111-1974; galvanized at exterior locations, at interior high humidity locations and for treated lumber; plain finish elsewhere. Use spiral shank nails generally.
.7 **Fasteners**
To hollow masonry use toggle bolts: to solid masonry and concrete use expansion shields and lag bolts; to steel use bolts or welded stud fasteners. Use lead or inorganic fibre plugs for fasteners in concrete and masonry. Provide washers at bolt heads and nuts. Galvanize fasteners at exterior locations, at high humidity interior locations and for treated lumber.
.8 **Wood Preservative**
Copper naphthenate or pentachlorophenol solution to meet specified requirements of CSA Standard O80.
.9 **Dampproof Membrane**
0.051 mm polyethylene film.

## PART 3 - EXECUTION

.1 **Installation**

.1 **General**
.1 Lay out items installed by this Section carefully and to accommodate requirements of other Sections. Cut and fit members accurately; erect them in position indicated by Drawings; align, level, square, plumb, and secure them permanently in place. Brace work temporarily as required. Join members only over solid backing.
.2 Bore holes true to line and to same size as bolts. Drive bolts into place for snug fit, and use plates and lag screws tightly when installed, and again just before being concealed by other installations or at completion of the work.
.3 Cooperate with other Sections to ensure that unity of actions will ensure orderly progress to meet construction schedule.
.4 Supply anchors, bolts, and inserts, required for installations of this Section, to those performing the work of other Sections and who are responsible for their installation.

.5 Include rough hardware such as nails, bolts, nuts, washers, screws, clips, hangers, connectors, and strap iron required for installations by this Section; and for all operating hardware required by this Section for temporary use.

.6 Do not attach installations of this Section by wood plugs or blocking in concrete or masonry. Use lead shields, expansion shields, concrete nails, or similar methods only as approved.

.2 **Blocking, Nailers, Strapping, Furring, Grounds & Miscellaneous Rough Framing**

.1 Do not regard nailers, blocking, and such other fastening provisions as shown on drawings as exact or complete. Install required provisions for fastening, located and secured to suit site conditions, and adequate for intended support.

.2 Cut members into lengths as long as practicable and with square ends.

.3 Install rough bucks for opening jambs, heads, and sills of minimum nominal 38 mm thickness, and of width of casings or as otherwise indicated. Set bucks plumb, level, and anchored securely in place.

.4 Verify that grounds required for fastening of components and equipment are located correctly, and that they provide adequate support.

.5 For general strapping, set preservative treated nominal 19 mm x 38 mm wood strips vertically and spaced at 400 mm o.c., unless otherwise indicated. Shim to provide a true face plane. Install intermediate horizontal strapping at all joints to wall finishes applied over grounds.

**.2 Adjustment**

.1 Ensure that bolted fasteners are drawn up tightly.

**End of Section**

## PART 1 - GENERAL

.1 **Description**

.1 **General Requirements**

Division 1 and General Requirements, is a part of this Section and shall apply as if repeated here.

.2 **Work Performed by Other Sections Related to This Section**

Section 06100: Rough Carpentry
Section 06410: Casework
Section 09900: Painting & Finishing

.2 **References**

.1 Conform to CSA Standard 0141-91 for dressed dimensions of wood members.

.2 Reference standards quoted in Contract Documents refer to:
ASTM E84-81a, Test for Surface Burning Characteristics of Building Materials.
CAN3-O188.1-M78, Interior Mat-Formed Wood particleboard
CAN/CSA-A172-M79, High Pressure, Paper Base, Decorative Laminates
CAN/CSA-O80 Series-M89, Wood Preservation
CAN/CSA-O141-91, Softwood Lumber
CSA Standard O115-1982, Hardwood Plywood
CSA Standard O121-M1978, Douglas Fir Plywood
CSA Standard O151-M1978, Canadian Softwood Plywood
CSA Standard O153-M1980, Poplar Plywood
CGSB Specification 11-GP-3M, Hardboard

.3 Fabricate millwork as specified in Finish Carpentry Schedule to meet specified requirements of Custom Quality Standard of either:
: AWI Specification, Architectural Woodwork Quality Standards and Guide Specifications, 1973, by Architectural Woodwork Institute, or
: AWMAC Specification, Quality Standards for Architectural Woodwork of the Architectural Woodwork Manufacturers Association of Canada, Seventh Edition, 1984.

.3 **Submittals**

.1 **Shop Drawings**

Submit detailed shop drawings of all millwork and finished carpentry items.

.2 **Samples**

Submit samples of each specified finish wood species, and in each cut if requested.

.4 **Delivery, Storage and Handling**

.1 Protect materials from damage during handling, delivery, and storage.
.2 Receive finish hardware supplied by Section 08710 and store, secure against theft.
.3 Do not deliver wood materials to site until storage areas are completed, and conditions are such that no damage will occur to them while in storage and during installation.

.5 **Site Conditions**

.1 **Environmental Requirements**

Ensure that relative humidity in areas where wood materials are stores and installed does not exceed 55%.

.6 **Warranty**

.1 **Extended Warranty**

Warranty installation specified in this Section covering the period for one (1) year beyond the expiration of the warranty period specified in the General Conditions to the Contract.

## PART 2 - PRODUCTS

.1 **Materials**

.1 **General**

.1 Provide rough hardware required for finish carpentry specified in this Section. Use non-corrosive hardware at exterior locations.
.2 Moisture content of wood at time of installation shall be for interior locations at an average of 7%, with a permitted range of individual pieces of 5% to 9%; and for exterior locations at an average of 12%, with a permitted range in individual pieces of 10% to 15%.
.3 Use only adhesive and fastenings that develop sufficient strength for intended use, are non staining, and are unaffected by the environment to which exposed.

.2 **Wood**

.1 Grade mark softwood and hardwood lumber by the appropriate association under authority of the National Lumber Grades Authority.
.2 Where not exposed to view, use wood of grades suitable for fabrication, utility and structural needs.
.3 Where exposed to view, use Appearance Grade wood for structural lumber, as otherwise specified. Meet requirements of specified AWI or AWMAC Quality Grade Standard, where applicable.
.4 Ensure that surfaces exposed to view and given a natural or stained finish are free from markings and stains caused by milling, treatment, storage, handling and other causes.

.5 Ensure that veneered panels, and solid finger jointed and edge laminated members, where admissible for incorporation as approved, are matched for grain configuration and uniformity of colour throughout all surfaces exposed to view which are to receive a natural or stained finish.

.3 **Plywood**

.1 Douglas Fir; To meet specified requirements of CSA Standard O121-M1978; Sanded Grade, Good Two Sides where both sides are exposed to view, and Good One Side where only one side is exposed to view.
.2 Softwood: To meet specified requirements of CSA Standard O151-M1978, Sanded Grade, Solid Two Sides where both sides are exposed to view, and Good One Side where only one side is exposed to view.
.3 Hardwood: To meet specified requirements of CSA Standard O115-M1978 veneer core, Type II, smooth sanded, rotary cut face veneers, Good Grade where exposed to view and Sound Grade where not.
.4 Poplar: To meet specified requirements of CSA Standard O153-M1980.
.5 Birch: Rotary cut Select Grade veneer where transparent or clear finish specified.

.4 **Particleboard**

To meet specified requirements of CAN/CSA-O188.1-M78, Grade S.

.5 **Plastic Laminate**

To meet specified requirements of CAN/CSA-A172-M79.

.1 Colour: Selected from manufacturer's standard solid colour range.

.6 **Hardboard**

To meet specified requirements of CGSB Specification 11-GP-3, Type 2.

.7 **Fire Retardant Treatment**

Pressure treat lumber in accordance with CSA Specification O80 Series-M89, C20 and plywood with O80 Series-M89 C27, or to ULC Specifications; to ensure a flame spread rating of less than 25 when tested in accordance with ASTM Standard E84.

.8 **Wood Preservative**

Clear pentachlorephenol, to meet specified requirements of CSA Standard O80 Series-M89.

.2 **Fabrication**

.1 **General**

.1 Assemble fabricated millwork units in mill in units as large as possible. Design units to fit together if site assembly is required.

.2 Edge plywood where specified or indicated with solid wood to match face veneer, with profiled pressure glued edge joint and finished level with plywood surfaces.

.3 Fabricate custom casework specified in this Section to meet workmanship specifications in Section 400, Casework, of AWI/AWMAC Custom Quality Standard, except as modified, and as follows:

.1 Conceal edge grain of exposed and semi-exposed plywood and particleboard using solid hardwood edges for stain finish or plastic laminate.
.2 Assemble cabinet body members with adhesive.
.3 Where permitted, drive power-driven Tee head nails or staples with long dimension parallel to grain.
.4 Install dust panels between drawers.

.4 Shop fabricate work of this Section in as large units as possible.

.5 Incorporate services, fixtures, and trim in units as indicated on drawings or specified in Divisions 15 or 16, or both. Make all necessary cutouts to template information.

.2 **Trim**

.1 Rout or groove backs of flat trim members.
.2 Kerf backs of wide flat member.

.3 **Fastening**

.1 Fasten assemblies with nails generally, but use screws or special fasteners at critical joints where strain, and excessive usage and shrinkage is anticipated, and where required by specified quality grade standards.
.2 Glue built-up assemblies as well as nailing and screwing.
.3 Bind nail unless impossible.
.4 Set finish nails below finished surfaces.

.4 **Plastic Laminate Facing**

.1 Apply plastic laminate for counters to poplar faced phenolic bonded plywood, or to particleboard, minimum 19 mm thick, or as otherwise indicated on Drawings. Apply plastic laminate for doors, drawer fronts, gables, etc. of cabinets to minimum 19 mm thick wood core, Birch faced plywood.
.2 Bond plastic laminate to backing with urea formaldehyde adhesive, or by methods of equal or better quality recommended by the plastic laminate manufacturer.
.3 Seal edges of cutouts with plastic laminate, or where concealed from view by other methods that will prevent entry of moisture into core.
.4 Apply plastic laminate backing sheet to core on back side of panels faced with plastic laminate.
.5 Ensure that both face and backing sheet have been sanded in same direction.
.6 Bond plastic laminate self-edges under pressure, and bevel and finish smooth finished corners.

.7 Round corners of holes cut through plastic laminate and file them smooth.

.8 Make joints only when lengths of plastic laminate facing exceeds 3660 mm. Butt joints together, reinforce core with 6.4 mm hardwood blind splines, and lock together with Tite Joint fasteners located at a maximum of 75 mm from edges.

.5 **Finishing**

.1 Finish each surface of millwork to specified quality grade standard where exposed or semi exposed. Consider that all visible surfaces are exposed, including underside surfaces above 1200 mm from floor and interiors of fitments behind glass doors. Consider that underside surfaces within 1200 mm of the floor, top surfaces more than 1800 mm above the floor, interiors of fitments behind opaque doors and the backs of fitment doors are semi-exposed.

.2 Fine sand surfaces level and smooth after fabrication.

## PART 3 - EXECUTION

.1 **Examination**

.1 Before commencing installation, ensure that grounds, strapping, and other constructions and surfaces to which finish carpentry is installed are satisfactory for fitting and adequate for its securement.

.2 Take site measurements of construction to which finish carpentry installations must conform, and through which access must be made, before fabricated units are delivered to site, to ensure that adaptation is not required which would result in construction delay.

.2 **Preparation**

.1 **Protection**

.1 Ensure that finish carpentry materials are protected from damage and deterioration during installation, and otherwise until project completion in accordance with General Conditions.

.2 Take particular care that wood made fire retardant by pressure treatment is not exposed to dampness.

.3 **Installation**

.1 **General**

.1 Backprime exterior and interior millwork specified in this Section immediately after delivery to site under work of Section 09900. Ensure that cut ends are primed. Scrape or sand smooth surfaces by this Section. Notify those who are responsible for backpriming in sufficient time to enable them to schedule their work.

.2 Coordinate the installation of casework manufactured under section 06410 and determine which section will be responsible for the installation of casework. Notify the architect of section responsibility for installation of casework.

.3 Install finish carpentry plumb, level and straight, and fasten it securely to backing to support itself and anticipated superimposed loads.

.4 Build finish carpentry into construction as indicated on Drawings or specified in other Section of the Specifications, or both.

.2 **Trim**

.1 Install in single lengths except where material limitation makes impossible. Stagger joints where they occur and locate over solid backing for fastening.

.2 Install wood bases after finish flooring is laid.

.3 Cut returns of stool and apron ends to match face profile.

.3 **Cutting and Fitting**

.1 Cut moldings with sharp true profiles.

.2 Cope trim and mouldings at interior corners and at returns.

.3 Miter trim and mouldings at exterior corners. Glue and lock shop miters that are over 100 mm from heel to point.

.4 Scribe and join members accurately together, and to other surfaces, to fit tightly and with flat smooth surfaces. Install trim or filler panels to close gaps.

.5 Ensure that all cutouts for electrical devices and plumbing are fully coordinated and neatly completed for work under this section and Section 06410.

.4 **Fastening**

.1 Fasten finish carpentry with nails generally, but use screws or special fasteners at critical joints where strain, usage and excessive shrinkage is anticipated, and where specified quality grade standards require.

.2 Blind nail unless impossible.

.3 Set finish nails below finished surfaces to receive putty.

.5 **Installation of Doors**

.1 Install wood doors after finishing of walls.

.2 Fit wood doors with 2 mm clearance at jambs and heads, and 9.5 mm over finished flooring.

.3 Trim hinge side of wood doors to fit, and bevel latch edges as required.

.4 Ensure that top and bottom edges of wood doors are primed under Work of Section 09900 after they are cut to fit.

.5 Undercut wood doors where indicated on Door Schedule.

.6 **Installation of Finish Hardware**

.1 Install finish hardware

.2 Make cuts in wood doors neatly

.3 Accurately locate and adjust hardware to meet manufacturer's instructions. Use special tools and jigs as recommended.

.4 Install hardware in wood doors at same locations as for hollow metalwork installed in project.

.5 Locate door stops to contact doors 75 mm from latch edge.

.6 Install hardware and trim square and plumb to doors.

.7 Replace missing hardware to ensure specified installation at time of building completion.

.8 After installation, replace wrappings for hardware provided by manufacturer.

.9 Safeguard keys to keep them out of unauthorized hands, tag them with opening number, and deliver them to person designated by Architect at building completion.

.7 **Finishing**

.1 Sand wood surfaces after installation to leave surfaces in true planes and free of machine or tool marks.

.8 **Wood Preservative**

.1 Give wood installed at exterior of building and which is specified for painting a soaking coat of wood preservative on all surfaces. Give freshly cut ends two additional soaking coats.

.4 **Adjustment and Cleaning**

.1 Adjust hinged doors to swing freely and easily, to remain stationary at any point of swing, to close evenly and tightly against stops without binding, and to latch positively when doors are closed with moderate force. Ensure that when doors are installed with hinged stiles adjacent, both doors can open simultaneously without binding.

.2 Adjust hardware so that latches and locks operate smoothly and without binding, and closers act positively with the least possible resistance in use. Lubricate hardware if required by supplier's instructions.

.3 Clean hardware after installation in accordance with supplier's instructions.

.4 Sand and clean woodwork to leave free from finish defects in any exposed part.

**End of Section**

## PART 1 - GENERAL

### .1 Description

#### .1 General Requirements

Division 1 and General Requirements, is a part of this Section and shall apply as if repeated here.

#### .2 Work Performed by This Section

Work of this section includes the supply and installation of architectural woodwork including, but not limited to the following:

.1 Standing and running trim.
.2 Cabinetry and hardware.
.3 Wood panelling and related wood doors.
.4 Wood frames and Jambs
.5 Plastic laminate countertops.
.6 Solid surfacing countertops and fabrications
.7 Wood wall panels.
.8 Acoustic panels.
.9 Factory and site finishing of architectural woodwork.

#### .3 Work Performed by Other Sections Related to This Section

Section 06200: Finish Carpentry
Section 09900: Painting and Finishing
Division 15: Mechanical Services to be coordinated with work of this section.
Division 16: Electrical Services to be coordinated with work of this section.

#### .4 Installation of Work Supplied by This Sections Specified Other Sections

Section 03300: To install blocking, anchors and inserts.
Section 04200: To install blocking, anchors and inserts.
Section 09250: To install support framing.

### .2 Quality Assurance

#### .1 Subcontractor Qualifications

Provide custom casework specified in this Section only by a fabricator who has adequate plant, equipment and skilled tradesmen to perform it expeditiously, and is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past five years.

.3 **References**

.1 **Reference Standards**

.1 Reference standards quoted in Contract Documents refer to: CAN/CSA-A172-M79, High Pressure, Paper Base, Decorative Laminates.

.2 Fabricate custom casework to Custom Quality Standard of either:
: AWI Specification, Architectural Woodwork Quality Standards and Guide Specifications, current edition, by Architectural Woodwork Institute.
: AWMAC Specification, Quality Standards for Architectural Woodwork of the Architectural Woodwork Manufacturers Association of Canada, Current Edition.

.4 **Submittals**

.1 **Shop Drawings**

.1 Submit shop drawings for the work of this section.

.2 Include plans, sections and large scale details indicating components, methods of assembly, materials and their characteristics, fastenings, finishes along with all other fabrication information required for the work of this section.

.3 Include full scale drawings of all exposed to view edge conditions.

.4 Indicate assembly joint lines.

.5 Submit coordination drawings indicating locations of concealed grounds, cut-outs, plates, access points, and other required coordination references and fabrications.

.6 Show relations to adjoining construction, details of outside and inside corners and door openings, including interference with swings, slides and active assemblies.

.2 **Samples**

.1 Submit samples of each specified finish species solid wood and wood veneer showing the full range of grain variation, finish and patterns proposed for the specified wood product and in each cut. Provide two samples of each showing the finish specified. If colour is specified include the original specified sample and one set with lighter tone and one set darker tone.

.2 Submit samples of melamine with specified self edge to match existing millwork in panel pieces of 300mmx300mm by specified thickness completely finished and matched.

.3 Submit samples of solid wood with specified wood trim in panel pieces of 300mmx300mm by specified thickness completely finished and matched cut.

.4 Submit 2 identical samples of plastic laminate showing edge profile and integrated backsplash profile.

.5 Submit 2 identical samples of plastic laminate for cabinet doors showing edge profile to match existing.

.6 Submit 2 samples of each item of hardware specified.

.5 **Delivery, Storage, and Handling**

.1 Package and otherwise protect custom casework from damage during handling, delivery, and storage. Provide temporary skids under large or heavy units.
.2 Do not deliver custom casework to site until conditions are such that no damage will occur to it while in storage. Ensure that relative humidity in storage areas does not exceed 55%.

.6 **Warranty**

.1 **Extended Warranty**

Warrant installation specified in this Section covering the period for four (4) years beyond the expiration of the warranty period specified in the General Conditions to the Contract. Warranty shall be against defects of material and workmanship.

.7 **Maintenance Manual**

Provide maintenance information to be incorporated into the project manual detailing the maintenance procedures for finishes requiring specific care, or procedures or materials which will cause damage to finished surfaces.

.8 **Extra Materials**

Deliver 2 new sets of each hardware component actually used in the supply and installation to be used as maintenance replacement. Ensure that a complete labeled duplicate set of cabinet and drawer keys are delivered upon completion.

.9 **Prices**

.1 **Separate Prices**

Separate prices concerning Work of this Section is specified in Section 01206, Prices.

## PART 2 - PRODUCTS

.1 **Products**

.1 Specified manufacturer's catalogue reference to establish minimum acceptable standards for products specified in this Section.
.2 Unspecified materials which form a part of complete assemblies shall be of manufacturer's standard.
.3 Acceptable alternatives for the Work of this Section are:

.2 **Materials**

.1 Conform to AWI or AWMAC quality grade standards defined in specified reference standards and as specified for custom casework items for lumber and plywood materials and their machining and sanding.

.2 Ensure that veneered panels and solid finger jointed and edge laminated members, where admissible for incorporation are matched for grain configuration and uniformity of colour throughout all surfaces exposed to view which are to receive a natural or stained finish.

.3 **Solid Wood**

.1 Exposed for Transparent Finish:
Grade: 1
Cut: Plain sawn (quarter cut)
Species: Clear birch.
.2 Semi-Exposed: Same as for exposed.
.3 Concealed: At option of fabricator.

.4 **Plywood**

.1 Backing Grade, veneer core, with no added urea-formaldehyde used in composition.
Softwood plywood to CSA O 151-04
Douglas Fir plywood to CSA O 121- M1978

.5 **Particleboard : Medium Density**

.1 Melamine: Match 992 Hard Rock Maple.
To meet specified requirements of ANSI A 208.1 - 1999, Grade M3 19mm thick with matching non-yellowing edge trim.

.2 Use Melamine board for all tops, bottoms, shelves, and backs of all cabinets. Edge all exposed edges.

.6 **Plastic Laminate**

.1 To meet specified requirements of CSA A172-96, GRADE GP OR GF, Type S, min. 1.2 mm thick. Colour to be selected by consultant. Allow for 3 colours and 3 patterns.

.1 For all cabinet doors: Plastic Laminate: 992 Hard Rock Maple. Covered for all interior and exterior door faces and edges.
.2 For Teachers Cabinet doors: Plastic Laminate: 992 Hard Rock Maple.Covered for all interior and exterior door faces and edges.
.3 For Postformed Counter Tops: Type 2, Postforming, 2a Standard, 1.25 mm thick.
.4 For Exterior Faces of Cabinets only where specified: Type 1, General Purpose lb Standard, 1.6 mm thick
.5 For Cabinet Lining and Shelves: Liner Sheet, Type 1, General Purpose, 1c Light Duty, 0.75 mm thick.
.6 Backing Sheet: In same thickness as face sheet.
.7 Surface Finish: Furniture Finish, except for backing sheet.
.7 Acceptable Manufacturers:

Formica
Nevamar
Laminart
Wilsonart

.7 **Fasteners and Adhesives**

Fasteners and anchors to be capable of supporting 2.5 times the load carrying capabilities of the panels or the loaded intended use of any millwork cabinetry, shelves, brackets, etc. in both the horizontal and vertical application. All cabinetry is to be securely anchored to walls to prevent tipping or falling in the fully loaded use condition. Refer to general conditions for further requirements.

.1 Wood Screws; FF-s-111D amendment #1 (1989), Type size, material and finish as required for the completed conditions of use.
.2 Nails: FED FF-N-105, Type size, material and finish as required for the completed conditions of use.
.3 Anchors: Type size, material and finish as required for the completed conditions of use.
.4 Fastening devices shall be set or countersunk flush with surface of framing members. No exposed fasteners permitted, except where accepted by the consultant. Exposed fasteners shall be flat head hex socket cap screws and matching joint connector sex bolts as supplied by Murakoshi, finish and sample approval by the Consultant.
.5 Concealed panel hanging strips: Extruded aluminum interlocking strips and fasteners.
.6 Adhesives: Moisture resistant complying with FS MMM-A125, Type II or FED MMM_A_188, Type I, II or III: best suited for the purpose.

.8 **Hardware**

Refer to cabinetry and casework schedule to be supplied and installed.

.9 **Wood Finishes**

.1 Polyurethane type conforming to CGSB Specification 1-GP-175M, semi-gloss finish, in colours to be selected from manufacturer's standard range.

.3 **Fabrication**

.1 Fabrication shall be in accordance with the Architectural Woodwork Standards, 8th Edition, 2003, Premium Grade, unless otherwise indicated or scheduled, and as follows:

.1 Panel Products:

.1 Fabricate in accordance with Architectural Woodwork Standards, 8th Edition, 2003, Section 200.

.2 Standing and Running Trim:

.1 Fabricate in accordance with Architectural Woodwork Standards, 8th Edition, 2003, Section 300.

.3 Architectural Cabinetry:

.1 Fabricate in accordance with Architectural Woodwork Standards, 8th Edition, 2003, Section 400.
.2 Construction: Flush overlay.

.4 Panelling and Related Wood Doors:

.1 Fabricate in accordance with Architectural Woodwork Standards, 8th Edition, 2003, Section 500.

.2 In addition, wood doors shall be in accordance with Section 08140.

.5 Frames and Jambs:

.1 Fabricate in accordance with Architectural Woodwork Standards, 8th Edition, 2003, Section 900.

.2 Fabricate woodwork to dimensions, profiles, and details indicated with openings and mortises pre-cut, where possible, to receive hardware and other items of work.

.3 Complete fabrication, assembly, finishing, hardware application, and other work before shipment to maximum extent possible. Trial fit in shop and disassemble components only as necessary for shipment and installation. Where necessary, provide ample allowance for scribing, trimming, and fitting. Reassemble with concealed fasteners.

.4 Pre-cut openings: Provide woodwork, solid tops and other indicated materials with pre-cut openings, where possible, for hardware, appliances, plumbing fixtures, electrical work, communication/data cut-outs and similar items. Locate openings accurately and provide proper size and shape. Smooth edges of cut-outs and, where located in countertops, seal edges of cut-outs with a water-resistant coating. Provide manufactured grommets as indicated.

.5 Measurements: Before fabrication of woodwork to be fitted to other construction, obtain field measurements and verify dimensions and shop drawing details as required for accurate fit.

.6 Provide lumber framing for architectural woodwork, complete with all bracing and fastening devices as required for a rigid installation, and as required to sustain the imposed loads.

.7 Do fabrication from field measurement with provision for scribing and transportation as required meeting built-in conditions.

.8 Maintain relative humidity and temperature during fabrication, storage and finishing operations matching that of the areas of installation.

.9 Reinforcing shown is minimum. Provide additional reinforcing as required to ensure a rigid assembly. Exposed surfaces shall be free from dents, tool marks, warpage, buckle, glue and open joints, or other defects. Accurately fit all joints, corners and mitres.

.10 Provide balancing sheets as required, and specified, complying with the Architectural Woodwork Standards, 8th Edition, 2003.

.11 Provide necessary cut-outs on a through the furniture to accommodate architectural woodwork and work of other sections.

.12 Provide surface mount blocking & strapping necessary to support the work of this section. Such blocking shall not be exposed upon completion of work.

.13 Prefinish work at the factory, except where specified or indicated otherwise.

.14 Take responsibility for the stability of furniture and fitments.

.15 At plastic laminate surfaces, mitre fold at cabinet corners and countertop.

.1 Plastic laminate countertops: unless otherwise indicated: Fabricate countertops with plastic laminate to top side of minimum 15.9 mm (5/8") particle board, with a 180° full wrap finished bullnose front edge, with 100 mm (4") back and sidesplashes. Joints in plastic laminate will not be permitted on countertops except at mitred corners.

.16 No end grain shall be visible: mitre external corners; house internal corners.

.4 **Fabrication – Solid Surfacing**

.1 Fabrication to be performed by a solid surface manufacturer's certified fabricator/installer.

.2 Wherever possible, fabricate in single piece accurately made to fit space.

.3 Fabricate components in shop to greatest extent practical to size and shape indicated, in accordance with reviewed shop drawings and manufacturer's written requirements.

.4 Form joints between components using manufacturer's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Attach 100 mm (4") wide solid surfacing material reinforcing strip under joints.

.5 Provide holes and cut-outs as indicated or as required.

.6 Rout and finish component edges to a smooth, uniform finish. Rout cut-outs then sand edges smooth. Repair or reject defective or inaccurate work.

.7 Surfaces shall have a uniform finish.

.5 **Finishing of Interior Architectural Woodwork**

.1 Quality Standard: Comply with the Architectural Woodwork Standards, 8th Edition, 2003 unless otherwise indicated.

.2 General: The entire finish of Interior architectural woodwork is specified in this section, regardless of whether factory applied or applied after installation.

.3 Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces and similar preparations for finishing of architectural woodwork, as applicable to each unit of work.

.4 Transparent finish for hardwood veneer and solid hardwood:

.1 Comply with requirements indicated below for grade, finish system, staining, and sheen.

.1 Grade: Premium
.2 Sheen: Low
.3 Factory finish with Premium grade transparent, clear, catalysed lacquer in accordance with the Architectural Woodwork Standards, 8th Edition, 2003, Section 1500.

.5 Shop fabricate work of this Section in as large units as possible.
.6 Incorporate services, fixtures, and trim in units as indicated on drawings or specified in Divisions 15 or 16, or both. Make all necessary cutouts to template information.
.7 Fabricate counter tops with post-formed plastic laminate facing.

.6 **Containers** (upper and base cabinet units, cubbies and open boxes)

.1 Fabricate of 19mm Melamine: Match 992 Hard Rock Maple, with interlocking tongue and groove joints using fasteners in accordance with specifications.
.2 Provide Melamine: Match 992 Hard Rock Maple at all edges of unit.
.3 Router cut slots and holes to permit coupling and to accept standard shelving and accessory parts.

.7 **Shelving**

.1 Fabricate of 19mm Melamine: Match 992 Hard Rock Maple, in sizes to suit containers.
.2 Router cut openings and holes for shelf supports.

.8 **Drawers**

.1 Fabricate of 15mm plywood rails, 19mm Melamine: Match 992 Hard Rock Maple and 9mm particle board bottom.
.2 Fabricate in sizes to suit containers.
.3 Router cut openings for pulls and drawer slides.

.9 **Doors** (cabinets)

.1 Fabricate of 19mm Plastic Laminate: 992 Hard Rock Maple, in sizes to suit containers.
.2 Router cut openings for pulls and hinges.

.10 **Doors** (Tall storage and teacher closet)

.1 Fabricate of 40mm doors with Plastic Laminate: 992 Hard Rock Maple on honeycomb core door panels, in sizes to suit containers.
.2 Router cut openings for pulls and hinges.

.11 **Bases**

.1 Fabricate of laminated plywood, 100mm high.
.2 Base to be levelling type, located at each corner of base.
.3 Finish on exterior base to match door/container finish.

.12 **Finishing**

.1 Conform to requirements of Section 09900.
.2 Sand each coat between applications of finish.
.3 Shop finish with polyurethane finish, 3 coat system using oil modified polyurethane, conforming to CGSB Specification 1-GP-175M, semi-gloss finish.

## PART 3 - EXECUTION

.1 **Preparation**

.1 Condition woodwork to average prevailing humidity conditions in installation areas before installing.

.2 Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

.3 Provide all grounds, nailers and other required fabrications which are to be built into other work when required.

.2 **Installation**

.1 Quality Standard: Install woodwork to comply with Section 1700 of the Architectural Woodwork Standards, 8th Edition, 2003 for same grade specified in Part 2 of this section for type of woodwork involved.

.2 Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 3 mm in 2400 mm (1/8" in 8') for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.

.3 Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

.4 Anchor woodwork to anchors or blocking built or directly attached to substrates. Secure to grounds stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine fishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

.5 Complete the finishing work specified in this section to whatever extent no completed at shop or before installation of woodwork.

.3 **Protection**

.1 Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that woodwork is without damage or deterioration at time of *Substantial Performance of the Work.*

.4 **Adjustment and Cleaning**

.1 Adjust operating parts of units to move freely, without excessive play, and to fit accurately.
.2 Clean, lubricate and adjust hardware.
.3 Ensure that when doors are installed with hinged stiles adjacent, both doors can open simultaneously without binding.
.4 Refinish damaged and defective custom casework before completion of project. Refinishing of exposed surfaces shall show no discernible variation in appearance.
.5 Clean custom casework respecting specified finishing.
.6 Final cleaning is specified in Section 01700.

.5 **Casework**

.1 Work of this Section will include the supply, fabrication and installation of cabinetwork and shelving. Refer to drawings for items and locations.

**End of Section**

## PART 1 - GENERAL

.1 **Description**

.1 **General Requirements**

Division 1 and General Requirements, is a part of this Section and shall apply as if repeated here.

.2 **Work Performed by Other Sections Related to This Section is Specified in**

Section 04200: Raking of Masonry Joints

.3 **Work Included Elsewhere but Performed in Compliance with This Section**

Section 04200 - Unit Masonry
Section 08110 - Steel Doors and Frames
Section 06200 – Rough Carpentry
Section 06200 – Finish Carpentry
Section 09250 - Gypsum Board
Section 10800 - Washroom Accessories

.2 **Quality Assurance**

.1 **Subcontractor Qualifications**

Seal joints specified in this Section by Subcontractor approved by manufacturers of sealants; who has equipment adequate for Project, skilled tradesmen to perform it expeditiously; and known to be responsible for satisfactory installations similar to that specified during at least the immediate past five years.

.3 **References**

.1 **Reference Standards**

Reference Standards quoted in Contract Documents refer to:
CGSB Specification 19-GP-5M, Sealing Compound, One Component, Acrylic Base, Solvent Curing.
CGSB Specification 19-GP-9Ma, Sealing Compound,
One Component, Silicone Base, Chemical Curing
CAN/CGSB-19.13-M82, Sealing Compound, One Component, Elastomeric, Chemical Curing.
CAN/CGSB-19.24-M80, Sealing Compound, Multi-Component, Chemical Curing.

.4 **Submittals**

.1 **Samples**

Submit samples of sealant and backing if requested.

.2 **Product List**

Submit manufacturer's and product name for each sealant which will be used for Project, before commencing joint sealing.

.5 **Site Conditions**

.1 **Environmental Conditions**

Apply sealants only to completely dry surfaces, and at air and material temperatures above minimum established by manufacturer's specifications.

.6 **Warranty**

.1 **Extended Warranty**

.1 Submit a warranty of the joint sealant installation specified in this Section covering the period for four years beyond the expiration of the warranty period specified in the General Conditions to the Contract, including materials and application. Replacement of joint sealants shall include removal of defective materials, preparation for and application of new material, and the repair and making good of damaged adjacent materials.

.2 Defective joint sealant installation shall include, but not be restricted to, joint leakage, hardening, cracking, crumbling, melting, bubbling, shrinkage, running, sagging, change of colour, loss of adhesion, loss of cohesion, and staining of adjoining or adjacent materials or surfaces.

## PART 2 - PRODUCTS

.1 **Materials**

.1 All materials utilized in a sealant system shall be compatible.

.2 Specified proprietary products are minimum acceptable quality. Products of other manufacturers of equal or superior quality will be accepted where specifically approved by Architect.

.3 **Sealants**

.1 Provide sealant formulation recommended by manufacturer for type of joint, substrate and service conditions applicable.

.2 Refer to Caulking Schedule for utilization of the following sealants.

.3 Colours of sealants will be selected from manufacturer's standard range.

.4 Acrylic Solvent Release, One Part, Sealant:
To meet specified requirements of CGSB Specification 19-GP-5.
PTI 738 by P.T.I. Sealants Ltd.

.5 Two Part Urethane Sealant:
To meet specified requirements of CAN/CGSB-19.24-M80, and as recommended by manufacturer for conditions.
Dymeric 240 by Tremco Canada.

.6 One Part Urethane Sealant:
To meet specified requirements of CAN/CGSB-19.13-M82, and as recommended by manufacturer for conditions.
Vulkem 45 SSL by Tremco Canada
Tremco Canada Dymonic FC

.7 Silicone Sealant: One Part Sealant:
To meet specified requirements of CAN/CGSB-19.13-M82. Tremsil 200 by Tremco (Canada) Ltd., or as otherwise approved.

.8 Two Part Polyepoxide Urethane Sealant:
To meet specified requirements of CAN/CGSB-19.24-M80. Dymeric by Tremco (Canada) Ltd.

.9 One Part Polysulphide Sealant:
To meet specified requirements of CAN/CGSB-19.13-M82.

.10 Two Part Polysulphide Sealant:
For use in joints except where subjected to traffic:
To meet specified requirements of CAN/CGSB-19.24-M80, non-sag, with a Shore "A" hardness range of 20 to 35.

.11 Two Part Polysulphide Sealant:
For use at surfaces subjected to traffic:
To meet specified requirements of CAN/CGSB-19.24-M80, self-levelling, with a Shore "A" hardness range of 35 to 40.

.4 **Primer**

Specifically designed for use with sealant compounds on surfaces encountered, and as specified by the compound manufacturer to assure adhesion of compound to prevent staining of substrate materials.

.5 **Sealant Backing (Bedding Material)**

Extruded, foamed, closed cell, round, polyethylene, urethane, neoprene or vinyl rod, 30% greater diameter than joint width, with Shore "A" hardness of 20, and 830 - 900 kPa tensile strength, and manufactured especially for the purpose.

.6 **Void Filler**

Mineral fibre as specified in Section 07200.

.7 **Bond Breaker**

For installation where minimum specified depth of joints is unobtainable. Pressure sensitive plastic tape, 3M 3266 or #481.

## PART 3 - EXECUTION

.1 **Examination**

.1 Before commencing joint sealing, verify at site that joint configuration and surfaces have been provided as specified in other Sections to meet intent of sealant specification; that joint conditions will not adversely affect execution, performance or quality of completed sealed joints; and that they can be put into acceptable condition by means of preparation specified in this Section. If in doubt, verify site conditions together with manufacturer's representative of sealant to be applied.

.2 Ascertain that sealers and coatings applied to sealant substrate are compatible with the sealant used and that full bond between sealant and substrate is attained. Request samples of the sealed or coated substrate from their fabricators for testing of comparability and bond if necessary.

.3 Verify specified environmental conditions are ensured before commencing joint sealing.

.4 Defective sealed joints resulting from application to unsatisfactory joint conditions will be considered the responsibility of this Section.

.2 **Preparation**

.1 Remove loose mortar, dust, oil, grease, oxidation, mill scale, coatings, all other materials affecting bond of compounds to surfaces that sealant compounds must adhere, except for painted surfaces, by brushing, scrubbing, scraping or grinding.

.2 Clean down caulked metal surfaces with clean cellulose sponges or rags soaked in solvent recommended by sealant manufacturer, and wipe dry with clean cloths. Ensure that solvent is not injurious to painted surfaces.

.3 Use method of preparation suitable for substrate as recommended by sealant manufacturer, and that does not damage adjacent surfaces.

.4 Ensure that releasing agents, coatings or other treatments have either not been applied to joint surfaces, or that they are entirely removed.

.3 **Application**

.1 Except where specified in other Sections, seal open joints in surfaces exposed to view, and to make the building weathertight and airtight as applicable; as indicated typically on Drawings, and as otherwise specified. Refer to Article 3.05, Caulking Schedule. Include, but do not restrict it to, sealing the following joints:

.1 Perimeter joints of exterior and interior pressed steel opening frames where installed in masonry and a weathertight joint is otherwise required.
.2 Perimeter joints of exterior and interior aluminum opening frames.
.3 Perimeter joints of exterior louvre and vent frames.
.4 Joints between underside of window sills and walls.
.5 Exposed control joints in masonry walls.
.6 Exposed expansion joints in masonry walls.
.7 Exposed control joints in concrete except for floors.
.8 Exposed expansion joints in concrete.
.9 Raked joints at masonry wall junctions and masonry to concrete junctions.
.10 Interior and exterior exposed joints, between dissimilar materials, and not concealed from view.
.11 Exposed control joints in gypsum/fiber reinforced gypsum panels.
.12 Joints at wall floor junctions, and at floors unless indicated on Drawings.
.13 Full length of exterior door saddles.
.14 Close-fitted space between mechanical and electrical ducts, conduits and pipes, and walls and also at floors where fire separations must be maintained.
.15 Joints between base angle and structure at preformed metal siding.

.2 Prime surfaces to receive sealants as required by substrate and manufacturer's specifications to ensure positive and permanent adhesion, and to prevent staining.

.3 Pack joints tightly with sealant backing set at depth specified for sealant. Fill other voids with filler.

.4 Install bond breaker tape in bottom of joints in lieu of sealant backing where proper depth cannot be obtained when backing is installed.

.5 Maintain depth of sealant as follows for joint widths of
: 6 mm (minimum joint width): joint depth 6 mm.
: 6 to 13 mm: depth equal to joint width.
: 13 to 25 mm: depth equal to 1/2 joint width.
: 25 to 50mm: maximum depth of 13 mm.

.6 Install sealant in joints over 50 mm wide only after consultation with and approval of sealant manufacturer.

.7 Fill joints with sealant compound to specified or indicated depths as indicated. Perform joint sealing in accordance with compound manufacturer's specifications, under his supervision, and using pressure guns and other equipment as approved by him. Finish joints with a full bead so that they are smooth; and free from ridges, wrinkles, air pockets and embedded foreign materials.

.8 Tool surface of joints to a slight concave profile.

.9 Make compounds workable only as manufacturer specifies.

.10 Caulk joints in site painted materials after adjacent surfaces have been painted. Match compound to paint colour.

.11 Do not allow sealants to cover or spot surfaces outside of joints. Use masking tape protection to prevent coating of adjacent surfaces if necessary.

.4 **Cleaning**

.1 Remove sealant smears and drippings, and masking tape immediately on completion of joint sealing.

.2 Do not use chemicals, scrapers, or other tools which would damage surfaces from which excess compounds or drippings are removed. Make good materials damaged by cleaning by the installer of the damaged material and at the expense of this Section.

.3 Instruct Contractor on proper final cleaning methods.

.5 **Caulking Schedule**

.1 **Type 1 Sealant**

One or Two Part Polysulphide Sealant, or
One or Two Part Urethane Sealant, or
One Part Silicone Sealant, or
Use at all locations except where another is specified.

.2 **Type 2 Sealant**

Use at exterior joints between window frames and masonry.

.3 **Type 3 Sealant**

One part Clear Silicone Sealant, mildew resistant.
Use at joints between:

1. Washroom fixtures and wall,
2. Washroom fixtures, water closets and floor,
3. Countertops and wall,
4. Cabinets and walls and adjacent finishes.

**End of Section**

## PART 1 - GENERAL

### .1 Description

#### .1 General Requirements

Division 1, General Requirements, is part of this Section and apply as if repeated here.

#### .2 Work Performed by Other Sections Related to This Section is Specified in

Section 06200: Hanging of Wood Doors
Section 07920: Caulking Frames
Section 08710: Supply of Finish Hardware
Section 09900: Painting and Finishing

#### .3 Installation of Products Supplied by This Section is Specified in

Section 04200: To build anchors/frames in masonry.
Section 06200: To set up frames in masonry openings.
Section 06200: To install hollow metal doors.
Section 09250: To install and anchor frames in drywall partitions.

### .2 Quality Assurance

#### .1 Subcontractor Qualifications

Provide fabrications specified in this Section only by a Subcontractor who has adequate plant, equipment and skilled tradesmen to perform it expeditiously, and is known to have been responsible for satisfactory installations similar to that specified.

#### .2 Requirements of Regulatory Agencies

.1 Construct fire rated doors and frames of ratings indicated in accordance with validating label requirements, otherwise required by jurisdictional authorities.
.2 Ensure hardware and installation meet CAN4-S104 requirements, Standard Method for Fire Tests of Door Assemblies adopted by Insurance Advisory Organization, when applicable.
.3 Doors and frames indicated as labelled, to meet conditions of NFPA No. 80, for installation, and shall have attached ULC labels.

### .3 References

#### .1 Reference Standards

Reference standards quoted in Contract Documents refer to:
ASTM A366-72, Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
ASTM A525-81, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
ASTM A526-80, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

ASTM A780-80, Standard Practice for Repair of Damaged Hot-Dip Coatings.
CGSB Specification 1-GP-132M, Primer, Zinc Chromate, Low Moisture Sensitivity.
CGSB Specification 1-GP-140M, Primer, Red Lead, Iron Oxide, Oil Alkyd Type.
CGSB Specification 31-GP-105M, Coating, Conversion, Zinc Phosphate, for Paint Base.
CGSB Specification 1-GP-181M, Coating, Zinc Rich, Organic, Ready Mix.
CSA Standard G164-M1981, Hot-Dip Galvanizing of Irregularly shaped Articles.

.4 **Submittals**

.1 **Shop Drawings**

Submit shop drawings.

.5 **Delivery, Storage, and Handling**

.1 Brace frame units to prevent distortion in shipment. Protect finished surfaces by sturdy protective wrappings.
.2 Ensure that doors are stored in a secure dry location to ensure they are not damaged until hung. Remove wrappings when finally stored in location secure from damage. Store doors vertically, resting on planks, with blocking between to allow air to circulate.
.3 Repair damage to finishes immediately as it occurs with matching specified finish materials.

## PART 2 - PRODUCTS

.1 **Materials**

.1 **Steel Sheet**

Cold-rolled, stretcher levelled to meet specified requirements of ASTM Specification A366 or SAE Specification 1010: galvanized sheet, commercial quality, to meet specified requirements of ASTM Specification A526.

.2 **Prime Paint**

.1 General: Ensure that primers are compatible with specified finish paint.
.2 Primer: To meet requirements of CGSB Specification 1-GP-132, 1-GP-81, or 1-GP-140.

.3 **Galvanizing**

.1 Full galvanized sheet steel; coating to meet specified requirements of ASTM Specification A525, zinc coating designation Z275.
.2 Wiped coated sheet steel; zinc wiped coating to meet specified requirements of ASTM Specification A525, zinc coating ZF75.
.3 Galvanized accessories; zinc coating to meet specified requirements of CSA Standard G164, including Appendix A.

.4 **Zinc Rich Paint**

To meet specified requirements of CGSB Specification 1-GP-181.

.5 **Panel Insulation**

At exterior: Polyurethane: closed cell rigid board, density; 32 kg/cubic metre.

.6 **Grilles**

E.H. Price, Series STG1, steel, prime painted, sizes as shown on Door Schedule.

.7 **Door Bumpers**

Single stud rubber at interior openings.

.8 **Door Core Materials**

.1 Honeycomb: Structural small cell 25mm (1") maximum Kraft paper 'honeycomb'. Weight: 36.3 (80lb) per ream (minimum). Density: 16.5kg/$m^3$ (1.03pcf) minimum, sanded to required thickness.
.2 Temperature Rise Rated (TRR): Solid slab core of non-combustible, inorganic composite to limit temperature rise on the "unexposed" side of door to 250°C at 60 Minutes to ULC CAN4-S104—M80, ASTM E2074-00e1 or NFPA 252-2008.
.3 Polystyrene: EPS polystyrene, Type 1, density: 16 to 32 kg/m3 (1 to 2 pcf), thermal values: RSI 1.06 (R 6.0) minimum, conforming to ASTM C578-09e1.

.9 **Adhesives**

.1 Heat resistant, single component, polyurethane reactive (water) hot melt, thermoset adhesive.
.2 Rigid insulation cores: Heat resistant, epoxy resin based, low viscosity, contact cement.
.3 Lock seam doors: fire resistant, resin reinforced polychloroprene, high viscosity sealant-adhesive.

.10 **Acceptable Manufacturers**

.1 All Steel Doors 2000 Ltd.
.2 Artek Door (1985) Ltd.
.3 Daybar Industries Ltd.
.4 Fleming-Baron Door Products, an ASSA ABLOY group company.
.5 Trillium Steel Doors Limited.
.6 Vision Hollow Metal Limited.

.2 **Door and Frame Systems**

.1 **Exterior Framing**

.1 2.0 mm thick steel frames, fully welded; minimum 170 mm jamb depth.
.2 Frame sizing shall be of the metric size shown in Door and Frame Schedules.

.2 **Interior Frames**

.1 For Masonry Partitions: 1.6 mm thick welded construction; knocked-down construction where Door and Frame Schedule makes reference to "suit existing construction"; minimum 170mm jamb depth factory welded.
.2 For Drywall Partitions: 1.6 mm thick welded construction; throat size to suit partition.
.3 Frame sizing shall be of the metric size shown in Door and Frame Schedules.

.3 **Doors**

.1 Interior: Wood by 08210.
.2 Door sizing shall be of the metric size shown in Door and Frame Schedule or to suit existing openings.

.3 **Fabrication**

.1 **General**

.1 Fit & assemble fabrication in shop where possible. Make trial assembly in shop when not possible.
.2 Fabricate, reinforce and anchor component parts and assemblies, to support loads usage will impose without deflection detrimental to function, appearance or safety.
.3 Reinforce components to resist stresses imposed by hardware in use.
.4 Prepare frames and doors for specified hardware with mortises, and reinforcement. Drill and tap to template information. Incorporate steel reinforcement of
: 1.6 mm thick flush bolts, locks & strikes.
: 6.4 mm for hinges.
: 4.8 mm for push/pulls and panic devices.
: 2.7 mm thick for surface mounted hardware, and door closer brackets and arms.
.5 Install metal mortar guards of minimum 0.76 mm thick steel at cutouts for hardware in frames installed in masonry walls.
.6 Reinforce all frames for closers.
.7 Provide for anticipated expansion and contraction of frames and supports.
.8 Fit elements at intersections & joints accurately together in true planes, plumb & level.
.9 Weld frame and door assemblies together. Weld continuously at joints exposed to view or at joints through which air or water could penetrate from the exterior of building to the interior.
.10 Where welding is impossible, connections may be bolted. Ream drilled holes and leave exposed edges clean and smooth.
.11 Isolate from each other dissimilar metals, and metal from concrete or masonry or prevent electrolysis.
.12 Ensure that exterior doors and frames are tightly fitted, and drips are installed on frames of out-swinging doors, to prevent entry of water where exposed to weather.

.2 **Pressed Steel Door Frames and Screen Frames**

.1 Supply frames to suit construction conditions and dimensions indicated on drawings and in Door and Frame Schedule.
.2 Schedule of fabrication and delivery must be such that it will not delay the project.
.3 Fabricate interior frames of wipe coat galvanized steel and exterior frames of full galvanized sheet steel.
.4 Fabricate steel frames in minimum thickness of 1.6 mm thick sheet steel unless otherwise specified or indicated.
.5 Use 2.0 mm thick sheet steel for exterior frames.
.6 Minimum frame material thickness applies only to doors not otherwise requiring heavier gauges to meet specified fire rated construction as required by validating underwriter's test.
.7 Fabricate removable stops of minimum 0.91 mm thick steel. Do not weld stop corners.
.8 Install recessed weatherstripping in stops of exterior doors.
.9 Finish frame with one coat of galvanized primer on zinc coated surfaces exposed to view.
.10 Where members join at corners, cut mitres and weld continuously along inside of sections.
.11 Where tubular frame sections meet frame members, join by butt welding.
.12 Attach two 1.2 mm thick steel channel spreaders at bottom of door frames to maintain square alignment, secured to facilitate removal after frames that extend only to finish floor are built in.
.13 Incorporate structural stiffeners for frame members as shown on Drawings. Securely anchor them at bottom and top. Where they extend above ceiling, anchor to concrete or structural framing to suit site conditions.
.14 Install 3 bumpers in interior frames at single opening latch jambs, and 2 at double door frame heads.
.15 Fasten removable stops by countersunk Phillips head screws at approximately 225 mm o.c. symmetrically spaced on stop length.
.16 Anchor frames at floor by 1.5 mm thick angle clips, welded to frame and provided with two holes for floor anchorage.
.17 For frames in masonry walls attach adjustable Tee-anchors fabricated from galvanized steel same gauge as frame. Install anchors on each jamb. Install 3 anchors for openings 2285 mm high.
.18 For frames in stud walls, weld L clip at bottom of frame for anchor to floor slabs.

.3 **Steel Doors and Panels**

.1 Fabricate steel doors and panels to a thickness of 45mm (1-3/4”). Unless indicated otherwise.
.2 Insulated doors and panels:
  .1 Face sheets fabricated from 1.5 mm (0.06”) 16 gauge steel.
  .2 Insulation core: Polystyrene.
  .3 Longitudinal edges mechanically interlocked.
    .1 Adhesive assisted with edge seams visible.
.3 Interior doors and panels:
  .1 Face sheets fabricated from 1.5 mm (0.06”) 16 gauge steel.
  .2 Honeycomb core.
  .3 Longitudinal edges mechanically interlocked
    .1 Adhesive assisted with edge seams visible.

.4 Temperature rise rated doors and panels:
- .1 Face sheets fabricated from 1.3mm (0.05") 18 gauge steel.
- .2 TRR asbestos free core.
- .3 Longitudinal edges mechanically interlocked.

.5 Fabricate of composite metal face construction with each face formed from flush sheet steel without visible seams, free of scale, pitting, coil brakes, buckles and waves.

.6 Formed edges shall be true and straight with minimum radius for the thickness of steel used.

.7 Lock and hinge edges shall be bevelled 3 mm in 50 mm (1/8" in 2") unless hardware or door swing dictates otherwise.

.8 Top and bottom of doors shall be provided with inverted, recessed, 1.5mm (0.06") 16 gauge steel end channels, welded to each face sheet at 50 mm (2") on centre maximum.

.9 Prior to shipment, mark each door with an identification number as shown on the approved submittal drawings.

.10 Exterior doors shall be provided with factory installed flush PVC top caps. Fire labelled exterior doors shall be provided with factory installed flush steel top caps.

.11 Blank, reinforce, drill and tap doors for mortised, templated hardware. Locate to manufacturer's standard unless indicated otherwise.

.12 Holes 12.7mm (1/2") and larger shall be factory prepared.

.13 Glazing:
- .1 For glazing materials up to and including 8 mm (5/16") thick, doors shall be provided with 1 mm (0.04") 20 gauge steel glazing trim and snap-in glazing stops.
- .2 For glazing materials greater than 8 mm (5/16") thick, doors shall receive 1 mm (0.04") 20 gauge steel trim and screw fixed glazing stops. Screws shall be #6 x 32mm (1 ¼") oval head Tek™ (self-drilling) type at 305 mm (12") on centre maximum.
- .3 Glazing trim and stops shall be accurately fitted (within 0.39 mm (0.015") tolerance), butted at corners, with removable glazing stops located on the 'push' side of the door.

.14 Fabricate closing stiles of paired doors as indicated or scheduled.

.15 Where indicated in schedule, prepare doors and panels for installation of fire-rated door grilles. If required to meet door grille manufacturer's rated design, provide reinforcement around door grill opening.

## .4 Finishing

.1 File and grind exposed welds smooth so that assemblies have appearance of one piece construction. Fill depressions with metal filler and finished

.2 For primed surfaces, clean, scrape and remove rust, mill scale, grease and other surface deposits from steel following fabrication. Apply full smooth coat of primer in shop. Force paint into corners and open spaces.

.3 For surfaces with zinc coating, clean and smooth ground surfaces at welds, fill if necessary, and coat all areas from which galvanizing has been removed with zinc rich paint coating of 0.1 mm minimum.

## PART 3 - EXECUTION

.1 **Examination**

.1 Take field dimensions of construction into which fabrications of this Section are incorporated before they are fabricated. Field adaption of work fabricated in error or without field check will not be allowed without approval.

.2 **Installation**

.1 **Pressed Steel Frames**

.1 Setting up of pressed steel frames in masonry walls is included in Section 06200.
.2 Building in of pressed steel frames is included in Section 04200 of Specification.
.3 Setting up and building in of pressed steel frames in metal stud drywall partitions is included in Section 05500 and Section 09250.
.4 Secure frames to floor construction with two fasteners each jamb, set and brace securely to maintain true alignment until built in.

.3 **Adjustment and Cleaning**

.1 Refinish damaged and defective fabrications before completion. Refinish exposed surfaces to ensure that no variation in appearance is discernible.
.2 Clean surfaces in preparation for specified finishing at completion of installation.
.3 Final cleaning is specified in Section 01710.

**End of Section**

## PART 1 - GENERAL

.1 **Description**

.1 **General Requirements**

Division 1, General Requirements, is a part of this Section and shall apply as if repeated here.

.2 **Work Related to this Section Performed by Other Sections**

Section 08520: Aluminum Windows

.3 **Work Performed by this Section but Specified Elsewhere**

Section 07920: To specify joint sealants.
Section 08800: To specify glazing.

**.2 System Description**

.1 **Tolerances**

.1 Fabricate frames to a tolerance of + 1.5 mm for vertical, horizontal, and diagonal dimensions of units under 1830 mm, and + 3 mm for dimensions greater than 1830 mm.
.2 Erect component parts within following tolerances
: Variations from plumb:
3 mm maximum variation in storey height or 3 m run, cumulative
: Variations from level:
3 mm maximum variation in any bay or 6 m run, non-cumulative
: Variations from theoretical calculated plan or elevation location related to established floor lines, column lines and other fixed elements of the structure, including variations for plumb and level:
: Offsets in end-to-end or edge-to-edge alignment of adjoining members:
1.5 mm maximum offset in any alignment.
.3 Maintain tolerances for glazing as recommended by glass manufacturer.
.4 Maintain locations of mullions related to, and within installed tolerances, of ceilings of walls as indicated on Drawings. Verify location of ceiling grid at each floor.

.2 **Design**

.1 The entire exterior skin execution shall be based on the rain screen principle.
.2 The system shall provide:
: Such gaskets, baffles, overlaps and seals as required to provide a rain screen barrier to effectively deter rain water entry into cavities.
: The necessary air seals to eliminate air passage from system cavities into the building and vice versa, and to assure adequate pressure equalization of the system cavities with the outside.
.3 The air and vapour seals required to eliminate air borne vapour infiltration from the building into the system cavities.
.4 Openings between cavities and outside shall be of sufficient cross section to provide pressure equalization. All openings must be effectively baffled to minimize direct water entry.
.5 Thermally, the grid members shall have a resistance to heat transfer equal to or better than that of the area along the bottom of the sealed glass units.

.3 **Structural Requirements**

.1 Entrances must withstand a minimum windload of (30 psf) 1500 Pa with a maximum deflection of span/200.

.4 **Performance**

.1 Air infiltration shall exceed 3.05 to the power of negative four cu.m/s/sq.m. of exterior surface at 75 Pa pressure difference.
.2 There shall be no water infiltration into the building under 50% of design wind load.
.3 No condensation shall form on any interior surfaces of the aluminum members before any of the exposed area of the 25 mm sealed units reaches the dew point temperature.

**.3 Quality Assurance**

.1 **Glazing Requirements**

Conform to recommendations of Flat Glass Marketing Association (FMGA), Glazing Manual 1980 (GM) and Glazing Sealing Systems Manual 1970 (GSSM).

.2 **Subcontractor Qualifications**

Perform Work of this Section only by a Subcontractor approved by one of the systems manufacturers approved for this Project and who has adequate plant, equipment and skilled tradesmen to perform it expeditiously and is known to have been responsible for satisfactory installations similar to that specified during a period of the immediate past five years.

Approved Suppliers:
Kawneer
Windspec Inc.
Alwind Ltd.
Alumicor

.3 **Welder Qualifications**

Perform welding of structural components only by fabricators certified by Canadian Welding Bureau to CSA welding qualification codes; CSA Standard W47.1 for welding of steel, and CSA W47.2 for welding of aluminum.

.4 **Requirements of Regulatory Agencies**

Conform to requirements of authorities having jurisdiction in the fabrication and installation of components specified in this Section.

.5 **Codes and Standards**

Except as modified by governing codes and by the Contract Documents, comply with applicable provisions and recommendations of the following:
.1 CSA W47.2-M1987 for welding of aluminum.
.2 CSA W59-M1989 for welding of steel.
.3 AAMA Aluminum Curtain Wall Design Manual.

**.4 References**

.1 **Reference Standards**

Reference standards quoted in Contract Documents refer to:
ASTM A167-81a, Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
ASTM A480-81, Specification for General Requirements for Flat Rolled Stainless and Heat Resisting Steel Plate, Sheet and Strip.
ASTM A525-76, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
ASTM A780-80, Standard Practice for Repair of Damaged Hot-Dip Coatings.
CGSB Specification 41-GP-19Ma, Rigid Vinyl Extrusions for Windows and Doors.
CGSB Specification 79-GP-1M, Screens, Aluminum Frame, Window.
CGSB Specification 1-GP-108M, Paint, Acid and Alkali Resistant, Black.
CGSB Specification 1-GP-132M, Primer, Zinc Chromate, Low Moisture Sensitivity.
CGSB Specification 1-GP-181M, Coating, Zinc Rich, Organic, Ready Mix.
CAN/CSA3-G40.20/G40.21-M92, Structural Quality Steel.
CSA Standard G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
CSA Standard W47.1-92, Certification of Companies for Fusion Welding of Steel Structures.
CSA Standard W47.2-M1987, Aluminum Welding Qualification Code.
CSA Standard W59-M1989, Welded Steel Construction (Metal Arch Welding).

**.5 Submittals**

.1 **Shop Drawings**

.1 Submit shop drawings showing and describing in detail system assemblies, including: large scale details of members and materials, of brackets and anchorage devices, and of connection and jointing details, fully dimensioned layout for positioning of brackets and anchorage devices to structures; dimensions, gauges, thicknesses; glazing details, description of materials, including catalogue numbers, products' and manufacturers' names; aluminum alloy and temper designations, metal finishing specifications; and degree of torquing required for bolted connections; and other pertinent data and information.

.2 Shop Drawings shall contain the minimum following details:
: jamb, head and sill of units at junction of wall faces, including air vapour seal
: structure required for system that is supplied with system and not part of building structure
: anchorage system
: dielectric separator details
: separator/slip gasket details
: thermal separator details
: flashing details

.2 **Samples**

.1 Submit samples of unit frame profiles, glass and glazed sample assembly prior to fabrication of units. Sample acceptance will be for colour, appearance, glazing methods only.

.2 Submit samples for each finish and colour required. Submit samples finished on the specified alloy on 600 mm lengths of extrusions or 600 mm square of sheet or plate, showing maximum range or variation in colour and shade, and matching the Architect's samples in each case. Sample submittals and acceptance shall be for colour, texture and specular gloss.

.3 **Maintenance Instructions**

Submit maintenance instructions for incorporation into Project Data Book.

**.6 Delivery, Storage and Handling**

.1 Suitable storage at site shall be provided by the Contractor. Parts shall be stored in this area to permit natural ventilation over their finished surfaces.
.2 Under conditions of high humidity, heating or forced ventilation shall be provided to prevent the accumulation of surface moisture.
.3 Deliver, handle and store units by methods approved by manufacturer. Store units at site on wood platforms raised above grade or in enclosures protected from elements and corrosive materials, and with resilient pads provided for full bearing support of frame. Stack units vertically in manner to prevent racking. Do not remove from crates or other protective covering until ready for installation.
.4 Protection of this work shall be the responsibility of this Section and the methods used shall be agreed with the Contractor.
.5 Do not permit foreign materials such as splashing of concrete, mortar, plaster or paint, which could damage the finish, to remain on the surface of aluminum work. All materials of this nature must be immediately removed, and where conditions are such that this will not be possible, the exposed surface of aluminum exposed to abuse shall be protected by removable aluminized vinyl protection throughout the period that work proceeds on the building. The protective materials must be carefully removed on completion of the building, and in such a manner that no damage occurs to the aluminum finish.

**.7 Warranty**

.1 **Extended Warranty**

.1 Warrant installation specified in this Section covering the period for four years beyond the expiration of the warranty period specified in the General Conditions to the Contract.
.2 Without restricting the generality of the warranty, defects shall include failure to maintain true lines, plumbness and weather tightness under all conditions.

.2 Promptly remedy defects and/or failures upon written notification that such exist. Remedy shall include labour, materials, equipment and services required to make good defective work, and to replace such work, without removal of non-defective work, and to make good any work, components and finishes and Owner's property damaged or disturbed in course of remedying defects and/or failures.

## PART 2 - PRODUCTS

**.1 Materials**

.1 **Aluminum**

.1 Extrusions: AA6063-T5, alloy and temper for framing, and otherwise where not exposed to suit specified and fabricator's requirements.

.2 Exposed Anodized Sheet and Plate: AA 5005-H14, alloy and temper, or AA 1100-H14, anodizing quality.

.3 Exposed sheets where painted: AA100-H14, alloy and temper.

.4 Non-exposed sheets: AA3003-H14, aloy and temper, mill finish, or Alcan "Utility Sheet".

.5 Exposed surfaces of aluminum shall be free of die marks, scratches, blisters, "leave-off" marks, or other blemishes which are visible.

.2 **Steel**

.1 Steel Framing: To meet specified requirements of CSA Standard G40.21, Grade 300W for rolled sections and Grade 350, Class H, for hollow sections.

.3 **Stainless Steel**

ASTM Specifications A480-81, and A167-81a, Type 304.

.4 **Finishes**

Anodic clear coating, Architectural Class 1, AA-M12C22A41 (.0007")

.5 **Glass**

To meet specified requirements of Section 08800; 25 mm sealed insulating units and as specified herein.

.6 **Glazing Gaskets**

Either neoprene of EPDM (ethylene propylene diene monomer) with dimensional tolerances and durometer hardness and of suitable size and shape to meet requirements of the specifications and their specific application. Gaskets shall be virgin material as manufactured by Tremco Manufacturing Company (Canada) Limited or other approved manufacturer. Gaskets shall conform to Tremco Information Bulletins:
For EPDM - TDB-460-1 or equal.
For Neprene - TDB-270-1 or equal.

.7 **Glazing Tape**

Polyisobutylene, with continuous molded-in synthetic rubber shim, in colour selected, Polyshim Tape by Tremco (Canada) Limited, or equivalent as approved.

.8 **Sealants and Sealant Materials**

To meet specified requirements of Section 07920 and design performance requirements.

.9 **Fastenings**

Stainless steel, Type 300 series, or double cadmium plated steel, selected to prevent galvanic action between fasteners and components fastened. Where exposed in finished surfaces, use oval-head countersunk Phillips head screws with shank diameter one screw size smaller than the diameter of holes in fastened material, and colour to match adjacent surfaces.

.10 **Exposed Anchors**

Aluminum or stainless steel with aluminum materials; and otherwise to match metal anchored. Non-exposed: as for exposed or may be galvanized steel.

.11 **Bituminous Paint**

To meet specified requirements of CGSB Specification 1-GP-108.

.12 **Separator/Slip Gaskets**

Nylon as suitable for connection detail at moving faces of connections.

.13 **Thermal Separator**

Solid extruded and thermally resistant sections with a durometer hardness of Shore "A" 50, ±5.

.14 **Supporting Angles, Plates, Bars, Rods and Other Steel Accessories**

.1 Mild steel CAN3-G40.21-M78, thickness as required to sustain imposed loads and in no case less than 4.8mm thick.
.2 Galvanize steel after fabrication where installed on exterior side of vapour retarder/air barrier. Prime paint steel where installed on interior side of vapour retarder/air barrier.

.15 **Thermal Insulation**

.1 Rigid glass fibre board, AF530 wall insulation manufactured by Fiberglas Canada Inc. in thickness indicated on Drawings with black coating on outer surface.
.2 Loose Insulation: Glass fibre, density of 12 kg/cu.m., by Fiberlgas Canada Inc.
.3 **Foam Insulation**
.1 One or two part, polyurethane, with a nominal density of 40 kg/m$^3$, coefficient of linear expansion of 0.00006 mm/m/°C, water vapour transmission of 73 Ng/Pa5m$^2$ and thermal conductivity of 0.02 W/m°K.
.2 Similar to products as produced by BASF Canada Inc.

.16 **Hardware**

Refer to Section 07810.

**.2 Products**

.1 Specified manufacturers' catalogue references to Alumicor Inc. establish the minimum standards for the products listed in this Section.
.2 Unspecified materials which form a part of completed assemblies shall be of manufacturers' standard.
.3 Products of the following manufacturer are considered as acceptable alternatives, provided that they meet the minimum requirements of the products listed and must submit technical literature, samples, drawings and performance data for comparison:
Kawneer
Windspec Limited
Alwind Industries

.4 **Screens and Framing**

.1 Framing: 2200 Series by Alumicor.
.2 Finish:
: exterior: clear anodized
: back sections: clear anodized
.3 Glazing: 25mm insulating glass units at exterior locations; Type 2.
.4 Sills: extruded aluminum, with concealed anchor system or hold down clips, colour and finish to match framing.
.5 Style: Combination of mullion depths, glazing rebates and caps as required by Drawings, and including door stops and cut pile weatherstripping.

.5 **Hinged Doors**

.1 Type: series 2200 thermally broken entrance framing by Alumicor. Refer to drawings for dimensions of bottom, mid and top rails and stiles.

.2 Glass: 25mm insulating glass units at exterior locations.
.3 Finish:
: clear anodized.
.4 Threshold: Extruded aluminum, clear finish, 12mm riser, overall width to match frames.
.5 Weatherstripping: Cut pile weatherstripping and adjustable door bottoms for exterior doors.
.6 Door Sweep: KN Crowder W-24S628.
.7 Hinges: continuous, heavy duty Rotun hinge

**.3 Fabrication**

.1 Ensure glazing rebate provided with depth and width to accommodate specified glass in accordance with glass manufacturer's recommendations. Install glazing gaskets anchored to aluminum extrusions.
.2 Provide structural support for air barrier tie-in.

.3 **Framing Members**

.1 Fabricate generally to dimensions/profiles indicated on drawings. Meet specified requirements and clearances to other construction components.
.2 Reinforce members and joints with steel plates, bars, rods or angles for rigidity and strength as needed to fulfill performance requirements. Use concealed stainless steel fasteners for jointing that cannot be welded.
.4 Provide glass setting, supports and stops to minimize posibility of glass breakage caused by structural inadequacy of frames, stops and frame joints, solar and thermal induced forces, within limitations of specfified design performance criteria, as recommended by glass manufacturer.
.5 Design system to ensure that site glazing may be performed in accordance with construction scheduling within environmental limitations specified in Section 08800.

.4 **Assembly of Units**
.1 Join members by welding where specified and otherwise where practicable.
.2 Join members where specified, and otherwise where welding is impracticable, by mechanical methods. Reinforcement or fasteners visible on faces of members where exposed to view will not be acceptable.

.3 Weld with electrodes and by methods recommended by the base metal manufacturer, and in accordance with CSA Standards W47.1, W47.2 and W59 as applicable, and to avoid distortion or discolouration of exposed faces. Make welds continuous unless otherwise shown. Grind exposed welds flush, to match adjacent metal.

.4 Join members in shop fabricated units to fit flush with hairline joints.

.5 Incorporate weepholes to drain off pocketed water. Baffle to prevent entry of driven water to conform to specified performance.

.6 Except where shipping makes impossible, fabricate units in shop and ship completely assembled.

.5 **Vapour Retarder and Air Barrier**

Maintain integrity of vapour retarder and air barrier system within systems installed by this Section and between systems and adjoining construction.

.6 **Dissimilar Materials**

.1 Protect material from electrolytic action when dissimilar metals are in contact with one another with two coats of bituminous paint or other approved means.

.2 Protect aluminum concealed in contact with masonry with two coats of biuminous paint.

.7 **Anchors**

.1 Incorporate anchorage to structure to support units adequately when subjected to specified loads.

.2 Allow for complete adjustment in anchorage for levelling and positioning of units during installation.

.8 **Doors**

.1 Fabricate doors with stiles and rails of extruded aluminum with major portions of 3mm minimum thickness.

.2 Join stiles to rails with sigma deep penetration welds and mechanical fastening.

.3 Provide flush glazing.

.4 Incorporate weatherstripping.

.5 Provide for master-keyed lock cylinders.

.9 **Fastenings**

.1 Where fastenings are exposed to dampness or moisture, use cadmium plated steel for steel-to-steel, aluminum for aluminum-to-aluminum, and stainless steel otherwise or alternatively for all above.

.2 Where fastenings are not exposed to dampness or moisture, cadmium plated steel may additionally be used for all combinations of metals noted in immediately preceding sub-paragraph.

.10 **Thermal Movement**

Fabricate exterior units and assemblies to provide for expansion and contraction of component members and between units when subjected to surface temperatures from -34 deg.C to 82 deg.C.

.11 **Mullions**

Fabricate mullions to provide for specified thermal movement without damage to adjacent units.

.12 **Dissimilar Materials**

.1 Protect material from electrolytic action when dissimilar metals are in contact with one another.
.2 Protect aluminum concealed in contact with masonry with a heavy coating of bituminous paint.

.13 **Anchors**

.1 Incorporate anchorage to structure for units at sills, heads and jambs on 450mm centres generally, and to support units adequately when subjected to specified loads.
.2 Allow for complete adjustment in anchorage for levelling and positioning of units during installation.

.14 **Attachment of Hardware**

.1 Match hardware fastenings to metal of hardware.
.2 Attach hardware by bolts or machine screws into tapped reinforcing plates.

.15 **Weatherstripping**

.1 Secure weatherstripping in place by mechanical means only, and in a manner to enable its removal and replacement without special tools.
.2 Ensure that continuity of weatherstripping is maintained around openings.
.3 Install adjustable metal backed pile cloth weatherstripping recessed in stiles at jamb locations provided with latches and butt hinges, and in top rails of doors.
.4 Install adjustable sweeps at bottom rails of doors.

.16 **Thermal Break**

.1 Incorporate a thermal break in frames in which insulating glass units are installed.

.17 **Finishing**

.1 For surfaces with zinc coating, clean and smooth ground surfaces at welds and prime areas from which zinc has been removed with a coating of zinc rich paint of minimum 0.102 mm thickness. Immediately following damage to galvanized protection prepare and repair surfaces to meet specified requirements of ASTM Specification A780.

## PART 3 - EXECUTION

### .1 Examination

.1 Take critical site dimensions to ensure that adjustments in fabrication or installation are provided for, that allowance is made for possible deflection of structure at heads, and that clearances to other construction have been maintained.

.2 Ensure that anchors and inserts, installed by others, are adequate to meet specified requirements, and make adaptations before installation.

## .2 Installation

### .1 General

.1 Coordinate fabrication of components specified in this Section with requirements of other Sections to ensure proper anchorage and fitting.

.2 Install components and units plumb, level and in accordance with shop drawings, by qualified experienced tradesmen and to conform to fabricator's instructions at location of testing and at site.

.3 Do not force units into place, nor superimpose on them loads for which they were not designed.

.4 Install vapour retarder and air barrier to ensure complete continuity and integration of vapour retarder and air barrier system.

.5 Provide structural support for air barrier to prevent its displacement or its loss of seal when subjected to forces specified for design performance.

.6 Install metal flashing to drain cavities in system. Secure flashings permanently to prevent displacement, leaks, and noise.

.7 Provide for thermal movement to take place between shop fabricated assemblies and between assemblies and adjacent construction.

.8 Secure units by non-corrosive anchorage materials. Use of wood or fibre is not acceptable.

.9 Conceal anchors, clips, blocking, and all other attachments.

.10 Install reinforcing and supporting members as indicated and required structurally as part of the work of this Section.

.11 Seal metal-to-metal joints between components included in the work of this Section to ensure a weathertight assembly, and in accordance with sealant manufacturer's specifications.

.12 Install insulation where aluminum is exposed to the exterior to ensure that thermal conductance to interior of building is no more than thermal conductance of insulating glass units.

.13 Install units with consideration for finish variations. Abrupt variations of appearance or colour in adjacent components wil not be acceptable without approval before installation.

.16 Coat all damaged prime painted surfaces of anchorage with rust inhibiting paint after welding is completed.

.17 Apply two coats zinc rich paint to metal surfaces bared by removal of galvanizing.

.18 Apply one coat of prime paint to metal surfaces bared by removal of shop applied primer.

### .2 Welding

.1 Perform welding in accordance with CSA Specification W59-1977. Exercise care during welding to minimize effect of welding heat. Design welds to prevent tearing at end of welds which could cause a progressive failure.

.2 Detailed welding procedure covering specified welds on erection and shop drawings may be requested for approval by the Consultant.

.3 Take precautions during welding to prevent damage or staining of adjacent surfaces.

.4 Remove prime paint from surfaces to be welded.

.3 **Caulking**

Caulk joints between frame members and sills and adjacent construction as a part of the work of this Section and in accordance with Section 07920 of the specifications.

.4 **Glazing**

.1 Install glass in units, as part of work of this Section and in accordance with Section 08800 of these specifications. Include manufacturer's standard glazing components to create prime seals.

## .3 Adjustment and Cleaning

.1 **Adjusting**

.1 Adjust doors to operate smoothly and fit tightly when closed and locked.
.2 Adjust hardware to operate smoothly, with proper tension and lubricate.
.3 Ensure that weatherstripping does not cause binding to prevent closing and locking, and that it makes weathertight contact.
.4 Adjust closers after doors are glazed, and other hardware and vestibule doors are installed.

.3 **Cleaning on Completion of Installation**

.1 Remove deposits which affect appearance or operation of units.
.2 Remove protective materials.
.3 Clean interior and exterior surfaces by washing with clear water; or with water and soap or detergent; followed by a clear water rinse.
.4 Clean and restore stained metal surfaces in accordance with manufacturer's recommendations. Replace if cleaning is impossible.
.5 Final cleaning is specified in Section 01710.

## .4 Protection

.1 Immediately upon completion of installation, suitably protect vulnerable edges, and exposed corners and surfaces. Protection shall prevent damage by mortar, paint or other hazards from the work of other trades.
.2 Protect prefinished surfaces of metal with protective coatings or wrappings to remain in place until construction completion. Use materials recommended by finishers or manufacturers of metals to ensure that method is sufficiently protective, easily removed, and harmless to finish.
.3 Remove protection from metal glazing surfaces before installation of glass.
.4 Maintain protection from time of installation to final cleanup in accordance with Sections 01040 and 01500.

**End of Section**

## PART 1 - GENERAL

### .1 Description

#### .1 General Requirements

Division 1 and General Requirements, is a part of this Section and shall apply as if repeated here.

#### .2 Work performed by other Sections Related to this Section is specified in

Section 06410: Cabinet hardware as specified by schedule.

#### .3 Hardware Specified This Section, Supplied Only, Installed by Other Sections

Section 06200: Finish Carpentry: To install hardware other than as specified.

.4 Selected hardware supplier will become a Subcontractor of the Contractor.

### .2 Quality Assurance

.1 Requirements of Regulatory Agencies:
Install only ULC or ULI listed hardware for fire rated doors and frames.

### .3 Submittals

#### .1 Samples

Submit samples of each hardware item.

#### .2 Templates

Submit templates to Contractor for use by installers and fabricators as required for proper location and installation of hardware.

#### .3 Maintenance and Operating Instructions

Submit maintenance, operating and installation instructions for installation purposes and for incorporation in Project Data Book.

### .4 Delivery, Storage, and Handling

.1 Package hardware and label with description of contents and installation location. Refer to hardware list designation, and with door number when applicable.
.2 Deliver hardware to location at building site designated by Contractor.

### .5 Warranty

#### .1 Extended Warranty

.1 Warranty contained in GC24 is, with respect to Section 08710, extended from 1 year to 5 years.

.2 Contractor hereby warrants that system is suitable for use in this type of installation.

.3 Contractor shall arrange with Architect and/or Owner, about 1 month before warranty expires, to visit site, examine the hardware, and make necessary repairs. Should Contractor fail to make such arrangement through no fault or neglect of Owner or Architect, then period of warranty shall extend to one month after such arrangement is made.

## PART 2 - PRODUCTS

### .1 Products

.1 Finish hardware fabricated of same materials shall have consistent colour and finish throughout Project.

.2 Supply with specified hardware screws, bolts, expansion shields, inserts, and other items and parts required for complete installation and functioning.

.3 Reference Hardware Group List for types of hardware used on this project.

## PART 3 - EXECUTION

### .1 Examination

.1 Before supplying materials, ensure by a check of Drawings, shop drawings and details prepared for the Project, that listed hardware is suitable by dimension and function for intended purpose. Inform Architect of discrepancies.

### .2 Installation

.1 Provide instructions required for preparation of doors and frames to the appropriate fabricators.

.2 Provide instructions required for installation of hardware to Section 06200, and other Sections as applicable.

.3 Provide assistance and supervision of installation when requested.

### .3 Adjustment

.1 Verify that installed hardware functions properly, and instruct installers accordingly of requirements and procedures for adjustments to ensure satisfactory operation.

**End of Section**

## PART 1 - GENERAL

### .1 Description

.1 General Requirements

Division 1, General Requirements, is a part of this Section and shall apply as if repeated here.

.2 This Section specifies work which shall be performed by:

Section 08440: Aluminum Framed Glazing Systems

### .2 References

.1 Reference Standards

Reference Standards quoted in Contract Documents refer to:
CAN/CGSB-12.20 - M89
CAN/CGSB-12.1-M79, Glass, Safety, Tempered or Laminated.
CAB/CGSB-12.3-M76, Glass, Polished Plate or Float, Flat, Clear.
CAN/CGSB-12.8-M76, Insulating Glass Units.
CAN/CGSB-12.10-M76, Glass, Light & Heat Reflecting
CGSB Specification 19-GP-5M, Sealing Compound, One Component, Acrylic Base, Solvent Curing.
CAN/CGSB-19.13-M82, Sealing Compound, One Component, Elastomeric, Chemical Curing.
CAN/CGSB-10.24-M80, Sealing Compound, Multi-Component, Chemical Curing.

### .3 Submittals

.1 Submit Samples in accordance with section 01300
.2 Submit two 216 mm x 280 mm samples of each specified type of glass, including tinted glass.

### .4 Site Conditions

.1 Environmental Conditions

.1 Proceed with glazing only when glazing surfaces are accumulating no moisture from rain, mist of condensation.
.2 When temperature of glazing surface is below 4°C, obtain approval of glazing methods and protective measures which will be used during glazing operations.

### .5 Warranty

.1 Extended Warranty, Insulating Glass Units

.1 Warrant insulating glass covering the period for four years beyond the expiration of the warranty period specified in the General Conditions to the Contract.
.2 Without restricting the generality of warranty, defects shall include
: warping of spacer blocks;
: dust or film of fogging formation on internal glass surfaces resulting from any cause except glass breakage;
: glass breakage except form impact by solid objects, or cause by failure of unit edge binding or of framing within limitations of specified performance criteria.

.3 Contractor agrees to make good defects and replace defective units. Replacement shall include removal of defective unit and installation of replacement unit. Fogging of glass inside sealed units will be considered sufficient evidence of loss of seal.

## PART 2 - PRODUCTS

### .1 Materials

.1 Label each piece of glass, and each container of glazing compound or sealant to indicate manufacturer, type, and quality. Leave labels on glass until final cleaning.

.2 Glass:

.1 Single Glazed Interior Units

.1 Warm edge,
.2 IGMAC Certified.
.3 Float
.4 Glass Thickness: 13mm minimum or as required to meet design requirements.
.5 Glass Type: Tempered as required to meet design requirements.

.3 Glazing Accessories

.1 Glazing Gaskets: Preformed, EPDM, Silicone comapatible, to ASTM C864 and ASTM C1115. Eternaflex by Gibson-Homans Co., Parlfex by Parr Sealants, 303 Glazing Tape by P.T.I. Sealants Limited, or Tremco 440 by Tremco (Canada) Ltd.
.2 Setting Blocks: Neoprene, of durameter hardness of Shore "A" 40 to 50.
.3 Spacer Shims: Neoprene, of durameter hardness of Shore "A" 40 to 50.
.4 Safety Film: 14 mil. Security Film, Armourcoat Glass Guard as supplied by Ultimate Reflections - Contact: Scott Hagle (519)476-8584 or (519)690-2636.
.5 Glass Clamps: CRL - Z series glass clamps 10mm - 12mm glass thickness. Brushed Nickle as supplied by C.R. Laurence.

.4 Glazing Sealants

.1 Any of the following specified sealants as utilized for approved glazing system will be acceptable.
.2 Incorporate sealants as incorporated in manufacturer's standard glazing systems as approved.
.3 Ensure that glazing sealants are completely compatible with insulating glass unit sealants.
.4 One Part Acrylic Glazing Sealant: To meet specified requirements of CGSB Specification 19-GP-5, in glazing hardness grade.
.5 One Part Silicone Glazing Sealant: To meet specified requirements of CAN/CGSB-19.13-M82, in glazing hardness grade.
.6 One Part Polysulphide Glazing Sealant: To meet specified requirements of CAN/CGSB-19.13-M82, in glazing hardness grade.
.7 Two Part Polysulphide Sealant: To meet specified requirements of CAN/CGSB-19.24-M80, in glazing hardness grade.

## PART 3 - EXECUTION

### .1 Installation

.1 General

.1 Install materials in accordance with manufacturer's specification, and ensure that each material in a glazing system is compatible with the others.
.2 Ensure that projections have been removed from rebates and that sufficient width and depth clearances are provided for specified glass.
.3 Remove stops and store during glazing to avoid damage to them.
.4 Remove excess glazing sealants from adjacent surfaces, including glass, during working life of material, and by methods not harmful to the surfaces.
.5 Collect broken glass and cuttings in boxes and remove from site.
.6 Do not set any glass without glazing beds or gaskets.

.2 Glass

.1 Install glass in thicknesses to comply with Ontario Building Code requirements.
.2 Cut glass to fit openings and to allow clearances which will ensure that glass is held firmly in place and is not subjected to stresses.
.3 Ensure that glass edges are clean cut, not nipped or seamed.
.4 Do not cut or nip tempered glass to fit. Replace oversize or flared lights with entirely new units of proper dimensions.

.3 Glazing Preparation and Methods

.1 Clean glazing rebate surfaces of all traces of dirt, dust, or other contaminants.
.2 Use glazing sealants without addition of thinners and from only containers with seals unbroken until opened for use.
.3 Prime all glass rebates for materials affected.
.4 When glazing commences, arrange for the presence of a technical representative of the glazing materials manufacturer to advise on procedures and methods.
.5 Ensure that glazing sealants and tapes are in full contact with glazing surfaces.
.6 Tool gunned sealants with a slight bevel away from glass faces.

.4 Positioning Glass

.1 Support glass, in lights of over 2540 mm perimeter, by two setting blocks, one at each quarter point of each light.
.2 Center glass in rebates. Use spacer shims in lights of over 2540 mm perimeter. Set shims on all four sides of lights at a maximum of 300 mm from the ends and 600 mm o.c. in between.
.3 Set shims to allow a space of no less than 6 mm between shim edges and sight lines.
.4 Spacer shims are not required where glazing tape is used.

.5 Bedding at Fixed Stops

.1 Apply sealants in sufficient beads that when glass is pressed into place they ooze out slightly.
.2 Cut tapes of full depth of stop accurately to length on a work table. Set sill and head tapes first at full length of rebated opening. Butt jamb tapes into sill and head tapes tightly to weld them together. Remove protective paper backing only when glass is ready for setting, and ensure that butted joints of tape are positively filled with applied sealant.

.3 Cut tapes accurately to length on a work table and install in a width less than stop height, so that tape edges are held 5 mm behind sight lines. Set sill and head tapes first at full length of rebated opening. Butt jamb tapes into sill and head tapes tightly to weld them together. Remove protective paper backing only when glass is ready for setting, and ensure that butted joints of tape are positively filled with applied sealant. After glass is set, fill void over top of tape to sight line by gunning in topping sealant.

.4 Apply heel beads of sealant between edges of glass and frame, except at insulating or heat absorbent glass exceeding 2540 mm perimeter. Fill voids entirely with heel bead, and to ensure a minimum bite on glass of 5 mm.

.5 Apply heel beads at insulating and heat absorbing glass, at lights exceeding 2540 mm perimeter to fill entire voids under glass at sills and for slight distance up each jamb, and at remaining perimeter of lights, in a bead only partially filling void and into which removable stops are set. Ensure a minimum 5 mm bite on glass at each heel bead.

.6 Bedding at Stop Beads

.1 Apply sealants to glazing face of stop. Press stops into place using spacer shims, and tool sealant at a slight bevel away form glass face. Fasten stops if design requires.

.2 Apply tape to removable stops as specified for fixed stops and with top of tapes held 5 mm behind sight lines. Press stops into place and fasten if design requires. Fill void over top of tape to sight line by gunning in topping sealant, and tool to slight bevel away from glass face.

## .2 Adjustment and Cleaning

.1 Replace scratched, etched, or defective glazing resulting from manufacture, setting, handling, or storage before or during installation. Glass accidentally broken or physically damaged, by other than faulty glazing or materials, after glazing by this Section has been completed shall be replaced as specified in Section 01710.

.2 Final cleaning of glass is specified by Section 01710.

.3 Remove stains, deposits, marks or blemishes caused by this Section from surfaces of all materials exposed to view. Replace materials that cannot be cleaned to appear as new.

## .3 Protection

.1 Following glazing, mark each light of glass, except heat absorbing, to indicate its presence with a material, easily removable and harmless to glass.

**End of Section**

## PART 1 - GENERAL

1. **Description**

.1 **General Requirements**

Division 1 and General Requirements, is a part of this Section and shall apply as if repeated here.

.2 **Work Performed by Other Sections Related to This Section is Specified in:**

Section 07920: Sealants and Caulking
Section 09510: Acoustic Ceilings
Section 09900: Painting and Finishing

.3 **Supply of Work Installed by This Section is Specified in:**

Division 15: To furnish access panels.

.2 **System Description**

.1 **Tolerances**

.1 Install board within 3 mm of dimensioned location unless approved otherwise, and flat to a tolerance of 1 mm maximum in 1000 mm and 1 mm maximum in any running 200 mm.
.2 Install framing members to ensure that deflection of each member does not exceed 1/360 of its span under dead load and loads imposed by mechanical and electrical equipment and fixtures supported by ceiling.

.3 **Quality Assurance**

.1 **Requirements of Regulatory Agencies**

Install fire separations and fire protection exactly as specified in Underwriters' Laboratories test design specification that validates specified rating. Verify installations specified in other Sections, as a part of the entire assembly, meets applicable validating test design specification.

.4 **References**

.1 **Reference Standards**

Reference standards quoted in Contract Documents refer to:
ASTM A116-81, Specification for Zinc Coated (Galvanized) Iron or Steel Farm Field and Railroad Right-of-Way Wire Fencing.
ASTM 153-80, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
ASTM A525-81, Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, General Requirements.
ASTM C475-64, Standard Specification for Joint Treatment Materials for Gypsum Wallboard Construction.
ASTM C646-76a, Specification for Steel Drill Screw for the Application of Gypsum Sheet material to Light-Gauge Steel Studs.

CGSB Specification 1-GP-118M Finish, Interior, Alkyd, Flat.
CAN/CSA-A82.27-M91, Gypsum Board.
CAN/CSA-A82.31-M91, Gypsum Board Application.

.5 **Delivery, Storage, and Handling**

.1 Package finish materials.
.2 Store materials in protected dry areas. Store board flat in piles with edges protected.
.3 Ensure that finish metal members are not bent, dented, or otherwise deformed.
.4 Deliver products supplied only by this Section to those responsible for installation, to the place they direct, and to meet installation schedules.
.5 Package fire rated materials with Underwriters' Laboratories labels attached.

.6 **Site Conditions**

.1 **Environmental Requirements**

.1 Install interior gypsum board systems only in areas closed and protected against weather, and maintained between 10 deg C and 21 deg C. In cold weather, ensure that heat is introduced in sufficient time, before installation commences, to bring surrounding materials up to these temperatures and that it is maintained until materials installed by this Section have cured.
.2 Do not install gypsum board systems in any area unless satisfied that construction in place has dried out, and that no further installation of damp materials is contemplated.

## PART 2 - PRODUCTS

.1 **Materials**

.1 **Gypsum Board**

.1 To meet specified requirements of CAN/CSA-A82.27.
.2 Plain Gypsum Board: With tapered edges.

.2 **Joint Materials**

.1 Gypsum Board Joint Reinforcing Tape: 50 mm wide glass, fibre mesh.
.2 Fiberbond Joint Reinforcing Tape: 50 mm wide, cross laminated fibre tape.
.3 Gypsum Board Joint Compounds:
.1 Latex, resin base, possessing good adhesion, mixed with fresh, unadulterated water having no detrimental effect on compounds.
.2 Durabond 45 in powder form to be mix on site in accordance with Manufacturer’s printed instructions

.3 **Galvanizing**

.1 Zinc Coating: To meet specified requirements of ASTM Specifications A525, zinc coating designation Z275 for sheet steel; A153, Class B.3 Coating for hardware and bolts; A116, Class 3 Coating for wire and rods.

.2 Wiped Coating: ASTM Specification A525 zinc coating designation ZF75.

.3 Hot Dipped: Zinc coating by hot dipping after fabrication to provide a uniform coating of not less than 2.0 ounces per square foot.

.4 **Fastenings and Ties**

.1 Screws: For securing gypsum board to metal furring: Self-drilling, self-tapping, case-hardened, Phillips head, drywall screws, with corrosion resistant finish; to meet requirements of ASTM Specification C646. #6 x 25 mm for single thickness board fastening, and #7 x 41 mm for double thickness board fastening.

.2 Tie Wire: 1.6 mm dia. galvanized soft annealed steel wire.

.5 **Furring System**

.1 Runner (Carrying) Channels: 1.6 mm thick cold rolled steel, prime painted.
38 mm x 13 mm where supported at centers of 900 mm maximum.
38 mm x 19 mm where supported at centers of 1200 mm maximum.

.2 Furring Channels: 0.55 mm thick cold rolled steel, wiped coated, nominal size of 19 mm deep x 32 mm face, hat type with knurled face.

.3 Metal trim: 13 mm, J - trim, no. 200-A; 13 mm, L - trim, No. 200-B, both as manufactured by Canadian Gypsum Company Inc.

.4 Control Joints: No. 093 as manufactured by Canadian Gypsum Company Inc.

.5 At areas of high humidity, use zinc coated runners, furring channels and accessories.

.6 **Partition System**

.1 Steel Studs: 0.85 mm (20 gauge) thick steel, wiped coated, having knurled flanges 32 mm wide with edges doubled back at least 4.8 mm, with girts as required, and with service access holes.

.2 Partition Runners: As specified for studs, with flanges a minimum of 22 mm high at floor, and 51 mm high for double runners at top of partitions and to suit width of studs.

.3 Control Joints: No. 093 as manufactured by Canadian Gypsum Company Inc.

.7 **Ceiling Hanger System**

.1 Hanger Anchoring Devices:
Phillips Red Head by Phillips Drill Company of Canada Limited, Thornhill, Ontario
: T32 self drilling for use in concrete deck.
: WS-3822 wedge anchor with tie wire insert for use in composite concrete .

.2 Hangers:
Zinc coated annealed steel wire:
: 2.8 mm dia. to support a maximum weight of 68 kg per hanger.
: 3.8 mm dia. to support a maximum weight of 140 kg per hanger.
Zinc coated annealed steel rod.
: 4.8 mm dia. to support a maximum weight of 250 kg per hanger.

.8 **Sealant**

.1 Acoustical Sealant: As manufactured by Tremco Manufacturing Co. (Canada) Ltd. or Presstite Acoustical sealant No. 579.64 as manufactured by Inmont Presstite Ltd.

.2 Fire Separation Sealant: Sealant Type 1 as specified in Caulking Schedule of Section 07920 where exposed to view, and acoustical caulking at concealed locations.

## PART 3 - EXECUTION

.1 **Examination**

.1 Before application of board systems commences, ensure that services have been installed, tested, and approved; that conduits, pipes, cables, and outlets are plugged, capped, or covered; and that fastenings and supports installed by other Sections are in place.

.2 Ensure that environmental conditions and construction completed before installation of gypsum board systems commences are satisfactory and will permit compliance with quality and dimensions required for gypsum board installation specified in this Section. Do not permit installations of others to touch the back of gypsum board.

.3 Verify that installations performed by other Sections which are a part of an underwriter specification for a fire rated assembly have been done in accordance with that specification.

.4 Verify that channels installed for rigid insulation are located properly and are well secured.

.2 **Installation**

.1 **General**

.1 Coordinate installation of systems specified in this Section with installations of other Sections for
: attachment of hangers, fasteners, stiffeners, and reinforcing.
: support and incorporation of flush-mounted and recessed components.
Ensure adequacy of supports by consultation and verification of methods specified in Divisions 15 and 16.

.2 Install systems in accordance with approved manufactured' specifications and printed directions, as applicable for materials incorporated.

.3 Do not install metal framing, trim, casings, or accessories which have been bent, dented, or otherwise deformed.

.4 Securely attach trim, casings, framing, and accessories.

.5 Framing and furring shown on Drawings is indicative but do not regard it as exact or complete. Construct systems to provide adequate strength to withstand stresses imposed by use without distortion, and to maintain dimensions indicated on Drawings.

.6 Provide continuous backing for all edges of board.

.7 Erect supporting and finish materials to dimensions indicated on Drawings; plumb, level, straight, and square to adjoining elements.

.8 Provide for movement at intersections with structural members to avoid transference of loads to systems.

.9 Make allowances for thermal movements in systems.

.10 Do not support systems from, nor make attachment to, ducts, pipes, conduit, or the support framing installed by other Sections.

.11 Install materials with the minimum of joints.

.12 Splice, framing members only where continuous lengths are not available from manufacturer.

.13 Frame openings on every side with suitable sections. Provide clearances required at mechanical and electrical services, such as grilles, diffusers, access panels, and lighting fixtures only after verification of requirements in each case.

.14 Cooperate with other Sections. Where the installations of other Sections penetrate board construction, fit openings snugly, and to ensure cover by escutcheons and plates utilized.

.15 Attach to framing, adequate steel reinforcing members to support the load of, and to withstand the withdrawal and shear forces imposed by, items installed by other Sections upon systems. Such items are, but not restricted to, coat hooks, washroom accessories, handrail anchors, guards, wall-hung cabinets and fitments, shelving, curtain and drapery tracks, and minor mechanical and electrical equipment and fixtures. Heavy mechanical and electrical equipment shall be self-supporting as specified in Divisions 15 and 16.

.16 Provide fire stopping; bulkheads over doors, frames, screens, and changes in ceiling levels; stair soffits; furred beams; pipe spaces; all as indicated on Drawings.

.2 **Suspended Ceiling Framing and Furring**

.1 Anchor hangers to structural frame or to hanger anchoring devices installed by this Section. Ensure that anchorage is capable of carrying the imposed loads of the assembly design.

.2 Space hangers for runner channels to suit structure, to support ceiling load, at a maximum distance of 1200 mm o.c., and at no greater distance than 150 mm from ends of runner channels.

.3 Install runner channels at 900 mm o.c., generally, and at no greater distance than 150 mm from terminations of supported cross furring members. Bend rod hangers sharply under bottom flange of runners, and wire securely in place with saddle ties.

.4 Splice runner channels by lapping at least 300 mm, with interlocking flanges, and wired at each end with two loops. Do not bunch or line up splices.

.5 Install cross furring at 400 mm o.c, generally, and at no greater distance than 150 mm from walls, openings, breaks in continuity of ceiling, and changes of direction. Space furring in all cases to suit incorporated services, and so as to avoid contact with perimeter walls. Span hat-type furring no greater 1200 mm. Use metal studs for greater spans: 42 mm deep spanning to 1525 mm, 63 mm deep to 1800 mm, and 92 mm deep to 2400 mm.

.6 Secure cross furring to supports with double wire ties or approved equivalent attachment. Splice by nesting and tying together with 200 mm overlap.

.7 Erect entire hanger and suspension system to adequately support the ceiling assembly, including services incorporated, with a maximum specified deflection for each component member, and free from horizontal movement.

.8 Enclose ducts, pipes, beams or other components that occur outside the general finished lines of ceilings, soffits and bulkheads with metal furring and gypsum board, in rooms where acoustic treatment for ceilings is specified.

3. **Metal Stud Framing**

.1 Secure runner channels at floor and tops of partitions for their full length, at 600 mm o.c with concrete nails, square cut nails, toggle bolts, or sheet metal screws as suitable for base material. Install runner channels also at heads and sills of openings. Secure runners at openings by butting flanges, turning up webs, and screwing to studs.

.2 Provide partition runners with deep flanges at heads of partitions where deflection and/or creep of structure will occur.

.3 Butt, not mitre, runners at wall intersections and corners. Lap runners and screw channels together.

.4 Space studs at 400 mm o.c., generally, or as indicated on Drawings, and at no greater distance than 50 mm from abutting walls, partitions, and corners.

.5 Secure studs to runners by screws, crimping, or welding, as required by stud type, and in accordance with manufacturer's design specification. Include provisions for deflection of building structure to ensure that structural loads are not transferred to studs.

.6 Install studs of depth indicated on Drawings: but in no case span studs 42 mm deep more than 2700 mm between supports; 63 mm deep, 3600 mm; and 92 mm deep, 4.5 m.

.7 Double studs at door jambs. At each jamb or doors exceeding either 900 mm in width or 57 mm in thickness, or both, install a 100 mm hot rolled structural channel, to structure above, and adequately anchored at each end.

.8 Double studs at all control joints.

.9 Erect three studs at corner and intermediate intersections of partitions.

.10 Install partition runners at heads and sills of openings in partitions. Form 150 mm bends in runners and secure bent portion to studs.

.11 Splice studs by nesting, with an 200 mm minimum lap, and fastened with one screw in each flange.

.12 Ensure that electrical boxes are not installed back to back in same stud space.

.13 Install blocking for bases, frames and supports before board in applied.

.14 Coordinate installation of board systems with other Sections installing horizontal runs of service lines so that all installations are done simultaneously. Where standard holes are too small for installed services, notch studs, and splice notched flanges with splice pieces 300 mm longer than notches, each fastened with two screws.

.15 Screw, or weld, frame anchor clips, of frames, supplied by Section 08110, to jamb studs, and head and sill runners. Ensure adequate fastenings to prevent movement of the frame within the partition. Remove spreaders at floor after frames are anchored.

.16 Unless shown otherwise on Drawings, partitions, together with gypsum board facings, shall extend above ceilings to underside of structure above.

.4 **Accessories**

.1 At External Corners: Install corner beads secured to framing at 150 mm o.c. on alternate flanges.

.2 At Board Edges: Secure “J” shaped casing beads at 150 mm o.c. at edges exposed to view, where board butts against other materials with no trim to conceal junction, at control joints, at perimeter of ceiling surfaces, at tops of partitions where they stop against continuous ceiling surfaces, and where otherwise indicated on Drawings.

.3 Install control joints in interior gypsum board systems at no greater spacing than 7.3 m for walls and 9 m for ceilings in each direction, at perimeters of ceilings where they abut walls and other vertical surfaces, or as otherwise indicated. Line up control joints with joints in other construction or with centre lines of mullions, columns, piers, or similar building elements.

.4 Install casings and thermal breaks at junctions of gypsum board with exterior door, window, or screen frames.

.5 **Application of Gypsum Board to Framing**

.1 Extend board into door, window, and other opening reveals; behind mirrors, fitments, and other applied items of a fixed nature; and on metal stud partitions to structure above, unless noted otherwise on Drawings.

.2 Apply board with long dimension perpendicular to supports except at stud partitions where they shall parallel studs.

.3 Back all joints with a framing member. Locate joints on opposite sides of partitions on different studs, and at least 300 mm from opening jambs.

.4 Install board in maximum lengths and widths to minimize joints, and in lengths of 1800 mm minimum, and stagger end joints where they are unavoidable. Locate joints in ceilings where least prominently discerned, and never line them up with opening edges.

.5 Tightly butt board joints, without force, and align them neatly.

.6 Form neat joints at mill ends and at edges of board panels cut in field. Cut paper on face with a knife. Smooth by sanding and rubbing edges together.

.7 Do not install board in close proximity to hot pipes or heating ducts.

.8 Fasten board to metal support members by metal drywall screws.

.9 Locate fasteners at 10 mm minimum to, and 13 mm maximum from, centre of joints. Space fasteners at walls and ceilings at 300 mm o.c. at edges and in field, unless otherwise specified. At ceilings of fire rated board, space fasteners at 200 mm o.c. at edges and in field, unless otherwise specified. At walls of fire rated board space fasteners at 200 mm o.c. at edges and 300 mm o.c. in field. Locate fasteners opposite one another in adjacent panels.

.10 Start application on walls at corners of rooms, and on ceilings from centre line of spaces. Do not force adjacent boards into place; allow moderate contact. Install extension clips where required. Drive screws to form a slight depression, but not so paper cover is broken.

.11 Install board with casing bead at termination of gypsum board edge abutting adjoining surfaces to provide for differential movement at internal corners

.6 **Finishing of Joints and Depressions at Gypsum Board**

.1 Fill joints, casing beads, corner beads, holes at board fasteners and depressions on board surfaces exposed to view to ensure smooth seamless surfaces and square neat corners. Use jointing compounds and reinforcing tapes in conformance with manufacturer's specifications. Ensure that board is tight against framing members, fasteners are properly depressed, and adhesives have sufficiently cured.

.2 Fill joints by three-coat method.
: Embed reinforcing tape in a cover coat of joint filler.
: Apply level coat of joint filler when cover coat has dried.
: Feather edges of compounds into surfaces of boards. After skim coat has dried for at least 24 hours, sand to leave smooth for decoration. Do not sand paper face of board.

.3 At bevelled joints, apply cover coat 180 mm wide, level coat 250 mm wide, and skim coat 300 mm wide.

.4 At end joints and butt joints formed at cut edges of board, apply cover coat 355 mm wide, level coat 500 mm wide, and skim coat 600 mm wide. Camber treatment over end joints to 0.8 mm thick at most.

.5 At Internal Corners: First fill gaps between boards with joint filler. Embed creased reinforcing tape in a thin coat of joint filler applied 50 mm wide at each side of corner. Apply cover coat as specified for bevelled joints. Apply skim coat (as specified for bevelled joints) to just one side of joint, and when dry, apply skim coat to other side.

.6 At External Corners: Fill to nose of corner bead with joint filler and topping cement as specified for bevelled joints.

.7 At Casing Beads: As specified for bevelled joints.

.8 At Board Fasteners: Fill holes and depressions with 2 coat application of joint filler.

.7 **Caulking**

.1 Caulk between casing beads and other construction where junction exposed to view.

.2 Caulk junctions between gypsum board fire separations and protection, and other construction to ensure that integrity of fire rating is maintained. Ensure that caulked joints provide a continuous seal and that they are caulked before other installations enclose them.

.3 Clean joints, and prime and install sealants in accordance with the requirements of Joint Sealants, Section 07920.

.3 **Adjustment and Cleaning**

.1 Remove droppings and excess of joint compound from property, materials and surfaces of others, and from board and accessories installed by this Section, before it sets.

.2 Make good to cut-outs for services and other installations, fill in defective joints, holes and other depressions with joint compound.

.3 Make good defective board installations, and ensure that surfaces are smooth, evenly textured and within specified tolerances to receive finish treatments.

.4 Clean off beads, casings and other metal trim, and leave all surfaces ready for specified finishes.

**End of Section**

## PART 1 - GENERAL

.1 **Description**

.1 **General Requirements**

Division 1 and General Requirements, is a part of this Section and shall apply as if repeated here.

.2 **Work Performed by Other Sections Related to This Section is Specified in:**

Section 09250: Gypsum Drywall, Bulkheads, Ceilings
Drawings: Mechanical Services
Drawings: Electrical Fixtures

.2 **System Description**

.1 **Tolerances**

.1 Install ceilings within 3.2 mm of dimensioned height above floor unless approved otherwise. Level within maximum tolerance of 3mm in 3 m.
.2 Install framing members to ensure that deflection of each member does not exceed 1/360 of its span under dead load and loads imposed by mechanical and electrical equipment and fixtures supported by ceiling.

.3 **Quality Assurance**

.1 **Subcontractor Qualifications**

Install acoustical ceilings specified in this Section only by Subcontractor who has adequate equipment and skilled mechanics to perform it expeditiously, and is known to have been responsible for satisfactory installations similar to that specified during a period of at least five years.

.4 **References**

.1 **Reference Standards**

Reference standards quoted in Contract Documents refer to:
CAN/CSA-A82.27-M91, Gypsum Board Products

.5 **Submittals**

.1 **Samples**

Submit two samples of each specified acoustical board and exposed grid material.

.6 **Delivery, Storage, and Handling**

.1 Package finish materials.
.2 Store materials in protected dry area.
.3 Ensure that finish metal members are not bent, dented, or otherwise deformed.

.7 **Site Conditions**

.1 Install acoustical ceilings in areas closed and protected against weather, maintained at no less than 10°C.

.2 Do not install acoustical ceilings in any area unless satisfied that construction in place has dried out, and that no further installation of damp materials is contemplated.

## PART 2 - PRODUCTS

.1 **Materials**

.1 **Accessories**

Fabricate miscellaneous clips, splicers, connectors, screws, other standard accessories of steel, zinc coated or cadmium plated, of strength and de-sign compatible with suspension methods and system specified. Include special accessories to provide complete assembly of acoustical ceilings.

.2 **Hangers**

Galvanized annealed steel wire; 2.8 mm dia. to support a maximum weight of 68 kg per hanger, #9 ga. to support a maximum weight of 140 kg per hanger. Galvanized annealed steel rod; 4.8 mm dia. to support maximum weight of 250 kg/hanger.

.3 **Hanger Anchoring Devices**

Phillips Red Head by Phillips Drill Company of Canada Limited, Thornhill, Ontario
: T32, self drilling for use in concrete deck.
: WS-3822 wedge anchor with tie wire insert for
use in composite concrete and steel deck.
: SDI-3822 for use in steel floor deck, with screw
screw eye bolts to suit inserts.

.4 **Exposed Tee Ceiling Grid System**

.1 Two directional, 610 mm X 1220 mm.
.2 Main Beams: 0.508 mm steel, bulb tees.
.3 Cross Tees: 0.508 mm steel, with tongues to interlock with main beams.
.4 Wall Moulding: Angle section to match tees.
.5 Finish: Baked vinyl enamel, white.

.5 **Acoustical Units**

.1 Acoustical units shall match submitted samples with no perceptible visual variations within a building area. Fabricate edges uniformly and true to fit suspension system, and maintain true lines and surface planes.

.2 **Acoustic Units**

Type 1
Pattern: Non-directional Fissured – Cortega 823
Colour: White
Edge: Regular, lay-in (square)
Size: 610 mm X 1220 mm (Imperial)
Thickness: 15 mm
Noncombustible
Manufacturer: Armstrong

## PART 3 - EXECUTION

.1 **Examination**

.1 Ensure that environmental conditions and installations preceding that of this Section are satisfactory, and will permit compliance with the quality and dimensions required of acoustical ceilings.

.2 **Installation**

.1 Coordinate installation of acoustical ceiling systems specified in this Section with that of other Sections. Ensure that adequate preparation is made for attachment of hangers and fasteners. Install framing for support and incorporation of flush-mounted and recessed service components. Ensure adequacy of supports by consultation and verification of methods and locations of installations specified in Divisions 15 and 16.
.2 Install hangers before sprayed fireproofing.
.3 Install hanger anchoring devices in appropriately drilled holes.
.4 Screw apply hanger anchoring devices to metal floor deck.
.5 Do not use through the roof hangers.
.6 Do anchor hangers from or make attachment to, ducts, pipes, conduit, or the support framing installed by other Sections.
.7 Space hangers for supporting grid at 1220 mm max. centers each way, and to suit structure and ceiling system. Secure hangers to structure by a permanent method as approved. Secure wire hangers to framing by bending sharply upward and wrapping securely with 3 turns. Install hangers free of kinks and at no more than 5° off vertical. Install extra hangers at each corner of lighting fixtures. Reinforce other ceiling equipment with hangers.
.8 Install the entire hanger and suspension grid to adequately support the ceiling assembly, including services incorporated, with a maximum specified deflection for each component member, and free from horizontal movement.
.9 Lay out ceilings with acoustic units evenly spaces in each area, with grid lines symmetrical about room axes, columns and service element, and with maximum border widths of equal dimensions on opposite sides of areas, or as indicated on reflected ceiling plans. Provide angle moldings to match exposed grid where ceilings abut walls or other vertical surfaces. At curved or circular element, cut vertical legs and bend track to conform to element.
.10 Frame around recessed fixtures, diffusers, grilles, and openings.

.11 Maintain true surface planes, and component and joint lines throughout each area.
.12 Butt joints between components tightly together.
.13 Install grid system ceilings as specified by the manufacturer of the system. Ensure that methods of installation used are acceptable to the manufacturer of each system component and Architect.
.14 Brace system to maintain alignment of grid.
.15 Install acoustical panels in exposed tee system. Cut panels neatly to fit off-module grid, with sufficient clearances to ensure removal without damage.
.16 Do not install acoustical units with broken or marred edges exposed to view.
.17 Install hold-down clips at each panel. Adapt installation to provide ceiling access where required for services.
.18 Mark access panels in an unobtrusive manner.
.19 Where retention clips are specified for Type 3 ceilings, install clips in accordance with manufacturers' written instructions.

.3 **Adjustment and Cleaning**

.1 Clean soiled/discoloured surfaces of exposed ceiling surfaces on ceiling installation completion.
.2 Replace components which are visibly damaged, marred, or uncleanable.

.4 **Extra Stock**

.1 Provide 2 sealed cartons of each specified acoustical board for Owner's use. Deliver to site at conclusion of project.

**End of Section**

## PART 1 - GENERAL

.1 **Description**

.1 **General Requirements**

Division 1 and General Requirements, is a part of this Section and shall apply as if repeated here.

.2 **Work Performed by Other Sections Related to This Section is Specified in:**

.2 **Quality Assurance**

.1 **Subcontractor Qualifications**

Install resilient flooring specified in this Section only by a Subcontractor who has adequate equipment and skilled tradesmen to perform it expeditiously, and is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past five years.

.3 **References**

.1 **Reference Standards**

Reference standard quoted in Contract Documents refer to:
CSA Standard A126.1-M1984, Vinyl Asbestos and Vinyl Composition Floor Tile.
CSA Standard A126.3-M1984, Sheet Vinyl Flooring Products.

.4 **Submittals**

.1 **Samples**

.1 Submit samples of each specified flooring, base, stair, and accessories that are specified.
.2 Submit full size tiles 300 x 300.
.3 Submit 216 mm X 280 mm pieces of sheet goods.
.4 Submit base and accessories in lengths of 300 mm.

.2 **Affidavits**

Submit for approval, a list of installation materials intended for use with each flooring material and for each subfloor condition, before installation commences. Accompany the list with an affidavit stating that the manufacturer of each material recommends and approves of its use in each case.

.3 **Maintenance Instructions**

Submit maintenance instructions for incorporation in Project Data Book.

.5 **Delivery, Storage, and Handling**

.1 Package flooring materials and identify contents of each package.
.2 Store materials for a minimum 48 hours immediately before installation at not less than 19 degrees C.

.6 **Site Conditions**

.1 **Environmental Requirements**

.1 Install resilient flooring only when surfaces and air temperatures have been maintained between 19 degrees C and 48 degrees C for 24 hours preceding installation, and will be so maintained during installation and for 48 hours thereafter. Maintain a minimum temperature of 13degrees C after above period.
.2 Ensure that adequate ventilation is provided during installation of flooring and curing of adhesive.
.3 Ensure that spark-proof electrical equipment is provided, and smoking is prohibited, in areas where flammable adhesives are used. Store materials to prevent spontaneous combustion.

## PART 2 - PRODUCTS

.1 **Materials**

.1 Provide each flooring material from same production run for one area, and from same manufacturer for entire project.

.2 **Flooring**

.1 Vinyl Quartz Composite Tile: 2.5 mm thick, 300 mm X 300 mm; Versa Tile - Quartz Tile as supplied by Centura. No more than 2 colours selected for project.
.2 Rubber Base: Roppe 100mm high Pinnacle.

.3 **Resilient Base - Rubber:**

.1 Top Set: Cove bottom, 2 mm thick, grooved back, preformed external corners.
.2 Straight: Butted Bottom, 2 mm thick, grooved back, Site Formed Corners.
.3 Base Height: 100 mm as specified in Room Finish Schedule for each base type.
.4 Colours: Solid as selected from manufacturer's standard range, not more than 2 colours.

.4 **Flooring Accessories**

.1 Ensure that accessories are compatible with, and match appearance and thickness of abutting flooring materials.

.5 **Filler/Subfloor Preparation.**

The intent of this section is to provide for a full fill and level of existing floors to receive all floor finishes. Contractor is to cover all costs associated with the intent to provide an acceptable substrate for all finishes.

.1 Assume an overall average levelling compound thickness of 4mm.
.2 Provide for shotblasting of all existing surfaces in preparation for filler and levelling compound.
.3 Provide Bonding agent as recommended by manufacturer.
.4 Levelling Compound: Ardex K15
.5 Cementitous bulk concrete filler: Ardex

.6 **Primers and Adhesives**

As recommended by manufacturer of each material for each subfloor condition. Use clear adhesive for vinyl polymer flooring.

Porcelain Tile: Mortar TEC 382
Vinyl Quartz Tile: TEC Rollfast or TEC 752
Sheet Vinyl: TEC 744

.7 **Cleaner**

Neutral chemical compound that will not damage tile or affect its colour.

.8 **Floor Protection**

Heavy kraft paper laminated with non-staining adhesive to both sides of glass fibre reinforcing ply, minimum weight of 0.18 kg/sq.m.

## PART 3 - EXECUTION

.1 **Examination**

.1 Test substrate to ensure that moisture level and acid-alkali balance does not exceed limits recommended by adhesive manufacturer.
.2 Ensure that environmental conditions have been provided as requested and specified.
.3 Ensure subfloors have been provided as specified without holes, protrusions, cracks greater than 2 mm wide, unfilled control joints, depressions greater than 3 mm deep, or other major defects.
.4 Defective resilient flooring resulting from application to unsatisfactory surfaces will be considered the responsibility of this Section.

.2 **Preparation**

.1 Remove dirt, soil, oil, grease, and other deposits which would lessen the adhesive bond of flooring, and which would telegraph through flooring.
.2 Remove chalking and dusting from concrete surfaces with wire brushes.
.3 Remove prime paint and adhesives in accordance with the manufacturer's requirements.
.4 Fill all defects such as cracks, depressions and scars from damage with filler. Level to smooth surface.
.5 Prime subfloors in accordance with the manufacturer's requirements.
.6 Protection: Prevent traffic and work on newly laid floors by barricading until adhesive cures.

.3 **Installation**

.1 **General**

.1 Lay each material in accordance with manufacturer's specification.
.2 Lay flooring with joints closely butted. Scribe, cut and fit around floor outlets and openings, door frames, and heavy equipment supports.
.3 Cut flooring and bases to fit within 0.4 mm of abutting surfaces were exposed to view.
.4 Avoid abrupt variations in shades between adjacent flooring material. Do not install units that are off-colour or contain untypical pattern variations.
.5 Carry floor patterns through openings.
.6 Roll flooring with three-section, 45 kg roller, in two directions from centre of area. Maintain rollers clean and polished.

.2 **Adhesives**

.1 Apply adhesive uniformly over surfaces with a notched trowel, at rate recommended by manufacturer.
.2 Cover only an area into which flooring can be set during working time of adhesive. Do not lay flooring over hardened adhesive.
.3 Use only waterproof type adhesive in all areas where plumbing fixtures or floor drains are installed.
.4 Protect adjacent surfaces from soil by adhesive.
.5 Clean trowels and maintain profile of notches as installation of flooring progresses to ensure a constant rate of application.

.3 **Resilient Tile Flooring**

.1 Lay tile with joints as directed by architect.
.2 Lay tile in square pattern with grain of adjacent units running in same monolithic direction.
.3 Lay out tile so that perimeter units are at least one half tile in width except where room irregularities make it impossible.

.4 **Resilient Bases**

.1 Install bases in lengths as long as possible: do not make up runs of short lengths.
.2 In areas where bases are indicated, install them on built-in fitments, columns, walls.
.3 Cut and mitre internal corners.
.4 Double cut seams between adjoining lengths.
.5 Apply adhesive to wall, masked to prevent spreading above base, and firmly bed base in place.
.6 Press top set base down to force cove against flooring.
.7 Install straight base before flooring, with bottom edge against subfloor and top edge level.
.8 Install top set base in all areas except as noted on Drawings.

.5 **Reducer/Transition Strips**

.1 Install strips at terminations of flooring where edges are exposed to view.
.2 Install strips in straight lines and relate their terminations to significant building features and within tolerance of 3 mm in 3 m.
.3 Install strips under doors at openings.
.4 Cut and fit strip terminations to profile of abutting construction.
.5 Secure strips to subfloor with contact bond adhesive to ensure complete bond.

.4 **Adjustment, Cleaning, Sealing, and Waxing**

.1 Replace defective resilient flooring installations so that there is no discernible variation in appearance between installed and replaced materials.
.2 Clean off excess adhesive as installation of flooring progresses and before it sets.
.3 Clean resilient flooring, but no sooner than 48 hours following installation. Use neutral floor cleaner where required, and proceed as recommended by manufacturer.
.4 Clean floors on a regular basis at least once per week if no other protection is provided.
.5 Clean floors before acceptance by Owner.
.6 Provide sealer, plus 5 (five) coats of wax applied according to manufacturer's technical specifications prior to final acceptance.

.5 **Protection**

.1 After materials have set, and until project completion, coordinate with other Sections to ensure that floors are not damaged by traffic, as specified in Section 01010. Ensure that flooring is not subjected to any static loading during the week following installation.
.2 At completion of flooring installation, install floor protection in areas where finishing operations, repairs and installation of equipment, and foot traffic will occur. Lap joints of material by 150 mm and seal with non-asphaltic tape.

.6 **Extra Stock**

.1 Deliver to Owner on completion of Project construction, and as he directs, 5% of the quantity of flooring installed, of each material and colour, in labelled packages.

**End of Section**

## PART 1 - GENERAL

.1 **Description**

.1 **General Requirements**

Division 1 and General Requirements, is a part of this Section, and shall apply as if repeated here.

.2 **Scope of Work**

.1 This Section of Work shall include all labour, materials, tools, scaffolds and other equipment, services and supervision required to cover with paint the surfaces of the building, or structure, building services and accessories not otherwise protected or covered, as shown on the "Room Finish Schedule" to the full intent of the Drawings and Specifications but does not include Mechanical Rooms.

.2 Refer to Drawings and Finish Schedules for type, location and extent of finishes required, and include all field painting necessary to complete work shown, scheduled or specified, including backpriming and surface preparation as specified herein.

.3 **Related Work Specified Elsewhere**

Section 06200: Finishing of Millwork

.2 **Quality Assurance**

.1 **Subcontractor Qualifications**

.1 The paint products and Manufacturer shall be listed in the Ontario Painting Contractors Association Specification Manual, latest edition, under Paint Product Recommendation section, or approved equivalent. Ideal and CIL equivalent products are considered equivalents.

.2 Perform painting and finishing specified in this Section only by a Subcontractor who has a minimum of five years of proven satisfactory applications similar to that specified. Subcontractor shall have equipment and skilled tradesmen to perform work expeditiously. Journeymen (and apprentices) shall have a provincial Tradesman Qualification certificate of proficiency.

.2 **Requirements of Regulatory Agencies**

.1 Apply coatings that require fire hazard classification exactly as specified in Underwriters' Laboratories test specification that validates specified rating.

.2 Coatings shall meet fire hazard classification requirements of jurisdictional authorities for each material in each installation location as applicable.

.3 Fire retardant coatings to meet fire hazard classification requirements of jurisdictional authorities for each installation location.

.4 Fire hazard classification ratings shall not exceed for:
Flame Spread: 25 for exits, 150 otherwise
Smoke Developed: 50 for exits, 300 otherwise.

.3 **Mock-Up**

.1 Before proceeding with painting, finish one complete space or item of each colour scheme required, showing selected colours, finish texture, materials and workmanship. After approval, the sample rooms or items shall serve as a standard for similar work throughout the building.

.4 **Inspection**

.1 A painting inspector may be appointed by the Consultant in order to provide independent inspection of all painting and testing where required.
.2 The inspector shall review the condition of the substrate prior to application of any paint. The inspector shall review all painting applications in accordance with a predetermined plan agreed upon by the painting contractor, the painting inspector and the Consultant.
.2 The painting inspector shall be acceptable to the Architect and the OPCA Association. The cost for the inspection reports shall be paid from the Inspection and Testing Allowance.

.3 **Submittals**

.1 **Approvals**

.1 Submit a written request to the Architect for approval of equivalent products during bidding period, listing each of the materials proposed, surfaces to be covered. State clearly manufacturer's name and brand name of any proposed equivalent material.

.2 **Colour Schedule**

.1 Paint and colours shall be selected by the Architect.
.2 Before any painting is to commence, the architect shall furnish a colour schedule showing where the various colours and finishes shall be applied.

.3 **List of Materials**

Before ordering materials, submit a list of those materials proposed for use for approval. For each material, give manufacturer and descriptive nomenclature that will appear on container labels. Do not order materials that have not been approved.

.4 **Affidavits**

Submit affidavits from manufacturer to certify that materials supplied for project meet specification requirements and that the manufacturer approves of their use for each proposed application.

.5 **Samples**

.1 Painter to prepare samples of each type of paint, stain and application specified, on 220 X 280 mm plywood for approval, to be left on the job site until painting contract is complete. Label samples to indicate finish, formula, colour name, number, sheen and gloss.

.6 **Inspection Reports**

A painting inspector shall review and submit reports on the quality of the painting contract.

.4 **Guarantee**

.1 The painting contractor shall furnish a Canadian Painting Contractors two-year Guarantee, or alternatively a 100% two-year Maintenance Bond, on completion of the work. The Guarantee (or Maintenance Bond) shall warrant that the work has been performed in accordance with the standards and requirements incorporated in the Canadian Painting Contractors Architectural Specification Manual, latest edition. The work performed by the Painting Contractor shall be inspected by an independent inspector acceptable to the specifying authority and to the appropriated Provincial Painting and Decorating Contractors Association. The cost of this inspection and the Guarantee (or Maintenance Bond) shall be included in this tender.

.2 Painting contractors using a Maintenance Bond type of guarantee shall supply with their tenders a facsimile of the bond to be used, together with written proof of their ability to furnish same, at no cost to the owner. In either event, the inspection is as referred to in the CPCA manual.

.5 **Delivery, Storage, and Handling**

.1 Deliver each container sealed and labelled with manufacturer's name, catalogue number/brand name, colour, formulation type, reducing instructions, and reference standard specification number if applicable.

.2 Store only acceptable project materials at site, in area specifically set aside for purpose that is locked, ventilated, maintained at a temperature of over 7°C, and protected from direct rays of sun.

.3 Ensure health and fire regulations are complied with in storage area. Provide carbon dioxide fire extinguishers of 9 kg minimum capacity in each storage area while materials are contained within.

.4 On each container, for materials requiring a fire hazard classification, attach Underwriter's label verifying material is listed under their label service, and giving the hazard classification.

.6 **Site Conditions**

.1 **Environmental Requirements**

.1 Apply painting materials only when air and surface temperatures exceed 5°C, except for:
7°C for latex paint at interior locations
10°C for latex paint at exterior locations
21°C for lacquers and enamels

.2 Do not apply exterior finishes in direct sunlight that raises surface temperatures above that for proper application and drying, nor in rainy, foggy, or windy weather.

.3 Do not apply finishes when relative humidity is over 85%, when condensation has formed or is likely to form, nor immediately following rain, frost or formation of dew.

.4 Test moisture of surfaces by electronic Moisture Meter.

.5 Do not apply finishes when dust is raised.

.6 Do not apply finishes on porous surfaces as concrete, plaster, gypsum board, pipe insulation, masonry, containing over 12% moisture.

.7 Masonry and Concrete Blocks must by installed at least 28 days prior to painting and must by visually dry on both sides before painting commences. This is not to be construed as including a "wetting down" process for Latex.

.8 Concrete Floors shall be tested for moisture by a simple "cover patch test".

.9 Painting and decorating work shall not proceed unless a minimum of 15 foot candles of lighting is provided on the surfaces to be painted. Adequate lighting facilities shall be provided by the General Contractor.

.10 All areas where painting and decorating work is proceeding require adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 7 deg. C. for 24 hours before and after paint application. Required heat and ventilation shall be provided for the Painting Subcontractor.

.7 **Protection**

.1 Protect other surfaces from paint and damage and make good any damage caused by failure to provide suitable protection, but will not be responsible for any damage caused by others.

.2 Furnish sufficient drop cloths, shields and protective equipment to prevent spray or dropping from fouling surfaces not being painted and in particular, surfaces within the storage and preparation area.

.3 Waste, cloths and material which ma constitute a fire hazard shall be placed in closed metal containers and removed daily from the site.

.4 Remove all electrical plates, surface hardware, fittings and fastenings, prior to painting operations. These items shall be carefully stored, cleaned and replaced on completion of work in each area. No solvent shall be used to clean hardware that will remove the permanent lacquer finish on some of these items.

## PART 2 - PRODUCTS

.1 **Materials**

.1 Paint, varnish, stain, enamel, lacquer, and fillers shall be of a type and brand specified and listed under "Paint Product Recommendations" as covered in the Association Manual, latest edition, for specified purposes.

.2 Paint materials such as linseed oil, shellac, turpentine, etc., and any of the above materials not specifically mentioned herein be required for first class work with the finish specified shall be the highest quality product of an approved manufacturer. All coating material shall be compatible.

.3 Only "top line" products produced by their manufacturers are acceptable.

2. **Mixing**

.1 Paints to be supplied ready-mixed unless otherwise specified, except that any coating in paste or powder form, or to field-catalysed shall be field-mixed in accordance with the directions of its manufacturer. Pigments shall be fully ground and shall maintain a soft paste consistency in the vehicle during storage that can and shall be dispersed readily and uniformly by paddle to a complete homogeneous mixture.

.2 Paint shall have good flowing and brushing properties and shall dry or cure free of sags, etc. to yield the desired finish specified.

## PART 3 - EXECUTION

.1 **Examination**

.1 Prior to commencement of work of this section, thoroughly examine all surfaces scheduled to be painted.
.2 Test all surfaces for moisture content with an electronic moisture meter. Test surfaces of materials containing lime for acid-alkali balance.
.3 Maintain at site at all times until applications are completed a moisture meter, hygrometer and thermometer to verify surface and environmental conditions.
.4 Report in writing to the Contractor and the Architect any condition adversely affecting this work. No painting work shall proceed until all such defects have been corrected and surfaces are acceptable to the Painting Inspector.
.5 Defective painting and finishing applications resulting from failure to properly test surfaces and/or from application to unsatisfactory surfaces shall be considered the responsibility of this Section.
.6 Continuation of painting after first coat on drywall, plaster, structural steel and miscellaneous metal surfaces, shall imply acceptance of surfaces.

.2 **Preparation**

.1 **General**

.1 Vacuum clean interior areas immediately before finishing work commences.
.2 Remove from all surfaces grease, oil, dirt, dust, ridges, and other oil and materials that would adversely affect the adhesion or appearance of finish coatings.
.3 Remove rust from damaged surfaces primed by other Sections or previously painted and reprime.
.4 Neutralize highly alkaline surfaces with a neutralizing wash of 4% solution of zinc sulphate. Substitute 4% solution of tetrapotassium pyrophosphate for surfaces to receive latex paints. Brush off residue before painting.
.5 Scrub mildewed surfaces with solution of tri-sodium phosphate, and bleach with a solution of one part sodium hypochlorite (Javex) to three parts water. Rinse with clear water.

.2 **Surface Preparation**

.1 Surface preparation to receive painting and finishing included under this Section of work shall be as follows or as specified in the Canadian Painting Specifications Manual and the Room Finish Schedule.

.1 **General:** Remove from all surfaces grease, oil, dirt, dust, ridges, and other oil and materials that would adversely affect the adhesion or appearance of finish coatings.
.2 **Woodwork and Millwork:** Clean and remove all foreign matter prior to prime coat application and sealing of knots, pitch streaks and sappy sections with sealer. Puttying of nail holes and minimal cracks after prime coat has dried and sanding between prime coat and following coats except final coat. Backpriming to interior and exterior woodwork.
.3 **Concrete Floors:** Shot blast and etch.
.4 **Galvanized Steel and Iron:** Washing (Etching).

.5 **Plaster:** Minimal cracks, holes and imperfections shall be filled with patching plaster and smoothed off to match adjoining surfaces by the Plastering Contractor after the prime coat has been applied. Washing and neutralizing high alkali surfaces where they occur. Moisture test surfaces before paint application.

.6 **Masonry, Concrete, Stucco and Cement Render:** Surfaces which are very smooth or have traces of form oil or parting compounds shall be treated with acid-detergent treatment and washed with water. Powder, chalking, oxidizing to be removed.

.7 **Drywall:** Surfaces shall be in a ready condition to paint. Any imperfection showing after application of the prime coat shall be corrected by the Drywall Contractor.

.3 **New Material**

.1 **Aluminum** (unfinished)

.1 Remove surface contamination by steam, high pressure water or xylene solvent washing. Apply etching type primer (or acid etching) then paint immediately, as per Manufacturers: Direction.

.2 **Asphalt, Creosote, Tar & Bituminous Surfaces**

.1 Remove dirt, oil, grease, sand if necessary for adhesion key. Apply Latex based sealer or primer.

.3 **Canvas & Cotton Insulated Coverings:**

.1 Remove dirt, grease and oil, test for moisture content of 12% or less.

.4 **Copper**

.1 Painted: Remove surface contamination by steam, high pressure water or xylene solvent washing. Apply Vinyl etching primer then paint immediately, as per Manufacturers: Direction.

.2 Oxidized: Remove contamination, apply oxidizing solution of copper acetate and ammonium chloride in acetic acid, and rub on repeatedly for correct effect. Finally, rinse well with clear water and let dry.

.5 **Drywall**

.1 Remove contamination, prime surface to show defects if any (defects to be repaired by others). After defects remedied carry on with paint coatings.

.6 **Galvanized Steel**

.1 Remove surface contamination, wash metal with xylene solvent and apply coat of an approved etching type primer.

.7 **Zinc Coated Steel**

.1 Remove surface contamination and prepare surface to material manufacturer's instructions for priming. Refer to Chapter 3 of CPCA.

.8 **Masonry Surfaces and Concrete**

.1 Remove dirt, loose mortar, scale, powder and other foreign matter. Oil and grease to be removed by solution containing T.S.P., then rinse and let dry. This is not to be construed to include cleaning, chipping or grinding of protrusions or filling of "honeycomb" holes, etc.

.2 Concrete stains caused by weathering of corroding metals shall be removed with solution of sodium metasilicate after being thoroughly wetted with water. Let dry. This shall be corrected at no cost to the Painter.

.9 **Plaster**

.1 Hairline cracks, small holes and imperfections shall be corrected by the Plastering Contractor. Wash and neutralize high alkali surfaces where they occur.

.10 **Structural and Miscellaneous Steel**

.1 Surfaces shall be in a proper condition to receive paint finish with grease, rust, scale, dirt and dust removed. Where steel and iron have a heavy coating of scale, it shall be removed by wire brushing, sandblasting, etc., as necessary by others. All steel surfaces must be primed and satisfactory before paint finishing.

.11 **Wood Plywood & Millwork**

.1 All wood surfaces shall be clean and dry with a moisture reading of less than 15%. Remove all foreign matter prior to prime coat: knots, pitch streaks and sappy sections shall be spot coated with sealer. Fill all nail holes and fine cracks after primer has dried and sanded between coats. Backprime to interior and exterior woodwork.

.4 **Previously Painted Surfaces**

.1 **Interior**

.1 Surfaces must be clean and dry and free of all grease, wax and dirt.

.2 Remove grease, wax and dirt by washing with a good quality household cleaner. Rinse with clean water and let dry thoroughly before painting.

.3 Remove all loose or peeling paint by scraping - feather edges with medium sandpaper.

.4 Patch holes and crack with a good quality water-based patching compound, let dry and sand smooth. Remove dust and spot prime with Latex Sealer.

.5 Sand glossy surfaces lightly with fine sandpaper to ensure proper adhesion.

.6 Seal porous surfaces, such as flat latex, with Latex Sealer, especially if refinishing with velvet or eggshell enamels to prevent "flashing" or uneven gloss.

.2 **Exterior**

.1 Surfaces must be clean and dry and free of all grease, wax, dirt and mildew.

.2 Mildew can be easily removed by washing with a chlorine bleach solution - about one litre of bleach to three litres of water. Rinse with clean water and let dry thoroughly before painting.

.3 Remove all loose or peeling paint by scraping.

.4 Patch holes and cracks with an exterior patching compound.

.5 Re-caulk all open joints or cracks to prevent moisture entering wood or masonry.

.6 Spot prime bare areas with the appropriate primer before painting.

.7 Remove excess caulk by washing and/or sanding. Chalky surfaces to be sealed with a coat of Exterior Alkyd Primer.

.8 Glossy surfaces should be dulled by light sanding with fine sandpaper to ensure proper adhesion.

.3 **Application**

.1 **General**

.1 Method of paint application shall be generally by the accepted trade method.

.2 Painting coats specified are intended to cover surfaces satisfactorily when applied in strict accordance to recommendations.

.3 Apply each coat at the proper consistency.

.4 Each coat of paint, shall be slightly darker than preceding coat unless otherwise approved.

.5 Sand lightly between coats to achieve an anchor for the required finish.

.6 Do not apply finishes on surfaces that are not sufficiently dry.

.7 Each coat of finish should be dry and hard before a following coat is applied unless the manufacturer's directions state otherwise.

.8 Tint filler to match wood when clear finishes are specified; work filler well into the grain and before it has set wipe the excess from the surface.

.9 Finish glazing rebates before glazing commences.

.10 Do not paint caulked joints.

.11 On exterior work do not paint during temperatures under **5 deg C.** or immediately following rain, frost or dew; on interiors do not paint during temperatures under **5 deg C.** or on surfaces where condensation has formed or is likely to form. The minimum temperatures allowed for Latex paints shall be **7 deg. C.** for interior work and **10 deg. C.** for exterior work.

.2 **General Colour Requirements**

.1 Refer to the Colour/Room Finish Schedule for type and extent of finishes.
.2 The following generally, will be painted colour, texture, and sheen to match adjacent surfaces; access doors, registers, radiators and covers, prime coated butts, prime coated door closers and exposed pipes.
.3 Exterior and interior steel frames and trim generally will be of a different colour than adjacent walls.
.4 Ceilings generally will be painted a different colour than walls. Doors generally will be painted a different colour than trim and walls. Door Frames are a different colour than doors and walls.
.5 Existing steel lockers body/trim will be painted a different colour than adjacent walls, lockers doors will be a different colour from the locker body/trim.
.6 This section shall figure on:
2 different light colours
1 different dark colours (deep and bright included) Black Included.

.3 **Priming and Backpriming**

.1 Exterior woodwork which is to receive a paint finish shall be back-primed upon arrival at the job site with exterior primer paint, stain or varnish, depending on the finish.
.2 Interior woodwork which is to receive paint or enamel finish shall be backprimed upon arrival at the job site with enamel undercoating paint.
.3 Stain, or gloss varnish reduce as per manufacturers directions.
.4 Top and bottom edges of wood and metal doors shall be primed with undercoating, stain or varnish, depending on the finish specified.

.4 **Painting**

.1 For block filler apply as follows: Apply by airless spray followed by immediate back-rolling to uniform appearance. For airless spray use a 28 to 32 mil. Tip.
.2 Apply paint by brush or rollers. Spray paint only when requested or approved, and in approved areas. Discontinue spraying if directed because of inadequate coverage, over spray, paint fog drift, or disturbance to construction operations.
.3 Use only brushes for enamels and varnishes, and for painting wood.
.4 Specified formulas are intended to completely cover surfaces. If it is considered that coverage is inadequate, do not commence application without direction. Otherwise, apply as many coats as necessary to ensure completely satisfactory cover.
.5 Use only unadulterated paint. Thin paint as specified by manufacturer.
.6 Touch up viable suction spots on dried primer and ensure that they are sealed before application of second coat. Repeat on second coat if still visible.
.7 Do not paint metal access and electrical panels when they are closed. Paint when open and leave open until dry.
.8 Where exposed to view, fill holes and open grain of exposed plywood edges with wood filler following prime coats. Smooth and sand before applying next coat.

.5 **Staining**

.1 Pad filler well into pores of open-grained wood with a circular rubbing motion. Clean surplus off by rubbing across the grain before filler dries.

.2 Tint filler to match wood.

.3 Where indicated in these specifications or on Drawings, wood is to receive either a "wiped" stain or solid stain.

Solid stain shall provide a uniform colour over the entire surface to receive the stain. Adjust stain colours as necessary to obtain the same colour over any variations between wood pieces.

"Wiped" stain shall provide a highlighting of the wood grain in the surfaces to receive this stain, with not more than 20% colour in open areas and not more than 80% colour in grain.

.6 **Field Quality Control**

.1 Alkali Content Tests: Use pink litmus paper for testing surfaces for alkalinity. Where extreme alkali conditions occur surfaces are to be neutralized by washing. Wash shall consist of a 4% solution of Zinc Sulphate.

.2 Alkali content tests, and such other tests as shall be necessary, shall be performed by the Painter in collaboration with the painting inspector.

.3 Painting Inspector to visit the site while painting and finishing applications are in progress. On each visit he shall verify that specified materials and methods are used, and that procedures agreed upon at the initial site meeting are followed.

.4 Painting Inspector to submit reports of each site visit.

.7 **Cleaning**

.1 Promptly as the work proceeds and on completion of the work, removal paint where spilled, splashed or spattered' during the progress of the work keep the premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris; at the conclusion of the work leave the premises neat and clean to the satisfaction of the Paint Inspector, Architect and/or Owner.

.8 **Extra Stock**

.1 Deliver to Owner on completion of painting and finishing, and as directed, sealed containers of each finish painting material applied, and in each colour. Label each container as for original, including mixing formula. Provide 4 L of extra stock when less than 50 L are used for project, 8 L of extra stock when 50 to 200 L are used, and 12 L of extra stock when over 200 L are used.

.9 **Painting and Finishing Schedule**

.1 **General**

.1 This Section shall include painting and/or finishing of all surfaces exposed to view that have been installed with no final finish provided by the installer, unless otherwise specified and except for mechanical and service spaces.

.2 Finish interior surfaces, including objects within each area unless otherwise excluded, as indicated on Finish Schedule.

.3 Wall surfaces partially finished with other finish materials shall have remainder of surfaces finished as for surrounding surfaces.

.4 An additional finish coat is required for dark colours and pastel colours.

.5 Finish equipment, panels, fitments, services, structure, attachments, accessories, prime coated hardware, or similar appurtances on or near finished surfaces to match finish of the surface.

.6 Finish edges and tops of trim, projecting ledges, fitments, cupboards, and similar surfaces to match adjacent surfaces, whether or not they are above or beyond sight lines.

.7 Finish interiors of alcoves, recesses, closets, cupboards, fitments, and similar spaces to match adjacent surfaces unless otherwise indicated.

.8 Finish surfaces visible through grilles, grille cloth, perforated metals, screening, convector covers, louvres, linear metal ceilings, and other openings, including inside of ductwork, with two coats of matte black paint. If it is the intention that finished surfaces be seen behind the elements listed above, finish the surfaces to match adjoining surfaces.

.9 Finish exposed wood and exposed ferrous metals, whether primed or galvanized or not, on surfaces that are indicated as unfinished.

.10 Paint exposed metal housings of weather stripping and door seals and door closers to match surface to which they are attached and which are painted or finished by this Section.

.2 **Include Finishing of the Following Surfaces by This Section**

Steel lintels where exposed to view.
Interior ferrous metal hardware, fasteners and accessories, new and existing.
Interior galvanized hardware, fasteners and accessories, new and existing.
Exterior ferrous metal hardware, fasteners and accessories, new and existing.
Exterior galvanized hardware, fasteners and accessories.
Finish wood edges of new and existing doors and edges of new and existing metal doors exposed to view with same number coats of material and colour as adjoining surface finishes. Where not exposed, finish wood doors with two coats of varnish.
Paint exposed plywood edges of new and existing doors to match stained finish.
Paint new and existing metal door grilles to match door faces.
New and existing sheet metal ducts in interior spaces where exposed to view.
Sprinkler system except for heads where exposed to view.
Access doors, new and existing.
Baseboard units, new and existing.
Convector covers, new and existing.
Prime painted louvres, grilles, and diffusers at interior.
Prime painted louvres, grilles, and diffusers at exterior.
Prime painted fire hose and extinguisher cabinets.
Prime painted electrical panel doors and frames.
Paint new and existing piping and conduit exposed to view in finished areas. Colours to match adjacent surfaces.
Ensure that no colour coding or other identification of services that are applied by others are painted over by this Section.
Fill pipes.
Electrical service entry.
Mechanical, electrical and other equipment and accessories on roof including any existing items.

.3 **Surfaces That Do Not Require Finishing**

Painting or finishing of the following surfaces is not included in this Section: Plastics; metals with porcelain enamel, baked enamel or plated finishes; sound absorbent surfaces; vitreous, glazed ceramic or plastic facings; special coatings; factory finished surfaces as specified in other Sections; control panels, circuit breakers, switches, receptacles or similar electrical components; or name and specification plates on equipment; ducts, pipes and conduit concealed from view.

.4 **Gloss**

.1 Gloss value shall be determined in accordance with ASTM D523 Tentative Method of Test for 60° specular gloss.
.2 Gloss required for each surface is noted on Room Finish Schedule.

.10 **Finish Formula Schedule**

.1 **General**

.1 The following titles and code numbers refer to the Canadian Painting Contractors Architectural (CPCA) Painting Specification Manual, latest edition, unless otherwise Indicated for type of coating, grade, named products and their manufacturers.

.2 **Exterior Woodwork** (Fences, Plywood, Partitions)

Ext. 1-A, Exterior Alkyd Finish, premium grade.
Ext. 1-D, Exterior Solid Colour Stain Finish, premium grade.
Ext. 1-F, Exterior Fire Retardant

.3 **Exterior Wood Trim** (Doors, Door and Window Frames, Fascia)

Ext. 2-A, Exterior Alkyd Finish, premium grade.
Ext. 2-G, Exterior Pigmented Polyurethane Finish Type 2, premium grade.

.4 **Exterior Concrete, Concrete Block, Masonry, Stucco, Stone**

Ext. 6-A, Latex Finish, Stucco, Bricks and Render, premium grade.
Ext. 6-B, Latex Finish, Concrete Block, premium grade.

.5 **Exterior Structural and Misc. Steel** (Factory Primed)

Ext. 11-A, Alkyd Finish, premium grade.
Ext. 11-C, Aluminum Paint Finish, premium grade.
Ext. 11-D, Two Component Epoxy Finish, premium grade.

.6 **Exterior Galvanized Metal** (Zinc Coated Steel)

Ext. 12-A, Alkyd Finish, premium grade.
Ext. 12-B, Aluminum Finish, premium grade.
Ext. 12-C, Bituminous Finish (Unexposed - next to concrete), Custom grade.

.7 **Exterior Aluminum** (Flashings, misc. work, downpipes, etc.)

Ext. 13-A, Alkyd Finish on Exposed Aluminum, premium grade.
Ext. 13-C, Bituminous Finish on unexposed aluminum, custom grade.

.8 **Exterior Copper**

Ext. 14-A, exposed Alkyd Finish, premium grade.
Ext. 14-C, Bituminous Finish unexposed next to concrete or wood, premium grade.

.9 **Exterior Steel - High Heat**

Ext. 15-B, Heat Resistant Enamel Finish, follow manufacturer's recommendations for application.

.10 **Interior Wood** (wood trim, benches, wood doors and frames, cabinets etc.)

Int. 1-B, Latex Finish, premium grade.
Int. 1-C, Semi Transparent Alkyd Stain Finish, premium grade.
Int. 1-D, Semi Transparent Stain Polyurethane Varnish, premium grade.
Int. 1-I, Clear Polyurethane, premium grade.
Int. 1-J, Fire Retardant Solvent Base Pigmented Finish, follow manufacturers' instructions to apply.
Int. 1-K, Fire Retardant Clear Finish, follow manufacturers' instructions to apply.
Int. 1-L, Chemical Resistant Finish Shelving, Cupboards, Etc, premium grade.

.11 **Interior Plaster, Drywall Etc.**

Int. 4-B, Latex Finish, premium grade.
Int. 8-D, 1 coat: Glidden Professional, GP 1000 High Hide Interior Primer Sealer
2 coats: Glidden Professional, 4426 Tru-Glaze-WB 4426 Waterborne Epoxy Semi-Gloss Coating
Int. 4-G, Fire Retardant Coating Latex. Follow manufacturers' recommendations for application.

.12 **Interior Canvas And Cotton Insulation Coverings** (pipes, and ductwork, boilers)

Int. 5-B, Aluminum Paint Finish, premium finish.
Int. 5-C, Latex Finish, premium grade.

.13 **Interior New Acoustic Plaster, Tile and Textured Ceilings**

Int. 6-C, Custom grade.

.14 **Interior Concrete, Masonry, Stucco.**

Int. 7-A, Latex Finish, premium grade.
Int. 7-D, Water Based Tile-Like Finish on Smooth Concrete, premium grade.

.15 **Interior Concrete Block, and Concrete Brick**

Int. 8-A, Latex Finish, premium grade.
Int. 8-D, 2 coats: Glidden Professional, 4426 Tru-Glaze-WB 4426 Waterborne Epoxy Semi-Gloss Coating

.16 **Interior Structural And Misc. Steel** (Factory-Primed)

Int. 12-A, Alkyd Finish, premium grade.
Int. 12-D, Two Component Epoxy Finish, premium grade.

.17 **Interior Galvanized Metal**(Zinc Coated Steel)

Int. 13-A, Alkyd Finish, premium grade.
Int. 13-D, Latex Finish, premium grade.

.18 **Interior High Heat Steel**(Boilers, Breeching, pipelines. etc.)

Int. 14-B, Heat Resistant Enamel Finish, follow manufacturers' instructions for application.
Int. 14-E, Heat Resistant Enamel Finish, for temp. between 315 to 425 deg. C. follow manufacturers' instructions for application.

.19 **Interior Aluminum**

Int. 15-A, Alkyd Finish, premium grade.

**End of Section**

## PART 1 – GENERAL

.1 **General Instructions**

.1 Read and be governed by conditions of the Contract and sections of Division 1 and General Conditions.

.2 **Installer Qualifications**

.1 Installation of the work of this section shall be by forces in the direct employ or under control of the system manufacturer, skilled, trained, and experienced in work of similar scope and complexity.

.3 **Submittals**

.1 Submit required submittals in accordance with Section 01300.

.2 Shop Drawings:

.1 Submit shop drawings or fully dimensioned catalogue cuts.

.2 Clearly indicate general construction, configurations, jointing methods and locations, fastening methods and installation details.

.3 Samples:

.1 Submit samples of each material and finish colour selected and each accessory for review.

.4 Mock-Up:

.1 Erect mock-up in accordance with Section 01400.

.2 Erect 1 full size mock-up each roller shade type at the Place of Work for review. Completed and accepted mock-up shall act as the standard to which balance of the work of this section will be judged.

.5 Maintenance Instructions: Submit in accordance with Section 01700.

.4 **Protection**

.1 Before delivery to the Place of the Work, check each shade for operation; remove finger marks and smudges.

.2 Tightly wrap Products in polyethylene or other protective covering and leave in open position until directed.

.5 **Delivery, Storage and Handling**

.1 Package Products to prevent distortion in shipment and handling. Label packages and crates, and protect finish surfaces by sturdy wrappings.

.6 **Warranty**

.1 The warranty period with regard to the work of this section is 2 years, in accordance with Section 01780.

**PART 2 – PRODUCTS**

.1 **Window Shades Systems**

.1 Roller shade systems as manufactured by Solarfective Products Ltd. and distributed by Patry Products Inc., Tel 416-282-1771, or approved alternative.

.1 Surface mounted motorized roller shades with fascia covers.

.2 Shade systems specified in this section shall be one manufacturer who shall take full responsibility for the total project.

.3 Operation:

.1 Manual: Easy-Lift Action, chain operated, with infinite positioning. Left or right hand operation as applicable to suite Place of the Work condition.

.1 Drive Assembly:

.1 must allow finger tip control and include a built in shock absorber system to prevent chain breakage under normal operating conditions.
.2 factory set for the size and travel of the shades;
.3 capable of being field adjusted from the exterior of the shade unit without having to disassemble the hardware.
.4 Drive Chain: No. 10 stainless steel bead chain formed in a continuous loop. The chain shall have a 40 kg (90 lb) load test. Chain may be positioned at either, or both, ends of the shade without disassembly of the shade unit.
.5 Each shade shall have a counter balancing mechanism designed to offset the weight of the shade and give fingertip control.

.4 Assembly:

.1 Provide fully factory assembled shade unit consisting of 2 end shade brackets, shade tube, extruded aluminum fascia, hembar and fabric as specified.

.2 End Brackets: a two piece molded ABS construction with a 6.35 mm (1/4") diameter nylon drive sprocket. Bracket colour shall coordinate with the fascia colour.

.3 Shade Tube: 1.52 mm (0.060") thick extruded aluminum with three equally spaced continuous stiffening fins 4.82 mm (3/16") high.

.1 Manual shade rollers: 38 mm (1-1/2") diameter.
.2 Motorized shade rollers: 64 mm (2-1/2") diameter.

.4 Fascia: 1.7 mm (0.067") thick extruded aluminum. Finish to be clear anodized.

.5 Exterior Hembar: extruded aluminum with matching plastic end finials. Finish to be clear anodized.

.6 Mounting: Mounting type to be face of mullions as indicated. Removal of shade system shall not require the disassembly of the shade unit.

.5 Shade Mounting System:

.1 Extruded aluminum bracket designed to accept preassembled shade system. Brackets to be used to facilitate the alignment of the shade opening with the ceiling. TELE-VENT Bracket to be of sufficient strength to prevent encroachment by other trades into shade space, and to ensure the underside of the fascia is within 1.5 mm (1/16") of the ceiling elevation. Brackets are not intended to be a ceiling support member. Brackets shall be supplied to Section 09250 for positioning and installation.

.2 Modular Construction: Shades must be removable as a complete modular unit without any component disassembly required.

.6 Shade Cloth:

.1 Solar Shade fabric: 300 Series woven of 0.018 opaque vinyl coated polyester yarn consisting of approximately 75% PVC and 25% polyester core yarn. The fabric shall be tensioned in the finishing range prior to heat setting to keep warp ends straight and minimize or eliminate weave distortion to keep the fabric flat. Fabric: dimensionally stable, 3% openness factor, 21 oz/yd$^2$ weight. Colour to be Grey.

.2 Performance: Fabric shall hang flat, without buckling or distortion. Edge, (where trimmed) shall hang true and straight, without shifting sideways more than 3 mm (1/8") in either direction due to warp distortion or weave design.

.3 Flame Retardance: Certified by an independent Laboratory to pass CAN/LUC-S109 Large Flame Test.

.4 Incorporate reinforcing, fastening and anchorage required for installation of shades.

## PART 3 – EXECUTION

### .1 Installation

.1 Shades to be snapped into place without screws or visible fasteners once initial cleanup is completed.

.2 Securely attach all installation fittings to their mounting surfaces with stainless steel or hardened aluminum screws of correct length and type, and with compatible plugs or anchors where required.

.3 Install shade roller true and level, and with cloth to hang flat without buckling or distortion.

### .2 Adjustment and Cleaning

.1 Verify that installed shade system functions properly, and adjust it accordingly to ensure satisfactory operation.

.2 Refinish damaged or defective work so that no variation in surface appearance is discernible.

**END OF SECTION**

## PART 1- GENERAL

### 1.1 General Requirements

.1 Read and be governed by conditions of the Contract and sections of Division 1.

### 1.2 Scope of Work

.1 Work Included
Supply all materials, provide all labour and equipment to erect the structural steel as shown or required by the drawings or specifications. The principal items include, but are not limited to:
- structural steel columns, girders, beams, open web steel joists, girts, angles
- bracing, plates, stiffeners, strap anchors
- galvanized shelf angles/bent plates
- anchor bolts for anchoring sole plate of wood stud walls
- Loose Structural Shapes Cast Into Concrete Work installed under Division 3 - Concrete, and built integrally with masonry work for installation under Division 4 - Masonry.

.2 Related Work Specified Elsewhere

- Masonry - Division 4.
- Metal floor and roof deck Division 5
- Grouting of Column Bases Division 3
- Painting Division 9
- Wind Bearing Studs Division 5

### 1.3 Referenced Standards

.1 All standards in accordance with latest issue.

.2 C.S.A. Standard CAN/CSA-S16-01, "Limit States Design of Steel Structures".

.3 C.S.A. Standard W59-03, "Welded Steel Construction" (Metal Arc Welding).

.4 C.S.A. Standard W.55.3-1965 (R2003), "Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings".

.5 C.S.A. Standard W.47.1-03, "Certification of Companies for Fusion Welding of Steel".

.6 C.S.A. Standard S136-01, "North American Specification for the Design of Cold Formed Steel Structural Members".

.7 CAN/CSA-G164-M92 (R2003), “Hot Dip Galvanizing of Irregularly Shaped Articles”.

.8 CISC/CPMA 2-75 Quick Drying Primer for use on Structural Steel.

.9 Ontario Building Code.

### 1.4 Shop Drawings

.1 Examine all drawings forming a part of this Contract and conform to the requirements of all such drawings.

.2 The Consultant reserves the right to relocate members prior to and during the approval of erection diagrams for the purpose of clearing ducts, piping, walls, etc., and to finalize the location of mechanical roof top units, etc., at no additional cost to the Owner. Any cost involved in revisions to erection diagrams or shop drawings as a result of these changes shall be borne by this Sub-Contractor.

.3 Any fabrication executed before review of shop drawings shall be at this Sub-Contractor's risk. Fabrication shall be assumed to begin when material is cut to length, whether this be by the fabricator or at the mill to the fabricator's orders.

.4 The Consultant's review of shop drawings will not relieve the Sub-Contractor from his responsibility for ensuring that his work is complete, accurate, and in accordance with the drawings and specifications.

.5 The use of reproducible copies of the Consultant's drawings for erection diagrams will not be permitted.

.6 Shop drawings are to be submitted as follows:
Erection drawings: 2 prints and 1 pdf digital of each.
Shop fabrication drawings: 1 print and 1 pdf digital copy of each.

.7 Provide two complete sets of sepias of the erection diagrams to the Consultant showing "as-built" conditions, including final sizes and locations of openings and final locations of mechanical units.

.8 Within two weeks of awarding the contract the structural steel fabricator must submit for approval, a drawing showing the top of bearing plate elevations and horizontal dimensions to all bearing plates. The mason cannot start with blockwork above finished floor elevation until these drawings are reviewed and approved.

.9 No levelling plates will be allowed on this project unless the steel fabricator hires a 3rd party inspection firm to confirm that the requirements of clauses 25.3.1.2, 28.5, and 29.7.8 of CSA standard S16-01 have been met for all column bases where levelling plates have been used. Following inspection the inspection firm must submit a letter signed and sealed by a professional engineer confirming that they have inspected all column bases employing levelling plates and that these bases meet the requirements of above noted clauses. The 3rd party inspection firm is to have a minimum 5 years' experience inspecting steel structures and shall be certified as CWB certified inspection company.

**1.5 Design Criteria**

.1 Certificates

.1 Provide a certificate signed and sealed by the registered professional engineer responsible for the detailed joist design, stating that the joists have been designed and fabricated in accordance with the applicable design and welding procedures for the loads shown on the drawings.

.2 Provide a certificate signed and sealed by the registered professional engineer responsible for the detailed structural steel connections, stating that the connections have been designed, detailed, and fabricated in accordance with the applicable standards for the loads shown.

.3 Where joist to structural steel connections occur, these engineers must be co-ordinate their designs to ensure compatible design assumptions.

.4 Certificates must bear the original seal and signature of the engineer and be dated. Photocopies are not acceptable.

.2 All loads, forces and reactions shown on the drawings or noted in the specifications are service loads (unfactored), unless noted otherwise.

.3 Design and detailing of joists, connections, etc., in accordance with CSA CAN3-S16-M. Service loads must be factored for limit States Design.

.4 Typical connection details are shown on the drawings for guidance only. Design and submit for approval suitable bolted or welded connections. In general, bolted connections are to be designed as "bearing" connections with threads included in the shear plane.

.5 The shear capacity of all beam and girder connections shall be not less than the shear capacity of the section acting as a simple beam loaded uniformly to its moment capacity over the same span nor less than that shown on the drawings, whichever is greater.

.6 Design joists and bridging members in accordance with applicable reference standards for the uniform loadings shown on the drawings with due allowance for local bending moments and for any additional concentrated and/or line loads for support of mechanical units and/or masonry walls. Design OWSJ such that total load deflection does not exceed 1/240th of the design span and the live load deflection does not exceed 1/360th of the design span.

.7 Refer to mechanical drawings for number of, approximate location, and weight of, suspended mechanical units and piping runs. Final location will be determined during the shop drawing stage.

.8 Refer to Structural Drawings and cross reference with latest mechanical drawings for all locations where mechanical ductwork passes through open web steel joists. All such ductwork shall pass through joists between top and bottom chords of joists. Design openings in joist by the use of reinforced open panels, if necessary, to accommodate duct sizes indicated on mechanical plans. Analyze open panels trusses with full and off balanced loadings to account for maximum shear forces across open panel.

.8 Where tie joists are shown on plan, extend the complete bottom chord of the joist and connect to either the column or beam.

.9 Provide additional bottom chord bridging to ensure adequate bottom chord compression capacity where stress reversal may occur due to net uplift, or cantilever action.

.10 Note that the roof systems are sloped for drainage which requires attention to detailing and fabrication.

.11 Typical bearing stiffeners for beams continuous over columns are shown on the drawings. Design suitable stiffeners at other locations of concentrated loads, as required to suit the connection design.

.12 Design and detailing of joists, connections, etc., to be in accordance with CSA CAN3-S16-M.

.13 Top chords of joists to have horizontal leg of angle not less than 38 mm wide for hot rolled angles and 50 mm wide for cold formed sections.

**1.6 Coordination**

.1 Coordinate the work of this Section with the General Contractor’s scheduling in accordance with the General Conditions.

.2 Coordinate the work of this Section with the work of all affected Divisions to provide proper clearances and assembly of the work.

.3 Coordinate the work of this Section with the work of the Section 05300 "Metal Deck" to provide a continuous erection procedure

### 1.7 Substitutions

.1 Substitution of available beam and column sections for those shown on the drawings may be permitted, provided that the substituted members have equivalent or greater capacity and stiffness than those shown.

.2 Proposed substitutions are subject to prior approval of the Consultant and must not interfere with Architectural clearances.

### 1.8 Quality Assurance

.1 Fabrication and erection of all components to be by Division 1 or Division 2.1 certified company only. Welders must have current CWB certification for the applicable position

## PART 2 - PRODUCTS

### 2.1 Materials

.1 Rolled Steel Sections, Shapes, Currently produced in Canada - in accordance with C.S.A. Standard G.40.21M-350W.

.2 Plates and Rod Currently produced in Canada - in accordance with C.S.A. Standard G.40.21M-300W.

.3 Hollow Structural Sections
Currently produced in Canada - in accordance with C.S.A. Standard G40.21-350W Class - C

.4 High Strength Bolts & Washers - in accordance with ASTM Standard A325.

.5 Shop Primer Paint - in accordance with CISC/CPMA Standard 2-75, for steel on interior of building.

.6 All exposed structural steel items on the exterior of the building are to be primed with a Reinforced inorganic Zinc Primer (Cathacoat 302H) and intermediate coat of High Build Epoxy (Bar-Rust 231 1) by Devoe Coatings .

.7 Anchor bolts - in accordance with C.S.A. Standard G40.21M-300W.

.8 Hot Dip Galvanizing - zinc coating by hot dip process after fabrication to provide a uniform coating of not less than 2.0 ounces per square foot.

.9 Field Touch-up Paint

.1 As for shop paint for previously shop primed members

.2 Galvafroid zinc rich coating by W.R. Meadows for previously galvanized members.

.3 Touch-up paint for exterior canopies and any other steel having exterior exposure to be same as specially specified primer, intermediate, and top coats.

### 2.2 Fabrication

.1 Fabrication of all structural steel in accordance with C.S.A. Standard CAN3-S16.1-M.

.2 Carefully make and fit all details and connections to ensure that the finished work presents a neat and workmanlike appearance.

.3 All shop and field connections are to be welded or high-strength bolted.

.4 Splicing will not be allowed without the approval of the Consultant at the shop drawing review stage. Splicing will then only be allowed if the length of the fabricated member required is longer than that normally produced at the mill.

.5 All members shall be true to length so that assembly may be done without fillers.

.6 Provide holes for bolted connections for connecting the work of other trades where such holes can be determined prior to fabrication and only at the request of the Engineer or the trade concerned. Such holes shall only be provided where they will not impair the satisfactory performance of the structure.

.7 Provide holes for blocking where blocking is required to receive 16 mm diameter bolts spaced at 600 mm o.c., and staggered where possible.

.8 Provide holes in webs or welded bar assemblies for masonry anchors as per typical details.

.9 Supply suitable anchor bolts for base plates and bearing plates and wood sole plates for installation under Division 3.

.10 Base plate sizes shown on the drawings are finished sizes. Allow additional thickness as required for milling.

.11 Take care to minimize distortion due to welding and galvanizing procedures. Straighten members as required to maintain the fabrication tolerances of C.S.A. CAN3-S16.1-M.

.12 Provide restraining clip angles at the tops of all masonry walls for lateral support of such walls.

.13 Thoroughly clean all steel of all loose mill scale, and rust.

.14 for structural steel items exposed to the exterior abrasive blast all surfaces to minimum SSPC-SP6 and immediately apply a 3.0 mil dry thickness (4.0 mil wet thickness) of primer followed by a 5 mil dry thickness of intermediate paint coat.

.15 Apply one coat of shop primer on dry clean surfaces for all members except as follows:

.1 Do not paint steel in direct contact with concrete,

.2 Do not paint steel at locations where field welded moment connections are to be made. (Field prime all steel after welding and after removal of slag down to bear metal)

.3 Do not paint any galvanized steel items.

.4 Do not paint steel to be fireproofed if the manufacturer of the fireproofing material indicates that the bond of the fireproofing will be adversely affected by the primer.

.16 Take care to minimize distortion due to welding and galvanizing procedures. Straighten members as required to maintain the fabrication tolerances of C.S.A. CAN3-S16.1-M.

.17 Galvanizing to C.S.A. Standard G164, including preparation. Blast clean to commercial quality after fabrication, prior to galvanizing. Provide seal welds in addition to structural welds as required by good practice.

.18 Provide welded "seal" plates (minimum 5mm) as required to close all HSS sections. If this is not possible in all locations, provide drain holes.

.19 Supply suitable loose lintels as shown on the Lintel Schedule for all openings in masonry walls for installation under Division 4. Lintels included are those for all openings shown on Architectural, Mechanical, and Electrical drawings.

.20 Fabricate steel HSS columns that are to be filled with concrete fill for fire rating such that column can be filled and vibrated on site without segregation of the concrete mix.

**2.3 Quality Control**

.1 All materials and fabrication shall be subject to test by a testing and inspection company appointed by the Owner.

.2 Provide access to the work in the shop for the personnel of the inspection company.

.3 Provide a written schedule supplied to the Consultant and the testing company when items to be tested are ready for inspection. This specifically includes site review dates for all large trusses in Show Arena. Submit schedule 2 weeks prior to completion of work to be tested.

.4 Provide such samples of materials and mill test reports as may be required by the inspection company at no cost to the Owner.

.5 The cost of testing will be paid for by the Owner.

.6 The testing done by the Independent testing company retained by the Owner is to inform the Consultant and the Owner of Contractor's performance and must not be used in any way to bolster the quality control efforts of the Contractor nor relieve the Contractor of their contractual responsibility.

.7 Non-destructive testing (NDT) is to be carried out by radiography, magnetic particle, or ultra sonic methods, whichever is more appropriate.

.8 Any deficient welds identified by means of NDT, shall be repaired and retested at the Contractor's expense.

.9 Shop testing by the Independent Testing Company retained by the Owner shall follow the following guidelines:

.1 Allow for 20% random visual and NDT on shop-welded connections.
.2 Allow for 20% random visual and 10% random NDT on and joist welding.

**PART 3- EXECUTION**

**3. 1 Examination**

.1 Examine and obtain all necessary measurements of previously executed and existing work which may affect the work of this Section.

.2 Make a line and level survey of the foundations and anchor bolts. Report any discovered discrepancies to the Consultant so that instructions can be given for the necessary remedial action.

**3.2 Erection**

.1 Accurately set all steel to the lines and elevations shown on the drawings. Temporarily connect all members with sufficient bolts to ensure the safety of the structure until permanent connections are made.

.2 Assemble all members without twists or open joints. Take particular care that all parts are well pinned up and drawn together before bolting or welding is started.

.3 Assume full responsibility for the correct plumbing and alignment and for setting of all members.

.4 If members do not fit properly in the field, repairs must be made by methods to the satisfaction of the Consultant. In no case shall cutting be done with a torch, except where specific approval as to size and location of same is granted by the Consultant. Unfair holes shall be enlarged with a twist drill and larger bolts used.

.5 Set column bases and beam bearing plates on steel shims or other suitable supports. Grouting under these plates will be by Division 3, "Cast-in-Place Concrete" or Division 4 "Masonry" for bearing plates built into masonry walls.

.6 Erect the steel frame true and plumb. Place temporary bracing where necessary to take care of all loads to which the incomplete building may be subjected, such as wind, equipment, or construction procedures. Leave temporary bracing in place as long as necessary for the safety of the structure.

.7 Erection tolerances in accordance with Section 28 of C.S.A. CAN3-S16.1.

.8 Install restraining clip angles to provide lateral support at the top of all new masonry walls. Carefully co-ordinate with the Contractor and the Masonry Sub-contractor.

.9 Erection of structural steel, OWSJ and bridging in accordance with CSA CAN3-S16.1. Take special care in the alignment of top chords to ensure a straight line for welding of deck.

### 3.3 Field Painting

.1 Field paint, using the appropriate finish paint, all scars, blemishes, and bolts not previously shop painted or those areas damaged by erection procedures.

.2 For members which are hot-dipped galvanized, touch up all scars, scratches, etc. with a compatible zinc rich paint.

### 3.4 Field Quality Control

.1 Provide access to the work at the site for the personnel of the inspection company.

.2 Testing shall be carried out at the option of the Consultant and will be paid for by a cash allowance, except that any re-testing required due to defective work shall be borne by this Sub-Contractor.

### 3.5 Clean-up

.1 At the completion of the work of this section, remove any excess materials, debris, and equipment from the site.

**END OF SECTION**

Chorley+Bisset
CONSULTING ENGINEERS

# GREGORY HOGAN CATHOLIC SCHOOL

## OFFICE RENOVATIONS

## SARNIA ONTARIO

## ST. CLAIR CATHOLIC DISTRICT SCHOOL BOARD


CHORLEY + BISSET LTD
CONSULTING ENGINEERS
LONDON ONTARIO



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MAY 2017



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**GREGORY HOGAN CATHOLIC SCHOOL**

**OFFICE RENOVATIONS**

**SARNIA ONTARIO**

**ST. CLAIR CATHOLIC DISTRICT SCHOOL BOARD**

# G E N E R A L  I N D E X

INDEX - SECTION 15001

PART 1 - GENERAL



PART 2 - PRODUCTS

INDEX - SECTION 15001 - continued

PART 3 - EXECUTION



DETAIL SHEETS

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 This Section and Division 1 - General Requirements applies to and governs the work of all Sections of Division 15.

1.2 **VISITING SITE**

1.2.1 Visit the site and be familiar with working conditions and work involved before submitting Bids. No extras will be granted due to lack of a thorough preliminary investigation of the site.

1.2.2 Remove and replace existing ceiling tile to inspect ceiling space for existing Mechanical, Electrical and Structural obstructions. Include cost of all necessary changes in Bid Price. No extras will be granted due to lack of a thorough preliminary investigation of accessible ceiling spaces.

1.3 **CONTRACT DRAWINGS**

1.3.1 Mechanical Drawings show Mechanical work only and are not intended to show Structural details, Electrical details or Architectural features. Take building dimensions and details from Architectural or Structural Drawings or from job measurements. Any dimensions shown on Drawings are approximate. Verify dimensions by reference to Shop Drawings and field measurement.

1.3.2 Only the general location and route of piping and ductwork is shown. Install all piping and ductwork neatly to conserve headroom. All piping and ductwork to be installed parallel to building lines unless shown otherwise.

1.3.3 The Consultant reserves the right to revise the locations of equipment and outlets within any given room without altering the Contract Price provided Notice of Change is given prior to roughing-in.

1.3.4 In case of conflict between work of other trades and work of this Division, clarify the location of these items with the Consultant before roughing-in.

1.3.5 In the event of any discrepancies or ambiguity of any symbol, note, abbreviation, etc., used in this Specification or on the Contract Drawings, obtain clarification, in writing, from the Consultant prior to submitting Bid. No allowance will be made for additional costs arising from failure to obtain proper clarification of conflicting information before Bid.

1.3.6 Quantities or lengths indicated in any of the Contract Documents are approximate only and will not be held to gauge or limit the work. No adjustment to the Contract Price will be allowed to complete the work.

1.3.7 Verify equipment access and coordinate with equipment supplier to ensure equipment can be physically transported to installation location. Under no circumstances will any claim be allowed for extra cost to disassemble and/or assemble equipment at the final location which will be considered as part of equipment installation.

1.3.8 Provide labour, products and services specified, but not shown on Drawings and vice versa, and all other labour, products and services necessary for completion of the work.

1.3.9 All dimensions and sizes are in SI units. Generally, units are in millimetres. All exceptions to this are noted. Pipe sizes are in accordance with ANSI Standards.

1.4 **SHOP DRAWINGS**

1.4.1 Submit Manufacturers' Shop Drawings, Electrical Wiring Diagrams and Control System Drawings to the Consultant. Provide title sheet for Shop Drawing submitted. Include project name, Shop Drawing item (including specification paragraph reference) and approval stamps. The Consultant reserves the right to have samples submitted of any specified products.

1.4.2 Before submitting shop drawings, provide a complete list of shop drawings to be submitted in Microsoft Excel format. List all shop drawings and approximate date of submission.

1.4.3 Submit all shop drawings electronically in Adobe Acrobat PDF format. File attachments to an email must total no more than 5 MB and must be submitted unzipped. If multiple items are submitted in single PDF file, each individual piece of equipment must be “book marked” using equipment labels as per Design Drawings. All shop drawings submitted electronically must be checked and stamped by the Contractor as specified below.

1.4.4 Catalogues, manuals or price lists will not be accepted as Shop Drawings. Before submission, check Shop Drawings, make necessary corrections, apply stamp “Checked and Certified Correct”, sign and date.

1.4.5 Submit one reviewed set of Shop Drawings with each set of Maintenance and Operating Instructions.

1.4.6 The review of Shop Drawings by Chorley + Bisset Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review does not mean that Chorley + Bisset Ltd. approves the detail design inherent in the Shop Drawings, responsibility for which remains with the Contractor. Such review does not relieve the Contractor of his responsibility for errors or omissions in the Shop Drawings or of his responsibility for meeting all requirements of the Construction and Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all subtrades.

1.4.7 The Contractor is to review each shop drawing and document the differences between the shop drawing submission and the description listed in the specification. If there are no differences listed, the Contractor implicitly declares the shop drawing meets all requirements of the Specification.

1.4.8 Ensure at least one copy of the reviewed Shop Drawings is kept on site at all times for reference.

1.4.9 Prepare all Drawings in SI units.

1.5 **FIELD DRAWINGS**

1.5.1 Submit, to the General Contractor, Drawings accurately showing all openings for ducts, pipes, etc. Drawings must include the size of openings and their locations by dimensions, including the location of the structural members framing these openings. Each trade will be responsible for detail layout of their own work.

1.5.2 Assume full responsibility for the detailed coordination of all Division 15 work. Prepare Field Drawings to determine the exact location of each service. On these Drawings, include all mechanical and electrical services, architectural features, and structural details. If a conflict becomes apparent after the installation of services, pay all costs associated with removing and reinstalling these services.

1.6 **AS-BUILT DRAWINGS**

1.6.1 The Contractor will be provided with the Mechanical Drawings in AutoCAD 2010 compatible electronic format. The Contractor is to plot and print Drawings from the discs.

1.6.2 Revise and maintain the prints as work progresses. Show all revisions, relocations and changes, to scale. Use colour markings.

1.6.3 Transfer information from the marked prints to AutoCAD format on a monthly basis. Have the marked prints and updated AutoCAD prints on site for review by the Consultant at all times. Monthly draws will not be approved unless all changes have been shown.

1.6.4 Prior to testing, balancing and final commissioning, complete the transfer of all information to the AutoCAD Drawings. The Drawing format is to match exactly the layering system of the Consultant. Mark Drawings “As Built Drawings” and insert name and logo of Contractor. Bind all xrefs. Submit one set of As Built Drawing prints for review by the Consultant. Remove Engineers Stamp. Include Contractors name and Logo.

1.6.5 Submit completed As Built Drawings disks in AutoCAD 2010 format and one set of Reproducible Drawings with the Operating and Maintenance Manuals.

1.6.6 For the purposes of Contract payments, As Built Drawings will be assumed to have a value of $2,500.00. This will not be released until As Built Drawings have been accepted as complete and acceptable by the Consultant. This amount is in addition to the normal 10% holdback required by the Construction Lien Act, 1983.

1.7 **CONFLICTS AND PRECEDENCE**

1.7.1 Immediately upon discovery of any conflict, ambiguity, error or omission in the Contract Documents, request clarification in writing from Consultant prior to starting the work in questions.

1.7.2 Failure to give such written notice will constitute an irrevocable waiver and release of any claim for additional compensation or delays incurred.

1.7.3 Where work fails to conform to Contract Documents, as clarified by Consultant, promptly remove and replace such work as directed, without adjustment to Contract price.

1.8 **FIRESTOPPING**

1.8.1 Before starting any work on site, submit detailed Shop Drawings to the Consultant for review and comments. Include:

1.8.1.1 Manufacturer's technical product data and installation instructions for each specific type and location of penetration.

1.8.1.2 Certification that proposed firestopping materials and assemblies comply with CAN-ULC S115 “Standard Method of Fire Test for Firestop Systems”.

1.8.1.3 For each specific type and location of penetration, provide installation instructions from a recognized independent testing agency.

1.8.2 Mark penetration types and locations on set of white prints. At completion of project, transfer this information to “Record” Drawings.

1.8.3 Comply with all requirements of Ontario Building Code, Clause “Building Services in Fire Separations and Fire Rated Assemblies”.

1.8.4 Submit one sample of the components of each firestop system to the Consultant for review.

1.9 **MAINTENANCE AND OPERATING INSTRUCTIONS**

1.9.1 Assemble three sets of equipment literature (cuts), operating instructions, maintenance instructions, pressure test results, certificate, other pertinent data and Letter of Warranty. Place in three ring binders, complete with index pages, indexing tabs and cover identification at front and side. Submit to Consultant for approval.

1.9.2 Make changes or submit additional information as required to obtain approval. Final Certificate of Completion will not be issued until the Consultant possesses three approved sets. Include copies of approved Shop Drawings and name and address of Spare Parts' Suppliers with manuals.

1.9.3 Provide two electronic copies of the maintenance and operating manual in Adobe Acrobat PDF format on a compact disc or DVD and submit with the final version of manuals. Provide separate files on the disc in accordance with the sections of the hard copy manuals. Divide the maintenance manuals into sections which correspond with Specification Sections.

1.9.4 The following information is to be contained within the Sections:

1.9.4.1 A list of names, addresses and telephone numbers of the Consultants, General Contractor and Mechanical Contractor. Written warranty of the Mechanical systems. A copy of the valve directory, giving number, valve location, normal valve position and purpose of valve.

1.9.4.2 A copy of all pressure tests and operational tests for pumping systems. A list of names, addresses and telephone numbers of all suppliers. A copy of all approved Shop Drawings.

1.9.4.3 A complete and comprehensive lubrication, maintenance and operating instructions details D (daily), W (weekly), M (monthly), SA (semi-annually), A (annually) schedule for maintenance and lubrication.

1.9.4.4 A complete list of all air filter sizes, quantities and types, corresponding with unit designations.

1.9.4.5 Copies of warranties.

1.9.4.6 Complete control diagrams, wiring diagrams and description of control system and the functioning of the system.

1.9.4.7 Copy of the project Testing and Balancing Report.

1.10 **REGULATIONS AND PERMITS**

1.10.1 Carry out all work in accordance with the latest editions of applicable municipal and provincial codes, regulations, bylaws, and requirements of local Authority Having Jurisdiction. In no instance, however, is the standard established by the Drawings and Specifications to be reduced by the codes referred to above. Apply for and obtain any necessary permits. Pay any necessary fees.

1.10.2 Enforce all prevailing Provincial and local safety regulations at all times. Abide by all Owner's safety and security policies and procedures and conform to all regulations of the current Occupational Health and Safety Act.

1.10.3 Submit copies of CRN Certificates for all boilers and registered pressure vessels.

1.10.4 Arrange and pay for TSSA inspection and certification.

1.11 **MATERIAL AND EQUIPMENT**

1.11.1 Where an item of material or any equipment is specifically identified by a manufacturer's trade name and/or catalogue number, make no substitution except as provided for in paragraphs 3, 4 and 5 below.

1.11.2 In the case of some items of equipment, one or more additional names of acceptable equal manufacturers are listed in the Clause describing an item or a group of items. The design, layout, space allocation, connection details, etc., are based on the products named first in the description of each item. The products named first in the description of each item establish the quality of manufacture and design standards for all other manufacturers of that item. The general approval indicated by listing the names of other manufacturers is subject to final review of Shop Drawings, performance data, test reports, production samples (if required) by Consultant, and equipment shipped to site. Ensure that the products used meet the requirements specified and as shown on the Contract Drawings.

1.11.3 Suppliers wishing to submit other items of equipment for approval as an equal to those specified must apply to the Consultant at least 8 working days before Bid closing date. Requests must be accompanied by complete description and technical data on the items proposed. Approval for substitution of equipment will only be given on the understanding that all details, accessories, features and performance meet the Specifications unless otherwise stated. Deviations from the Specifications must be stated in writing at time of application for approval.

1.11.4 Include in the Bid, the equipment named in the Specifications or approved as an equal as in paragraph 3 above. This will form the Base Bid. Any number of alternative bids, as defined below, may be included in addition to the Base Bid.

1.11.5 Items of equipment by Manufacturers not named in the Specifications may be offered as alternatives to the manufacturers named in the Specifications. The alternative proposals must be accompanied by full descriptive and technical data, together with the statement of amount of addition or deduction from the Base Bid, if the alternative is accepted. Prior approval by the Consultant is not required on items submitted as alternative bids.

1.11.6 After execution of the Contract, substitution of equipment will be considered only if equipment accepted cannot be delivered in time to complete the work in proper sequence, or if the manufacturer has stopped production of the accepted item. In such cases, requests for substitution must be accompanied by proof of equality and difference in price and delivery, in the form of Certified Quotations from Suppliers of both specified and proposed equipment. Credit any decrease in price involved in substitution to the Owner by reduction of the Contract Price. The Contractor will not be reimbursed for any such increase in price.

1.11.7 Where equipment other than the equipment used as a basis for design, layout and space allocation is used, produce and submit revised layouts of equipment, pipes, ducts, etc., in the areas affected. Submit these Drawings with the Shop Drawings. Failure to produce these Drawings is indication by the Contractor that they are not required and the original space allocations are adequate for the substituted equipment.

1.11.8 Name the Subcontractors and Manufacturers in the Bid as indicated in Clause “List of Mechanical Subcontractors and Manufacturers”.

## 1.12 INTERPRETATION OF CONTRACT DOCUMENTS

1.12.1 The decision as to which trade provides required labour or materials rests solely with the Contractor. Extra payments will not be considered based on a difference in interpretation of the Contract Documents as to which trade involved provides materials or labour for specific items of work. The Consultant will not enter into such discussions.

## 1.13 SITE VISITS

1.13.1 The Mechanical Contractor shall have an office representative (not site personnel) at each site meeting and deficiency review. Attendance at these meetings is mandatory.

## 1.14 PROGRESS DRAWS

1.14.1 Mechanical Contractor shall review all supplier and subcontractor draws submitted to their office to ensure they are fair and reasonable for the amount of work completed on site to date prior to submitting to the General Contractor. Mechanical Contractor will be responsible for the validity of supplier and subcontractor draw claims.

1.15 **WARRANTY**

1.15.1 Warranty all workmanship and make good any defects for one year after Substantial Completion. Warranty material and equipment supplied by the manufacturers for one year after Substantial Completion. Make good damage caused due to defects and workmanship.

1.15.2 Where equipment specified in Sections of Division 15 to have an extended warranty period, e.g. five years, the first year of the warranty period will be governed by the terms and conditions of the warranty in the Contract Documents, and the remaining years of the warranty will be direct from the manufacturer and/or supplier to the Owner. Submit signed and dated copies of the extended warranties to the Consultant before applying for a Certificate of Substantial Performance of the Work.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Clause “Material and Equipment”.

2.2 **BACKFILL**

2.2.1 Use backfill material in accordance with the requirements of Division 2 unless specified or shown otherwise.

2.3 **CONCRETE**

2.3.1 Use concrete in accordance with the requirements of Division 3.

2.4 **SLEEVES**

2.4.1 In general, sleeves are not required through walls or floors except for penetrations through Service Room walls or floors.

2.4.2 For all pipes passing through foundation walls, use Link-Seal pre-engineered mechanical seals between sleeves and pipes.

2.4.3 For sleeves through mechanical room floors, use Schedule 40 steel pipes with annular fins continuously welded at midpoint.

2.4.4 For rated separation requiring a FT firestopping rating, use materials in conformance with manufacturer's recommendations.

2.5 **FIRESTOPPING**

2.5.1 Use only service penetration firestop components and assemblies tested in accordance with CAN/ULC S115 Fire Tests of Firestop Systems and listed in most recent ULC “List of Equipment and Materials” or by another recognized independent testing and certification agency acceptable to the Consultant.

2.5.2 All pipe insulation passing through the fire separation to be approved with the listing of the firestop system.

2.5.3 Pipe sleeves through fire separations requiring a rating are to be installed as per firestopping manufacturer's recommendations, as some firestopping manufacturers do not allow pipe sleeves within their approved system. Confirm pipe sleeve compatibility prior to starting work on site.

2.5.4 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause “Material and Equipment”:

Tremco

## 2.6 FIRE CLOSURES

2.6.1 Use only fire damper assemblies tested in accordance with CAN/ULC S115 Fire Tests of Firestop Systems and listed in most recent ULC “List of Equipment and Materials” or by another recognized independent testing and certification agency acceptable to the Consultant.

## 2.7 ESCUTCHEON PLATES

2.7.1 Use chrome or nickel-plated brass, solid type, with set screws for ceiling or wall mounting.

## 2.8 ACCESS DOORS

2.8.1 Access doors to be flush to edge of frame, concealed continuous hinge with screwdriver operated cam latch. Non fire-rated door construction to be minimum 14 gauge, with 16 gauge frame. Fire-rated door construction to be a minimum 20 gauge insulated door with 16 gauge frame. Insulation thickness to provide required rating.

2.8.2 Size doors to allow adequate operating/maintenance clearance for devices. Doors to be a minimum 600 mm x 600 mm (24″ x 24″) for body entry, and 300 mm x 300 mm (12″ x 12″) for hand entry, unless noted otherwise. Use the following access doors:

| | |
|---|---|
| Masonry Walls | - Acudor UF-5000 |
| Drywall Walls | - Acudor DW-5040 |
| Drywall Ceilings | - Acudor BP58, match ceiling thickness |
| Fire-Rated | - Acudor FW-5050/FB-5060 to match fire separation |

2.8.3 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause “Material and Equipment”:

Adam
Ancon LeHage
E. H. Price

## 2.9 ELECTRICAL EQUIPMENT

2.9.1 This building will be fully sprinklered (future). Use weatherproof electrical equipment in vaults and electrical rooms or shield equipment in such a way as to prevent the sprinkler system water from entering the electrical equipment and/or interfering with its operation.

## 2.10 ELECTRIC MOTORS

2.10.1 Provide motors of adequate size and type for intended service. Use CSA approved motors with the following characteristics:

| | | |
|---|---|---|
| 250 watts (1/3 hp) and under | - | 115 volt, 60 hertz, single phase |
| 370 watts (1/2 hp) and over | - | 60 hertz, three phase, voltage as shown on Drawings. |

2.10.2 Motors are to be the voltage specified. Step down or step up transformers will not be accepted.

2.10.3 Motors 250 watts (1/3 hp) and under: Use continuously rated squirrel cage induction type with capacitor start, NEMA Design Class “B” with NEMA “N” or better starting characteristics and a minimum of Class "B" insulation, unless specified otherwise..

2.10.4 Motors 370 watts (1/2 hp) and over: Use continuously rated squirrel cage induction type NEMA Design Class “B” with NEMA “B” or better starting characteristics and a minimum of Class “B” insulation.

2.10.5 Use open drip-proof type motor with a 1.15 service factor for motors located in dry locations indoors, unless specified or required otherwise by the motor location.

2.10.6 Use totally enclosed motors outdoors and in locations subject to water spray. Totally enclosed motors must be fan cooled and have a 1.0 service factor.

2.10.7 Use totally enclosed explosion-proof (TEXP) motors where indicated to prevent ignition of external gas.

2.10.8 All enclosures shall be rolled steel band or cast iron construction. Motor nameplate shall be mounted on enclosure with stainless steel fastening pins and shall have, as a minimum, all information as described in CSA C22.2 No 100-04 (R2009).

2.10.9 Unless specified otherwise, starters for electric motors will be provided by Division 16. Where multi-speed motors are specified, ensure that motors are compatible with starters supplied under Division 16. All two speed motors to be single winding, unless specified otherwise. Provide inverter duty motors where indicated on drawings.

2.10.10 All motors 0.75 kW (1 hp) and above, use premium efficiency type motors in accordance with NEMA Premium efficiency standard.

## 2.11 ELECTRICAL WIRING

2.11.1 Meet all requirements of Division 16 for all wiring included in Division 15 and pre-wired equipment provided by Division 15.

2.11.2 Ensure all pre-wired electrical equipment is CSA approved. Where this is not possible, arrange and pay for special Electrical Safety Authority approval.

2.11.3 All electrical wiring, both line voltage and low voltage, for equipment supplied by Division 15 is the responsibility of Division 15. Line voltage wiring from power panels to starters and from starters to motors will be supplied and installed by Division 16.

2.12 **IDENTIFICATION NAME LABELS**

2.12.1 Identification name labels, directional arrows and colour bands for ductwork and piping to be plastic coated pressure sensitive “Brady” or “Westline” selfstick labels, waterproof, colourfast, dirt and grease resistant. For pipes up to and including 65 mm (2-1/2″) diameter, use markers 28 mm (1-1/8″) high. For pipes 80 mm (3″) diameter and over, and all ductwork, use markers 57 mm (2-1/4″) high. For all piping exposed to view, use Smillie McAdams Summerlin Coil - Mark pipe covers.

2.13 **VALVE AND CONTROLLER TAGS**

2.13.1 Use brass valve and controller tags with 32 mm (1-1/4″) stamped code lettering and numbers filled with black paint. Hang a copy of the valve chart in Mechanical Room.

2.14 **EQUIPMENT NAMEPLATES**

2.14.1 Use minimum size 90 mm x 40 mm x 2.4 mm (3-1/2″ x 1-1/2″ x 3/32″) thick laminated phenolic plastic nameplates with black face and white lettering. Lettering to be minimum 6 mm (1/4″) high.

2.15 **BELT AND MACHINE GUARDS**

2.15.1 Provide OSHA compliant expanded metal guards in steel frames to protect drives of all belt driven equipment and all equipment with exposed rotating or moving parts. Firmly bolt guards in place and make easily removable for servicing. Provide openings in metal guards to permit use of a tachometer without removing the guard.

2.16 **FLASHING**

2.16.1 For locations with multiple roof penetrations serving a single piece of equipment, such as for roof mounted split system condensing units, use Portals Plus, Inc. Alumi-Flash system consisting of 100 mm (4″) high, one piece spun aluminum base with deck flange and EPDM rubber cap. Use caps suitable for required number and diameter of service penetrations.

2.16.2 For plumbing vent roof penetrations, use Thaler SJ-38 “Stack Jack” insulated flashing consisting of 330 mm (13″) high, one piece spun aluminum base with deck flange, urethane insulation liner and EPDM base seal. Size seals to suit pipe diameter.

2.16.3 For electrical conduit roof penetrations use Lexsuco Flash-Tite ‘Gooseneck’ insulated wire and cable flashing consisting of 220 mm (9″) high, one piece spun aluminum base with deck flange, 50 mm (2″) diameter 430 mm (17″) high stainless steel gooseneck and neoprene insulation liner.

3 Execution

3.1 **GENERAL**

3.1.1 Instruct and supervise other Sections doing related work.

3.1.2 Supply the measurements of equipment to other Sections to allow for necessary openings to be left in the work of other Sections.

3.1.3 Install pipes, ducts and tubing, which are to be concealed, neatly and close to building structure so that the necessary furring can be kept as small as possible.

3.1.4 Install all ceiling components in direct accordance with reflected ceiling plans.

3.1.5 Mechanical Drawings show approximate locations for wall-mounted devices. Clarify exact location and mounting height with Consultant prior to roughing-in.

3.1.6 All serviceable equipment installed on the roof (including boiler vents) to be installed minium 3m (10'-0") from roof edge.

## 3.2 DISSIMILAR METALS

3.2.1 Separate dissimilar metals by means of gaskets or shims of approved material or use dielectric unions or flanges in order to prevent electrolytic action. Where piping of dissimilar metals is connected, use approved dielectric unions or couplings. A brass fitting or brass valve may also be used in making connections between copper and steel piping.

## 3.3 STORAGE OF MATERIALS

3.3.1 Provide proper weatherproof storage for the protection of materials and equipment on site. Blank off openings in all equipment until required for use. Consultant may require materials which are not properly stored to be discarded and removed from the site.

## 3.4 EXCAVATION AND BACKFILL

3.4.1 Be responsible for any excavation and backfill required for work of Division 15. Slope or shore all trenching in accordance with all current regulations and safety standards. Where any pipes pass under building footings, backfill under footings with lean concrete.

3.4.2 Use materials and standards of compaction for backfill in accordance with Division 2 unless specified otherwise.

3.4.3 If changes are required in locations, depth of excavating or related data, advise the Consultant in reasonable time to avoid disruption of work sequence.

## 3.5 SUPPORTS AND BASES

3.5.1 Provide structural work required for installation of equipment provided under this Division.

3.5.2 Where piping and/or equipment is to be supported by steel stud walls, use brackets and supports which attach to steel studs. Support equipment independently of wall sheathing.

3.5.3 Provide sleeves for insulated pipe large enough to permit free movement of pipe without crushing the insulation.

3.5.4 Set all floor-mounted equipment on concrete bases at least 100 mm (4″) high Provide bases, anchor bolts and any special isolation bases. Concrete bases for air handling equipment are to be sized to suit unit drain air seal requirements, but 100 mm (4″) to remain as minimum. Size concrete equipment bases to suit the equipment actually supplied and in accordance with the Shop Drawings of such equipment. Do not start concrete work until anchor bolts and other embedded parts required for the complete installation, as well as Shop Drawings, are available at the site.

3.5.5 Carry out all concrete work in accordance with requirements of Division 3. Provide wire mesh, rebar and all necessary reinforcing.

3.5.6 For new concrete bases or pads on existing floors, first scrape and remove existing floor finish. Scarify existing floor so that new concrete adheres to it. Dowel new pads to existing floors.

## 3.6 CONCRETE INSERTS

### 3.6.1 General

3.6.1.1 Anchors for the support of pipes, ducts and equipment from the underside of suspended structural concrete systems may be by cast-in-place inserts placed prior to the pouring of concrete or by the use of inserts placed in holes drilled after the forms are stripped. The use of inserts cast into the concrete is the preferred option.

3.6.1.2 The safe load capacity of concrete anchors is affected by a number of variables such as specific anchor type, embedment, spacing between individual anchors, edge distances, direction of loading, concrete strength and “prying action”. Refer to the manufacturer's recommendations for each specific insert proposed, including any dynamic or vibratory loads.

3.6.1.3 Be responsible for the proper selection and installation of inserts, including number, type, spacing and accurate placement to provide the necessary safe load capacity and satisfactory long term performance.

3.6.2 **Installation of Cast in Place Inserts**: Ensure that anchors are accurately placed and "fixed" in position with sufficient rigidity to maintain their position during the placement of concrete. Do not displace reinforcing to install anchors without the prior permission of the Consultant.

3.6.3 **Installation of Inserts in Hardened Concrete**:

3.6.3.1 Use inserts placed in pre-drilled holes. Do not use powder driven inserts or self-drilling inserts. Before drilling holes, accurately locate all reinforcing bars in the affected areas using an electro-magnetic locator.

3.6.3.2 Do not drill through or otherwise damage reinforcing bars. If reinforcing is encountered, the inserts must be relocated. Ensure that hole diameter, depth of penetration, spacing, etc., are in strict accordance with the insert manufacturer's recommendations for the specific insert type and load condition.

3.6.3.3 Due to the relatively close spacing of reinforcing bars in the bottom of many of the beams and girders, the preferred location of drilled-in-place anchors in beams and girders is into the sides of these members, rather than upwards into the bottom.

3.6.4 **Sleeves Embedded in Concrete**: Except as approved otherwise by the Consultant, install sleeves embedded in concrete in accordance with the following general guidelines:

3.6.4.1 Centre to centre spacing to be not less than 3 diameters of the maximum size adjacent sleeve.

3.6.4.2 Provide additional reinforcing at points of congestion as directed by the Consultant.

3.6.5 Sleeves through beams will be permitted only as directed by the Consultant.

3.6.6 The reinforcing in beams, slabs and columns must not be displaced from its intended position under any circumstances unless prior written approval is obtained from the Consultant.

## 3.7 SLEEVES

3.7.1 Provide sleeves for insulated pipe large enough to permit free movement of pipe without crushing the insulation.

3.7.2 Provide sheet metal framing around ducts through masonry walls in exposed areas to ensure a clean finish around ducts.

## 3.8 FIRESTOPPING

3.8.1 Provide a listed firestop system in accordance with the Ontario Building Code to seal around all piping, tubing, ducts, conduits, electrical wires and cables, and other similar mechanical services which penetrate part of a building assembly required to have a fire resistance rating or a fire separation. Refer to Architectural Drawings and Specifications Section “Firestopping and Smoke Seals” for building assembly and fire separation types and locations.

3.8.2 For all penetrations through fire separations required to have a fire resistance rating, use firestop systems with an F rating not less than the fire resistance rating for the fire separation. This includes the sealing of any sleeves provided for future uses. Provide an FT rating where required by the Ontario Building Code.

3.8.3 All firestopping must be thoroughly reviewed by the Technical Representative of the systems manufacturer on site before any firestopping is concealed and submit a report of compliance with the rating requirements. Technical Representative to complete 3 destructive tests to confirm compliance with ULC listing, minimum one floor test and one wall test, third test to be Contractors choice. Submit a copy of the report to the Consultant.

3.8.4 Install duct fire damper assemblies in strict accordance with manufacturer's instructions provided with each assembly.

## 3.9 CUTTING AND PATCHING

3.9.1 Do not cut or drill holes through floors, roof or structural members before obtaining permission from the Consultant. All cutting and patching to be done by the trade specializing in the materials to be cut.

3.9.2 For penetrations through walls not required to have a fire rating, seal all spaces between pipe or pipe and surrounding wall construction with a fire-rated foam sealant. Use 3M Fire Barrier, Metacaulk, or Dow Fire Stop UL Classified fire rated foam sealants. Do this as the work progresses, to avoid leaving inaccessible holes at completion of the job. For penetrations through parts of the building assembly required to have a fire resistance rating or acting as a fire separation, see Clause "Firestopping" in this Section.

3.9.3 Where pipes and ducts are shown on the Mechanical Drawings passing through existing walls, floors, and roof, cut and patch the necessary openings. Include the cost of all cutting and patching in the Lump Sum Contract Price for the work of Division 15. Before drilling holes through floors or roof slabs, accurately locate and note sizes for each required hole. Get approval of Consultant before any cutting is started. Electrical conduits with live wiring may be embedded in concrete floor slabs.

3.9.4 Remove and replace ceiling where necessary to complete the work of this Division unless this work is specifically included in another Division.

## 3.10 ELECTRICAL EQUIPMENT

3.10.1 Where electrical equipment provided by this Division is not of sprinkler proof design, provide shields to prevent the sprinkler system water from entering the electrical equipment and/or interfering with its operation.

## 3.11 ELECTRICAL WORK

3.11.1 Perform all electrical work included in the work of this Division in accordance with the requirements of Division 16.

## 3.12 PAINTING

3.12.1 With the exception of prime painting of miscellaneous steel, painting of interior of ductwork behind grilles and other specific requirements as specified under the respective sections of Division 15, all painting will be provided under general trades, including painting of exterior of ductwork and interior piping exposed to view unless specifically noted below.

3.12.2 Touch up minor damage to finish on equipment supplied with factory applied baked enamel finish. Completely refinish items suffering damage which, in the opinion of the Consultant, is too extensive to be remedied by touchup.

3.12.3 Paint all steel framework provided by this Division with a chromium oxide primer.

3.12.4 Paint all exposed piping on roof. Use two coats of paint. Use colours as selected by the Consultant.

3.12.5 Paint all new and existing gas piping. Use bright yellow colour. Use two coats of paint.

## 3.13 ACCESS DOORS

3.13.1 Supply access doors wherever equipment, valves, dampers, life safety devices, etc., are concealed behind walls or inaccessible ceilings. All devices installed requiring periodic maintenance to be made accessible. Doors will be installed by Division 9.

## 3.14 IDENTIFICATION

3.14.1 Identify all piping and ductwork using name labels. Apply labels at 7 m (24′) intervals and at all branch connections, valves, and access panel locations. Neatly stencilled labels will be acceptable above accessible ceilings on insulated piping and on ductwork.

3.14.2 Mark each pipe in a space or area less than 7 m (24′) at least once with a name label. Apply flow directional arrows beside each name label.

3.14.3 To ensure permanent bond, apply 3M Adhesive EC-1341 to the surface of the insulation or pipe material. Apply the label with its own adhesive on this surface. Remove any labels “lifting”or “peeling”. Clean the surface and repeat the procedure specified with a new label. Where labels do not adhere, use pipe banding tape spirally wrapped for full length of label. Apply label over the banding tape.

3.14.4 Provide nameplate identifying equipment type, identification number, service and area served on each piece of mechanical equipment. Contractor is to complete a SCCDSB Bar Code/Asset Tag Information Form for new and/or replaced piece of equipment. Obtain form from SCCDSB.

3.14.5 Identify all manual and automatic control valves on all systems using brass tags attached with non-ferrous chains. Prepare a schedule of all tags for each system showing designating number, service and function. Include these schedules in the Operating and Maintenance Manuals and in the Mechanical Room.

3.14.6 Provide identification of all duct balancing dampers. Identify both support points of balancing damper and bottom of duct. Fluorescent orange spray paint is acceptable.

3.14.7 Where equipment is concealed above accessible ceilings, indicate location using coloured-coded marking devices, approved by Consultant, fastened to the ceiling components.

## 3.15 PIPING

### 3.15.1 General

3.15.1.1 Conceal all piping except in equipment rooms, unfinished areas, and where specifically noted. Unless shown otherwise, install all above ground piping parallel to building walls and partitions.

3.15.1.2 Install escutcheon plates at walls, floors and ceilings where piping is exposed. Install piping to conserve headroom.

3.15.1.3 In locations where space is provided for future or other equipment requiring connection to systems installed under this Contract, install services with shutoff valves and caps to allow connection to the system without interruption.

3.15.2 **Drain Hose Connections**: Provide drain hose connections at the base of all risers, on the suction side of all pumps and in all locations shown on Drawings.

3.15.3 **Supports and Hangers**

3.15.3.1 Provide all hangers, supports and sway braces in accordance with ANSI B31.1 and the Ontario Building Code. Support all piping in accordance with the Ontario Building Code.

3.15.3.2 Use Anvil beam clamps.

3.15.3.3 Use line size adjustable wrought steel clevis type hangers for horizontal piping 32 mm and less (1-1/4″ and less). For copper pipe, wrap pipe with tape at all hangers or use Anvil Figure CT-99C adjustable tubing ring hangers.

3.15.3.4 For piping 40 mm and over (1-1/2″ and over) use adjustable wrought steel clevis type hangers large enough for pipe insulation. See Section 15260 for insulation shields.

3.15.3.5 Where specified and/or shown on Drawings and in schedules, use spring hangers. See Drawings for details.

3.15.3.6 Unless specified otherwise, support piping at maximum spacing as shown and within 460 mm (18″) of each side of all valves and bends.

3.15.3.7 Support all plumbing piping in accordance with the Ontario Plumbing Code.

3.15.3.8 Support horizontal cast iron drainage piping at 1.5 m (5′) maximum spacing. Where the drain has successive fittings with no pipes between the fittings exceeding 800 mm (1′)in length, support the drain at intervals not exceeding 1 m (3′). Where mechanical joints are used, provide double hangers and sway bracing.

3.15.3.9 Where cast iron pipe with mechanical joints is used, support piping on both sides of horizontal joints within 460 mm (18") of joint each side, at all branch ends, and at all points where there is a change in direction. Where the pipe is 150 mm (6″) or larger in horizontal runs, brace to prevent horizontal movement at each branch or change in direction. Use braces, blocks, rodding or other suitable method recommended by the joint manufacturer. Provide Inspection Report from the manufacturer's representative certifying the installation is in accordance with their published installation data.

3.15.3.10 Do **not** support piping from other piping or equipment, or from metal roof decking.

3.15.3.11 **Schedule**:

| **Pipe Size mm** | **20** | **25** | **32** | **40** | **50** | **65** | **80** | **100 to 200** |
|---|---|---|---|---|---|---|---|---|
| Max. Span m | 1.8 | 2.1 | 2.4 | 2.4 | 3 | 3.4 | 3.7 | 4.3 |

3.15.4 **Anchors**: Install anchors where shown and where required. Use “U” bolts for piping 80 mm (3″) in diameter and less. For piping over 80 mm (3″) diameter, use steel fabricated anchors welded directly to pipe.

3.15.5 **Provision for Expansion**: Make proper allowance for thermal expansion and contraction whether shown on the Drawings or not. Use adequate offsets on all takeoffs to allow for expansion and contraction of mains. Weld all steel pipe forming an expansion loop regardless of size. Silver solder all copper pipe forming an expansion loop regardless of size. Use Flexonics or Anvil pipe alignment guides where shown and where required. Provide pipe guides for piping on either side of expansion loops, expansion joints and expansion compensators in accordance with "Standards of the Expansion Joint Manufacturers Association, Inc.".

## 3.16 USE OF FANS

3.16.1 Do not use any fan supplied under this Contract for ventilation while the building is under construction. The building must be "broom clean" and all painting finished before permission will be granted for testing fans.

3.16.2 The Consultant reserves the right to use any piece of equipment, device, or material for such reasonable lengths of time and at such times as may be required to make a complete and thorough test of the same before final completion and acceptance of the work. Such tests are not to be construed as evidence of acceptance of the work, and it is agreed and understood that no claim for damage will be made for injury or breakage to any part or parts of the equipment and/or materials due to the aforementioned tests, where such injuries or breakage are caused by a weakness or inaccuracy of parts, or by defective materials and/or workmanship of any kind. Supply all labour and equipment required for such tests. Trial usage will not initiate or affect in any way the warranties required for devices being tested.

## 3.17 INSPECTION AND TESTING

3.17.1 **General**: Inspect and test all piping. Repair any leaks and retest until satisfactory. Do not cover or close in piping until inspection and tests are completed. Thoroughly test all systems before making arrangements for the final demonstration in the presence of the Owner's staff. At the completion of the work, demonstrate operation of all systems to the Owner's representative and the Consultant. Promptly rectify any malfunction found and retest.

3.17.2 **Soil, Waste, Vent and Building Drains**: Seal all openings in section under test, then fill with water to a height of 3 m (10′) above top of section. Maintain water level for at least two hours. Test in sections as the work progresses. After all fixtures have been placed, apply a smoke test to the satisfaction of the local Plumbing Inspector.

3.17.3 **Domestic Hot and Cold Water - Heat Pump Water**: Apply a hydrostatic test of 1034 kPa (150 psig) or 1-1/2 times working pressure, whichever is greater, for two hours.

## 3.18 PERFORMANCE VERIFICATION

3.18.1 All systems must be thoroughly tested by the Technical Representative of the system manufacturers before arrangements are made for the final demonstration in the presence of the Owner's staff.

3.18.2 At the completion of the work, demonstrate operation of all systems to the Owner's representative and the Consultant. Promptly rectify any malfunction found.

3.18.3 For the following Systems, the manufacturer's representative must be present for the test period and submit a Certificate of Operation to the Consultant:

Controls
Heat Pumps

3.18.4 The manufacturer's representative must be present for the test period and submit a Certificate of Operation to the Consultant.

3.19 **START-UP SERVICES**

3.19.1 Provide the services of a qualified person to be in the building daily from 0800 hours to 1700 hours Monday through Friday for one week after work of this Contract is taken over by the Owner. Assist Owner's staff to become familiar with the system operation. Provide a similar service for one week after switchover to the opposite air conditioning cycle (heating or cooling).

3.20 **WELDING**

3.20.1 All welding is to be compliant with CSA W59-03 (for steel) or CSA W59.2-M (for aluminum). Welding is to be performed by tradesmen certified to CSA W47.1 (steel) or CSA W47.2 (aluminum). Inspectors shall be qualified to CSA W178.2. Provide proof of certification upon request.

3.20.2 For welding of stainless steel, use the provisions of the American Welding Society standard AWS D1.6/1.6M. When provisions of this standard conflict with provisions of applicable CSA standards, the CSA standards shall take precedence.

3.20.3 Welding and cutting tasks shall be carried out in accordance with CSA 117.2.

3.21 **PLACING IN OPERATION**

3.21.1 Upon completion of all work and before turning over the job, test each system for proper operation.

3.21.2 Flush through all drains and properly adjust flush valves and other fixtures.

3.21.3 Open and clean all new and existing traps, strainers and scale pockets after two weeks' operation.

3.21.4 Clean out all new and existing room heating units, terminal heating units, heat pumps and all air handling equipment with a vacuum cleaner when building is completed.

3.21.5 For each new filter bank, provide one extra set of filters.

3.21.6 Engage chemical treatment vendor of Owner’s choice to oversee cleaning and treatment of hydronic system. Completely flush system and refill with chemical cleaning compound. Operate the system for 24 hours at as high a temperature as possible with all control valves wide open, so that the compound reaches all parts of system. Drain, thoroughly flush and refill. Add corrosion treatment chemicals in recommended quantity to final filling. Provide report from chemical treatment vendor at completion of work.

## 3.22 COOPERATION BETWEEN TRADES

3.22.1 Cooperate and coordinate with other trades as required for satisfactory and expeditious completion of work. Take field dimensions relative to work. Fabricate and erect work to suit field dimensions and field conditions. Pay cost of extra work caused by and make up time lost as result of failure to provide necessary cooperation information or items to be fixed to or built-in, in adequate time.

## 3.23 MAINTENANCE OF EXISTING SERVICES

3.23.1 Take every precaution to locate and protect existing services so that no unscheduled interruption occurs. If any existing service is damaged due to the work of this Division, arrange and pay for repair. Bear any costs due to interruption of existing services.

3.23.2 The operation of the building by the Owner for day-to-day activities takes precedence over all construction related scope of work. The Contractor may be asked to cease work immediately in these instances and directed to work at another time. Assume all construction related activities which will impact the day-to-day operations of the facilities will be done after hours. Include all costs associated with after hours and overtime hours in the Base Bid. Additional costs related to after hours or overtime hours after Award of Contract will not be entertained.

3.23.3 Permission from the Owner is required before making any connections to or rerouting of existing services. Before any interruptions of service or restriction of use of any service, provide seven days prior written notice to the Consultant and Owner.

## 3.24 PROTECTING AND MAKING GOOD

3.24.1 Be responsible for protection of Owner's property, as well as finished and unfinished work, from damage due to execution of work under this Contract. Repair damage resulting from failure to provide such protection to the satisfaction of the Consultant, at no expense to the Owner.

3.24.2 Provide temporary heating, cooling and humidification systems for protection of existing Gymnasium wood floor at all times when central systems are not fully operational. This area must be maintained between 22 and 24C (72 to 75F) and 30 to 55% RH at all times during the work of this contract. Provide temporary vapour tight barrier between the Gymnasium and all adjacent areas where environmental conditions are not closely maintained. Provide a minimum of two temperature and humidity sensors in the area with LCD displays, for the duration of the contract. Monitor conditions in this space regularly. Pay for repair/replacement of any and all damage to the floor which occurs during the work of this contract.

3.24.3 Attach and fasten fixture and fittings in place in safe, sturdy, secure manner so that they cannot work loose or fall or shift out of position during occupancy of building, as the result of vibrating or other causes in normal use of building.

## 3.25 REMOVAL OF EXISTING MATERIAL AND EQUIPMENT

3.25.1 Remove existing material and equipment where shown or specified. Unless noted or specified otherwise, all material and equipment which is removed becomes the property of the Contractor and must be immediately removed from the site.

3.26 **FIRE SAFETY IN EXISTING BUILDINGS**

3.26.1 Where temporary shutdown of sprinkler systems, standpipe systems or other fire protection systems is required, do all work in compliance with Article 1.1.1.2, Clause 2.8.2.1.1.G and Subsections 6.4.1 and 6.5.2 of the Fire Code.

3.27 **DEFICIENCY REVIEW**

3.27.1 The Mechanical Contractor shall confirm in writing that the work is complete and ready for inspection. The Consultant will schedule a site visit to review the work and provide a written deficiency list. Once deficiencies have been corrected, the Mechanical Contractor shall confirm in writing to the Consultant that all deficiencies have been corrected. The Consultant will schedule a second site visit to review the correction of noted deficiencies. Should any noted deficiencies be found to be still outstanding, the Mechanical Contractor shall correct them and again notify the Consultant in writing. Charges to the Mechanical Contractor may result from repeat visits after the second visit.

3.27.2 The Mechanical Contractor is required to complete all work above ceilings and allow time for deficiency reviews and correction of noted deficiencies in a timely manner in order to accommodate the current Construction Schedule. This includes time for reinspection as required prior to concealing (drywall enclosures, drywall ceilings and acoustic tile ceilings) of any service. The Mechanical Contractor will be responsible for uncovering any concealed services for inspection.

3.28 **LIST OF MECHANICAL SUBCONTRACTORS AND MANUFACTURERS**

3.28.1 In the Bid documents, name the Subcontractors and Manufacturers for the items listed below. Use only one name for each item. See Clause “Material and Equipment”. Where the name of a manufacturer is not entered on the Bid Form, the Contractor will be required to use the base specified manufacturer.

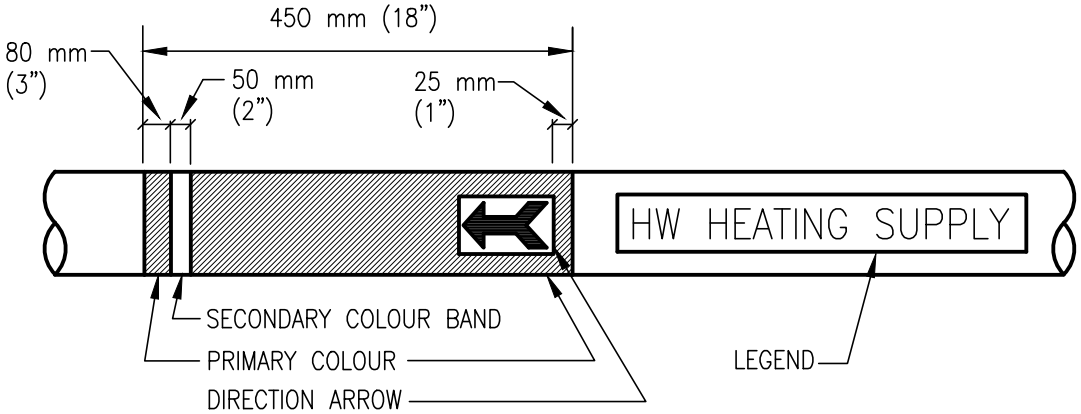
3.28.2 **Subcontractors**

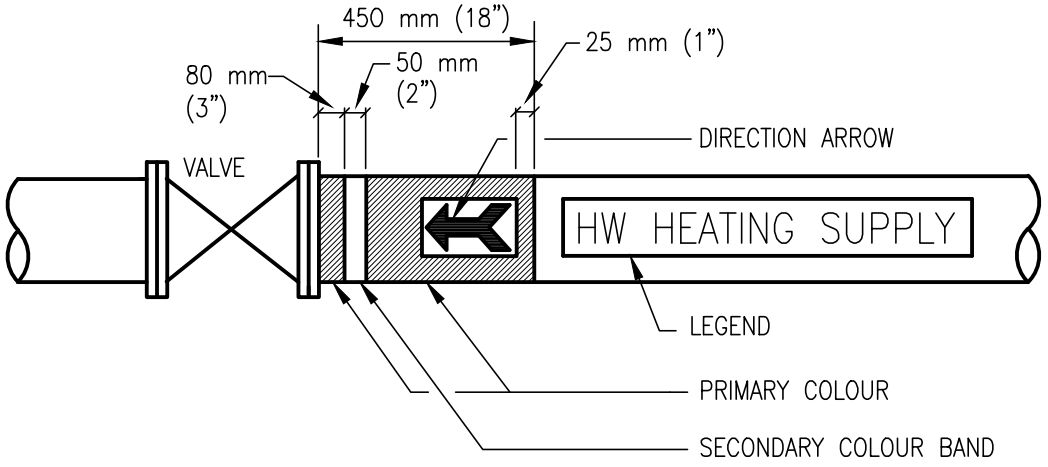
Sheet Metal
Testing and Balancing

3.28.3 **Manufacturers**

Drains
Grilles, Registers and Diffusers
Heat Pumps
Plumbing Brass
Plumbing Fixtures

**END OF SECTION**




| | | |
|---|---|---|
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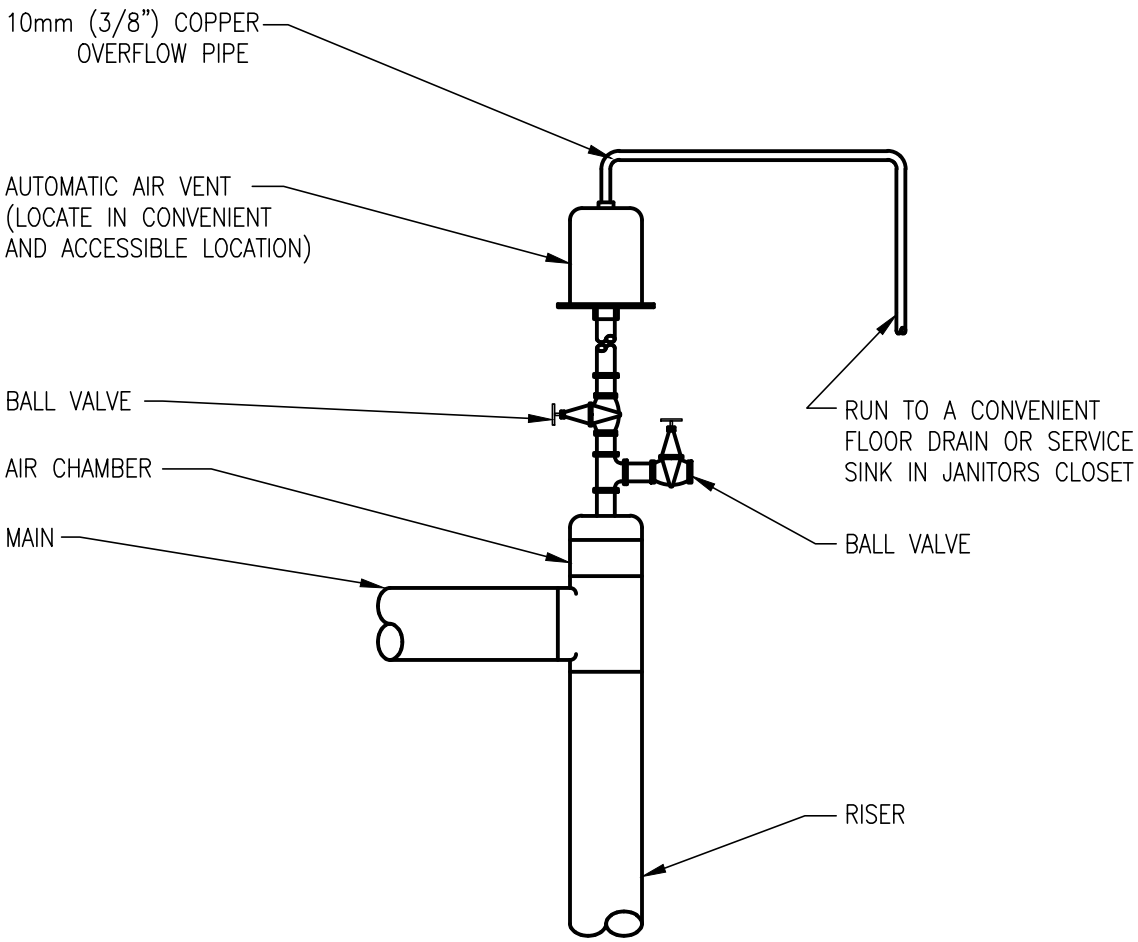
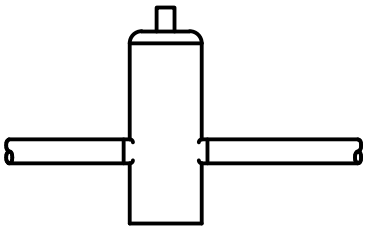
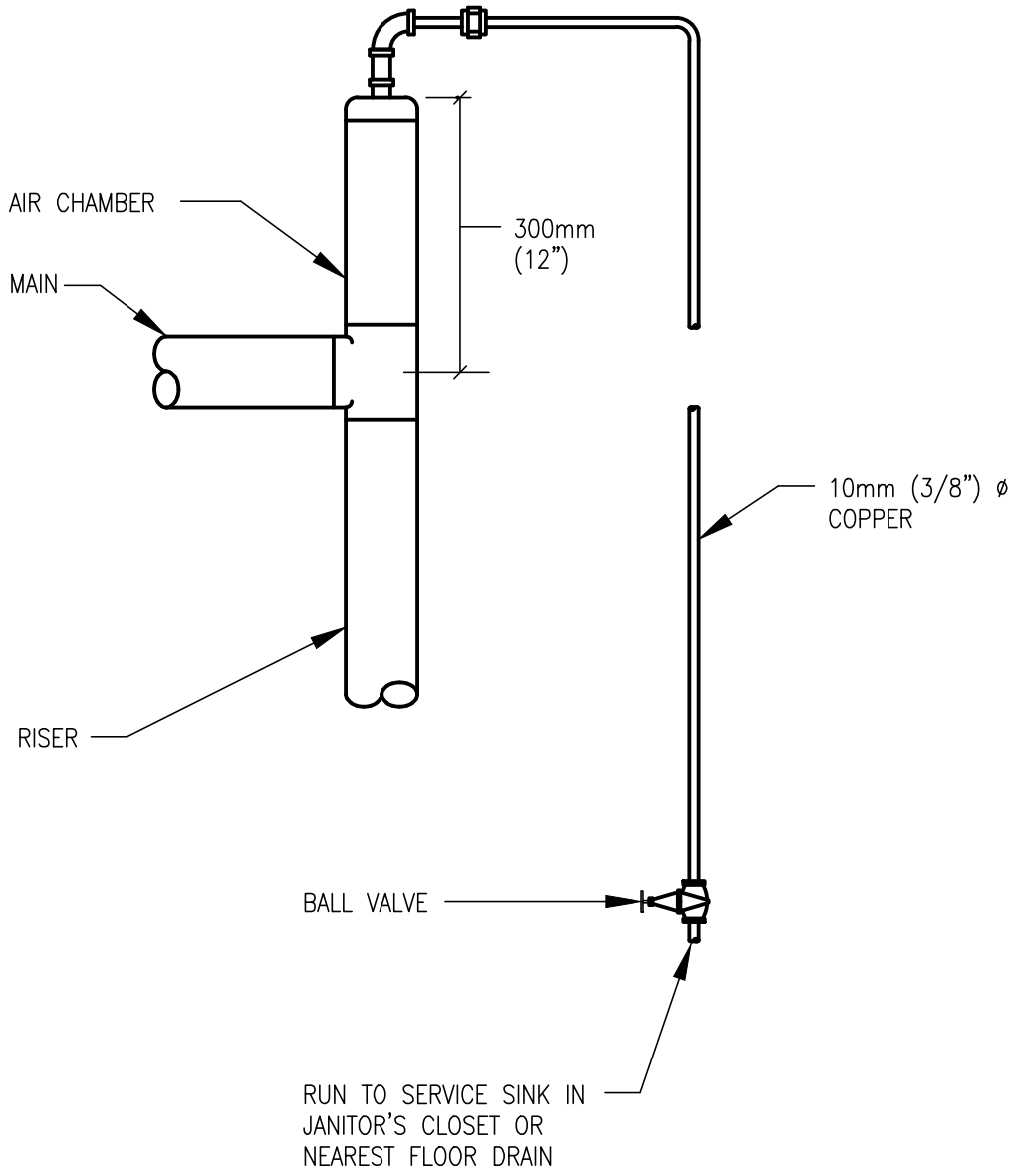


FOR AIR VENT ON LEVEL
PIPING USE AIR CHAMBER
AS ABOVE.

| | | |
|---|---|---|
| Chorley + Bisset<br>CONSULTING ENGINEERS | TITLE<br>TYPICAL DETAIL OF<br>AUTOMATIC AIR VENT | DETAIL NO.<br>**002** |

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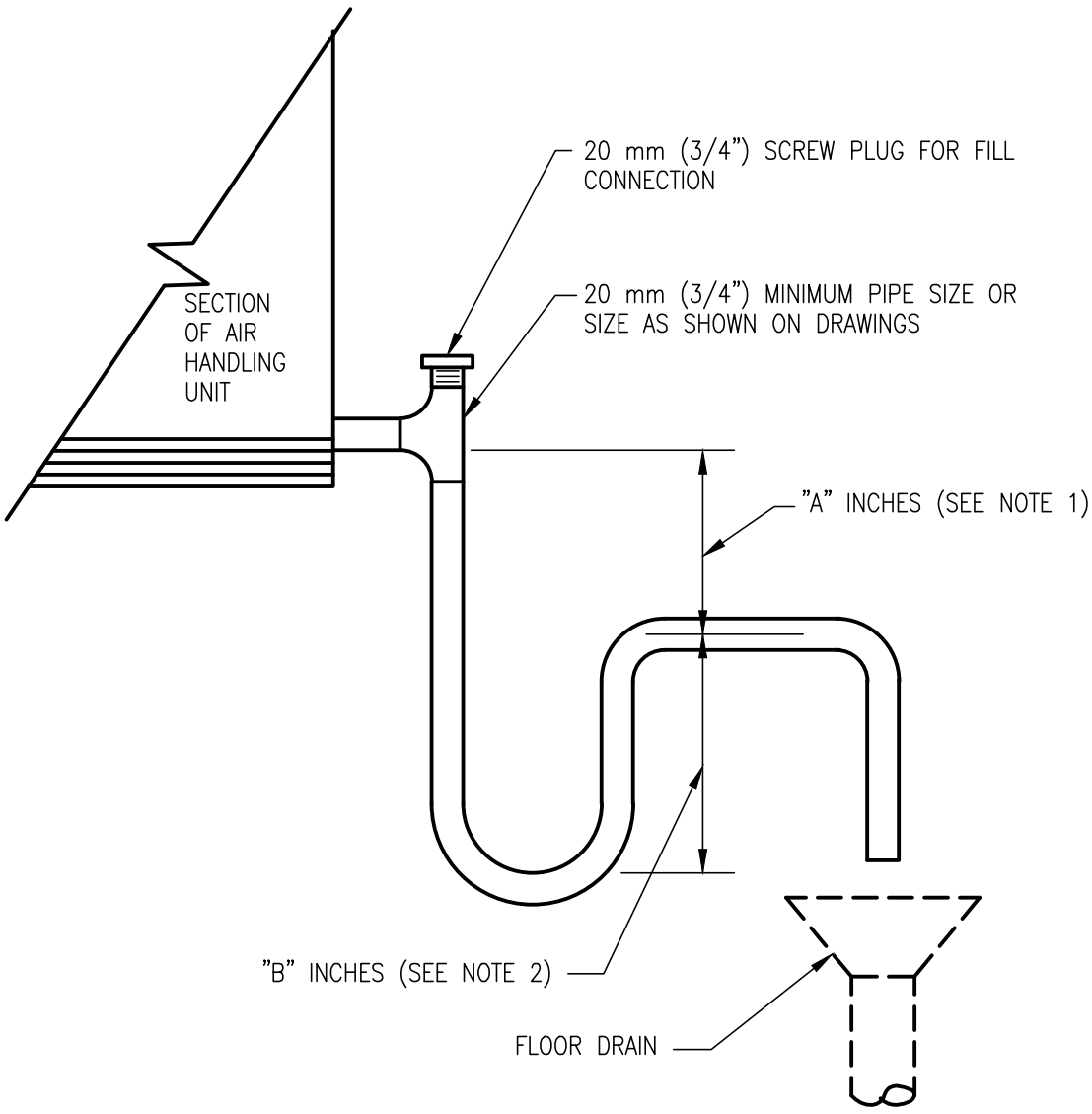
| Chorley + Bisset<br>CONSULTING ENGINEERS | TITLE<br>TYPICAL DETAIL OF<br>MANUAL AIR VENT | DETAIL NO.<br>**003** |

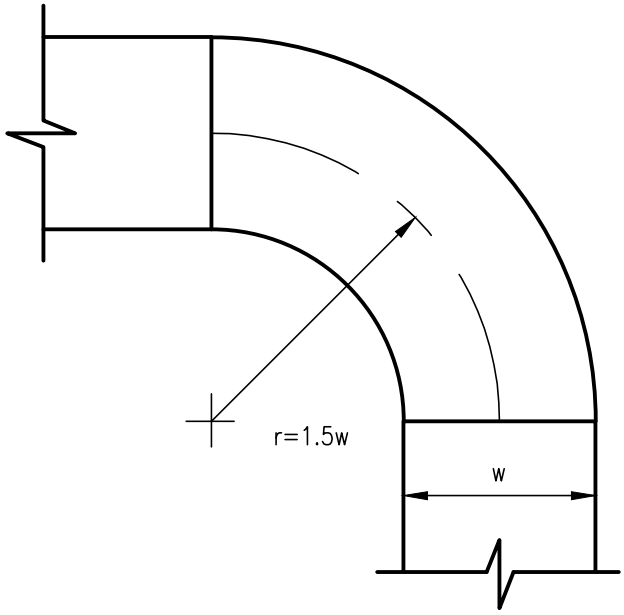


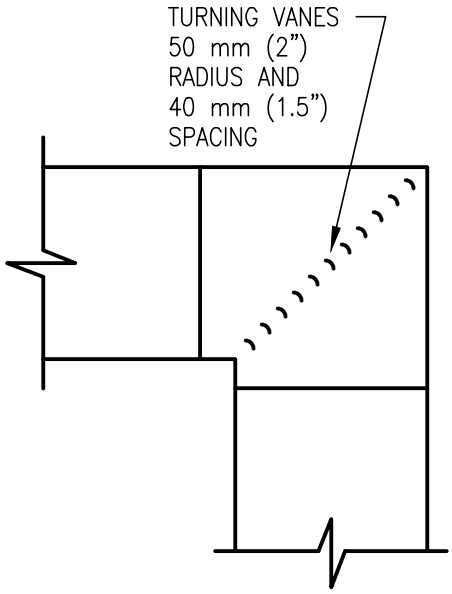

NOTES

1. "A" MUST BE EQUAL TO OR GREATER THAN THE NEGATIVE STATIC PRESSURE INSIDE THE SECTION REQUIRING DRAINAGE DURING NORMAL OPERATING CONDITIONS.(DRAW THROUGH COIL)

2. "B" MUST BE EQUAL TO OR GREATER THAN 1/2 OF THE NEGATIVE STATIC PRESSURE INSIDE THE SECTION REQUIRING DRAINAGE DURING NORMAL OPERATING CONDITIONS.(DRAW THROUGH COIL)
   OR
   "B" MUST BE EQUAL TO OR GREATER THAN THE POSITIVE STATIC PRESSURE INSIDE THE SECTION REQUIRING DRAINAGE DURING NORMAL OPERATING CONDITIONS.(BLOW THROUGH COIL)

| Chorley + Bisset CONSULTING ENGINEERS | TITLE: AIR SEAL FOR DRAINS FROM AIR HANDLING EQUIPMENT | DETAIL NO. 004 |
|---|---|---|



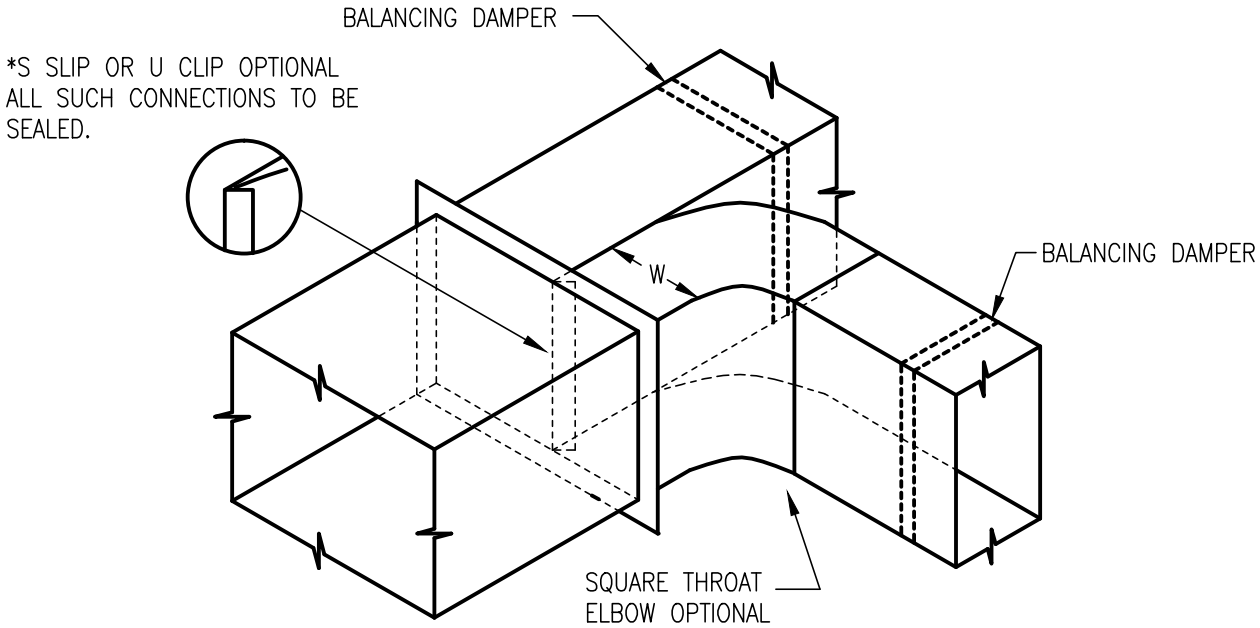

Chorley + Bisset
CONSULTING ENGINEERS

TITLE

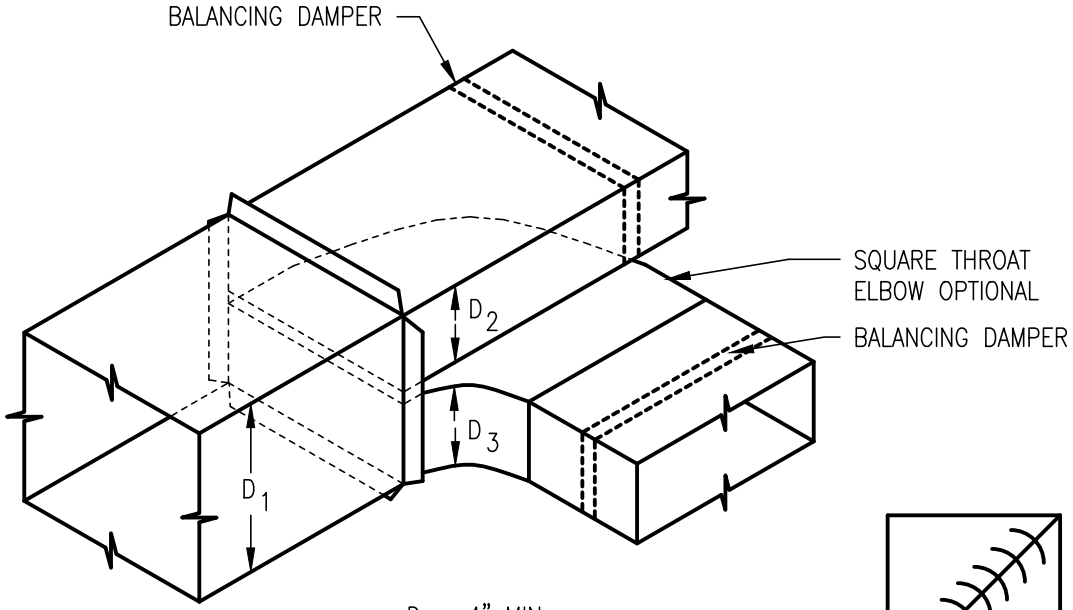
TYPICAL LOW VELOCITY
AIR DUCT TURNS

DETAIL NO.

**005**



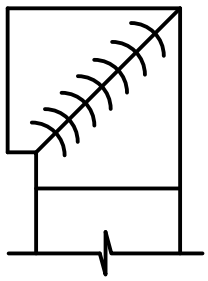

W =4" MIN.




$D_2$ =4" MIN.

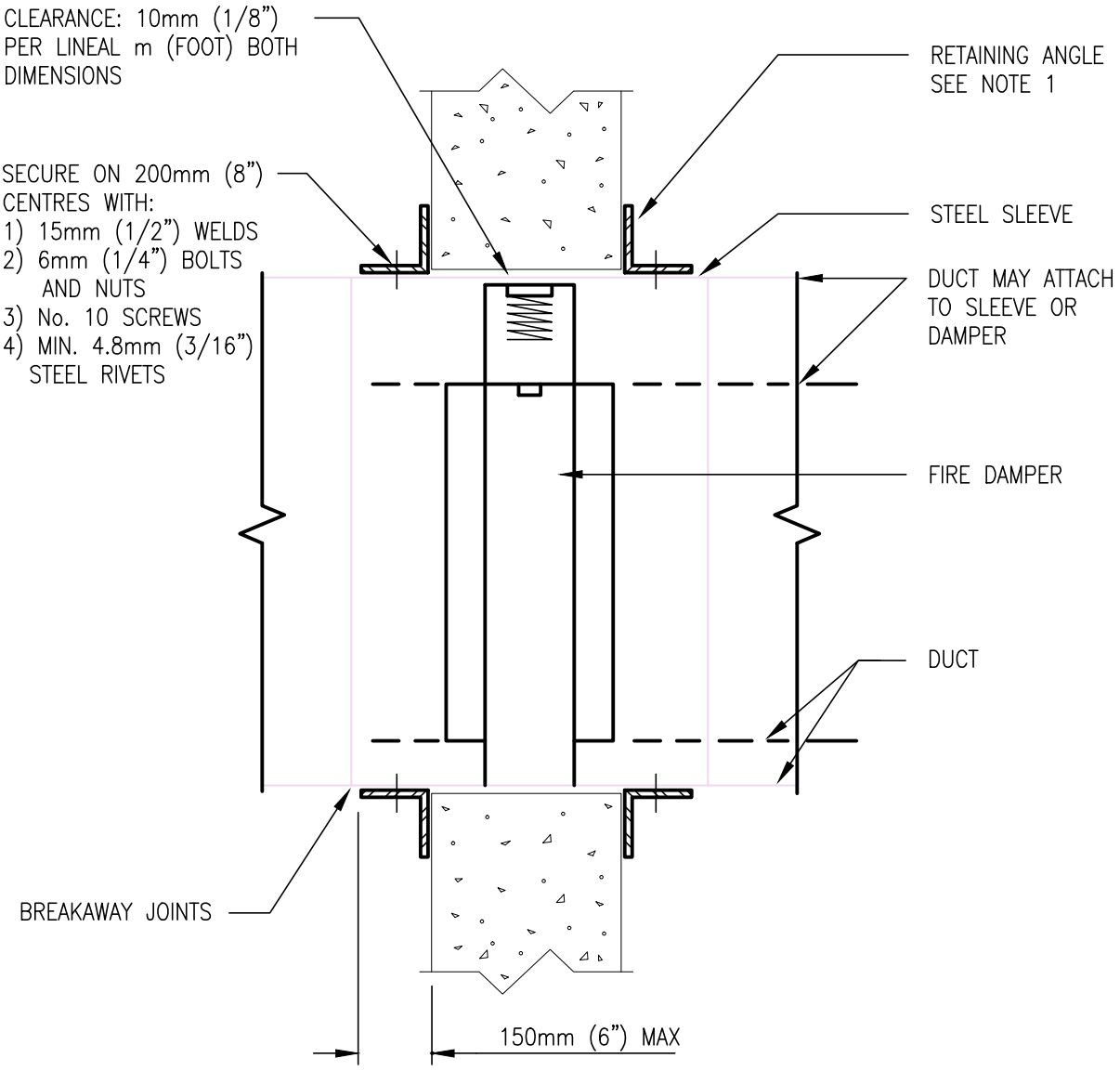
$D_3$ =4" MIN.

B.D.=BALANCING DAMPER



SQUARE THROAT

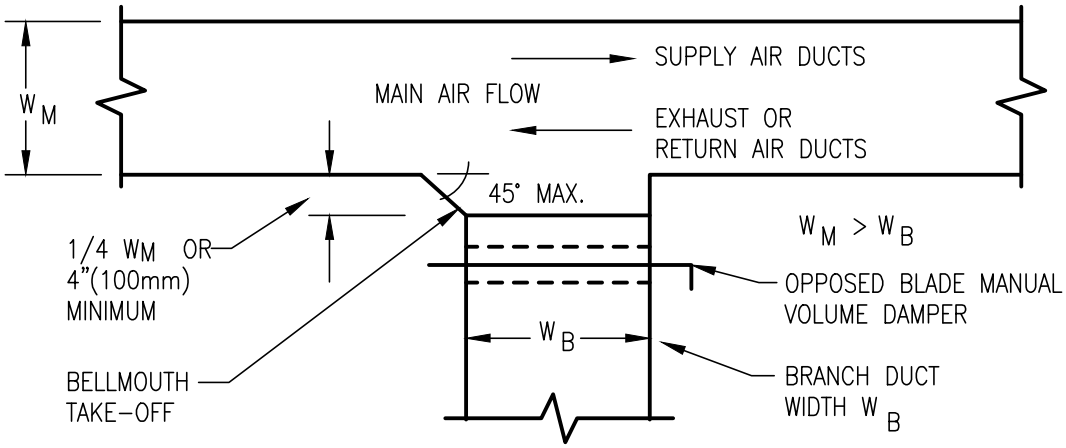
| Chorley+Bisset CONSULTING ENGINEERS | TITLE DUCT FITTINGS | DETAIL NO. 006 |
|---|---|---|



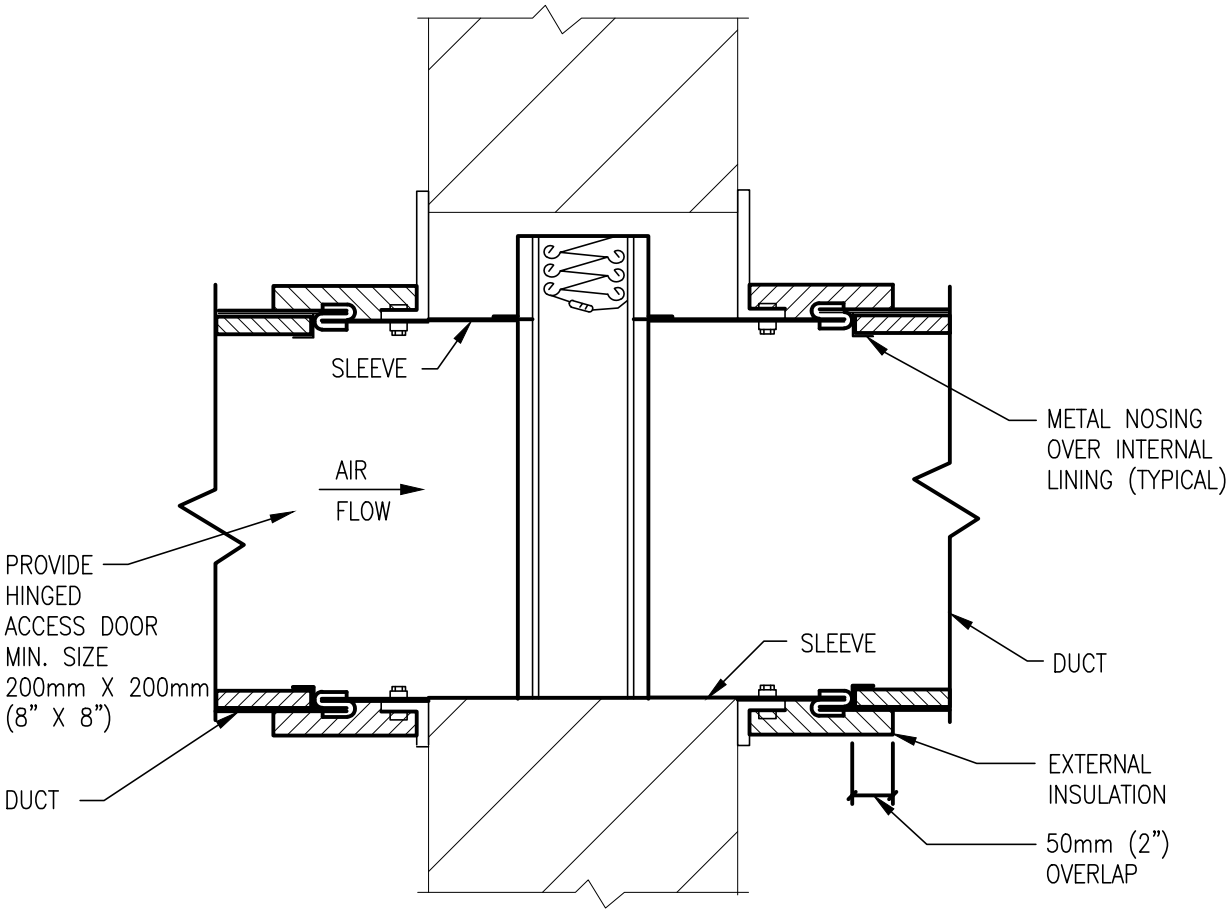

NOTES:

1. RETAINING ANGLES – MINIMUM 40 x 40 x 1.37mm (1 1/2" x 1 1/2" x 0.54" (16 GA)). ANGLES TO OVERLAP STRUCTURE A MINIMUM OF 25mm (1") ALL SIDES.
2. INSTALL ACCESS DOOR. LOCATE ON CORRIDOR SIDE IF POSSIBLE
3. MANUFACTURER U.L. APPROVED INSTALLATION PROCEDURES MUST BE USED IN LIEU OF THE ABOVE DETAILS WHERE APPLICABLE.

| | | |
|---|---|---|
| Chorley + Bisset CONSULTING ENGINEERS | TITLE VERTICAL FIRE DAMPER INSTALLATION | DETAIL NO. 007 |




| | | |
|---|---|---|
| Chorley+Bisset CONSULTING ENGINEERS | TITLE DUCT MAIN AND BRANCH TAKE OFFS | DETAIL NO. 008 |




| | | |
|---|---|---|
| Chorley + Bisset CONSULTING ENGINEERS | TITLE DUCT LINER INSTALLATION AT FIRE DAMPER | DETAIL NO. 009 |

INDEX - SECTION 15200

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 15001, “Mechanical General Provisions”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Heat Pump Water System**: The existing geothermal water source heat pump system will be modified to serve renovated areas.

2 Products

2.1 **GENERAL**

2.1.1 Furnish all test equipment. All equipment will remain the property of the testing and balancing company. Use recently calibrated instruments. Provide verification of calibration to the Consultant when requested.

2.1.2 Approved testing and balancing companies for this project are:

Air Audit Inc., Cambridge
C. J. Zettler & Associates Ltd., London

2.2 **MATERIALS**

2.2.1 Use materials specified herein or approved equal as defined in Section 15001, “Mechanical General Provisions”, Clause “Material and Equipment”.

2.3 **DUCT ACCESS HOLE PLUGS**

2.3.1 Use Duro-Dyne Type IP-4 duct access hole plugs.

3 Execution

3.1 **GENERAL**

3.1.1 Include all labour, engineering and test equipment required to adjust and balance all heating, ventilating, air conditioning and exhaust systems installed or altered under this Contract.

3.1.2 Check rotation of all fans. Advise appropriate trade if any corrections are needed. Ensure corrections are made before starting any testing or balancing.

3.1.3 Ensure that all control valves, devices and equipment interlocks are operating in the manner required for the correct performance of the systems.

3.1.4 Where existing systems are modified, balance the entire system, including terminals in non-renovated areas.

3.1.5 Carry out testing and balancing under both extreme summer and extreme winter conditions. If you wish to simulate these conditions, obtain approval from the Consultant before beginning work.

3.2 **JOB CONDITIONS**

3.2.1 Schedule this work in cooperation with other trades involved.

3.2.2 Do not begin testing and balancing until the systems have been completely installed, tested and put in running order. Correct operation of equipment and system components and cleanliness of piping and ductwork is the responsibility of the appropriate trade.

3.3 **SUBMITTALS**

3.3.1 Record all test data and submit four copies of completed reports to the Consultant. A copy of the final report to be included in each of the Operation and Maintenance Manuals.

3.3.2 Use data sheets which are approved by the Consultant to record measurements. Include schematic diagrams of all systems identifying branches, inlets, outlets and equipment. Submit sample sheets for review using same procedure as for Shop Drawings.

3.3.3 Provide a Deficiency List to the Contractor for all materials and installation methods which are found not to be complying with the Specifications and, where specified, quantities could not be achieved within the required tolerances. Submit copy of Deficiency List to the Consultant at the same time it is issued to the Contractor.

3.3.4 Submit report in hard cover 3-ring binder, complete with index page, indexing tabs and cover identification at front and side.

3.3.5 Record all test data in SI units.

3.4 **AIR SYSTEMS**

3.4.1 Test and adjust fan speeds and dampers to deliver the required air quantities. For belt-driven fans, determine size of sheaves required to properly balance systems and operate systems at minimum static pressures. Install selected sheaves. Sheaves for new equipment will be supplied by fan supplier. For existing equipment supply and install new sheaves, pulleys and belts as required.

3.4.2 **Constant Volume Systems**: Make pitot tube traverse of main supply and return air ducts to measure total air quantities.

3.4.3 Seal duct access holes with plugs. Do not use duct tape to seal access holes.

3.4.4 Test and adjust each diffuser, grille and register to within 10% of design requirements and also adjust so as to minimize drafts in all areas. After locking balancing dampers at desired position, mark “locked” position on damper for reference purposes.

3.4.5 Coordinate with Section 15600, “Liquid Heat Transfer”, to adjust wire taps on heat pump units to give required air quantities. **Where required air quantities fall between heat pump speeds, use higher speed setting rather than lower one.**

3.4.6 Record data as specified in Clause “Balancing Data”.

3.5 **WATER SYSTEMS**

3.5.1 Prior to mechanical contractor's removal of the existing geothermal heat pump main circulating pumps, visit the site and measure and record the flow rate and pressure drop to the existing borefield loop. Measure and record the existing circulating pump flow rate and pressure drop. Provide a written report to the Consultant. Use these values to reinstate geothermal borefield flow rates after the system changes are complete.

3.5.2 Prior to testing and balancing of these systems:

3.5.2.1 Verify that all new and existing strainers are clean.

3.5.2.2 Check new and existing expansion tanks and ensure that the systems are not air bound and are completely filled with water as required.

3.5.2.3 Check air vents at coils and high points of the systems to verify that all are installed and operating freely.

3.5.2.4 Position all automatic valves, hand valves, and balancing valves for full flow through coils, heat exchangers, heat pumps, individual room heating elements, etc.

3.5.3 Measure and adjust circulating water pump flow capacities to design quantities.

3.5.4 Balance all main branches and terminal equipment where balancing devices are installed. See Piping Schematics for locations. Lock all balancing valves. This includes heat pumps, force flow units and convectors, etc. Balance to within 5% of design requirements.

3.5.5 Mark and record flow readings of balancing devices. Where flow measuring devices are not installed, balance using design temperature differences.

3.5.6 Record data as specified in Clause "Balancing Data".

3.6 **BALANCING DATA**

3.6.1 Include the following information in the test report:

3.6.1.1 **Motors:**

Manufacturer
Model and/or Serial Number
Rated amperage and voltage
Rated kW (hp)
Rated rpm
Corrected full load amperage
Measured amperage and voltage
Calculated kW (hp)
Measured rpm
Sheave size, type and manufacturer

3.6.1.2 **Fans:**

Manufacturer
Model and/or Serial number
Rated L/s (cfm)
Rated rpm
Rated pressure rise
Measured L/s (cfm)
Measured rpm
Measured pressure rise
Pulley size, type and manufacturer
Belt size and quantity
Performance curve by manufacturer

3.6.1.3 **Air Systems (including inlets and outlets):**

Grille, register or diffuser reference number and manufacturer
Grille, register or diffuser location
Design air quantity
Effective area factor and size
Measured air quantity

3.6.1.4 **Heat Transfer Elements (Coils, Convertors etc.):**

Manufacturer and type
Design inlet and outlet temperatures (air and water side)
Design pressure drop (air and water side)
Measured inlet and outlet temperatures (air and water side)
Measured pressure drop (air and water side)
Measured flow rate (air and water side)

3.6.1.5 **Testing and Balancing Instruments:**

Types
Serial Numbers
Dates of calibration

3.7 **DUCT LEAK TESTING**

3.7.1 Perform leakage testing on representative sections, as selected by the Consultant, involving at least 25% of the duct distribution systems. Include all ductwork types (rectangular, round) and pressure classifications in the leak testing.

3.7.2 Test duct systems to the following SMACNA standards.

| Pressure Class | Seal Class | Leakage Class |
|---|---|---|
| All | A | 6 |

3.7.3 Refer to Section 15800, Clause “Duct Leak Testing”.

3.7.4 Test ductwork before ducts are insulated painted or concealed.

3.7.5 Immediately advise Contractor of any defects discovered during test. Retest systems after defects have been corrected.

3.8 **FINAL INSPECTION AND ACCEPTANCE**

3.8.1 After submission of balancing report, arrange a final inspection with the Consultant.

3.8.2 At final inspection recheck points or areas selected by the Consultant.

3.8.3 For each system, if more than 10% of the measurements at the selected recheck stations deviate by 10% or more from those in the Report, then the Report for that system will be rejected as unacceptable.

3.8.4 If Report is rejected, re-balance systems deemed to be unacceptable, submit new Reports, and make reinspection at no extra cost to the Owner.

3.8.5 After acceptance of Reports by Consultant, permanently mark settings of valves, splitters, dampers and other adjustment devices so that adjustment can be restored if disturbed. Type of marking and method of application to be approved by the Consultant.

**END OF SECTION**

INDEX - SECTION 15260

PART 1 - GENERAL



PART 2 - PRODUCTS



PART 3 - EXECUTION

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 15001, “Mechanical General Provisions”.

1.1.2 Under no circumstances may any insulation product containing asbestos fibre be used on this project.

1.1.3 All products used must have a flame spread rating less than 25 and a smoke developed classification not more than 50 when tested in accordance with CAN/ULC-S102-M88.

1.1.4 **Submittals:** Provide shop drawings which include product description, list of materials and thickness for each service and manufacturers' installation instructions.

1.1.5 **Environmental Requirements*:*** Maintain ambient temperature and conditions required by manufacturers of adhesives, mastics and insulation cements.

1.1.6 **Quality Assurance*:*** Insulation materials must be manufactured at facilities certified and registered to ISO 9000 Quality Standard.

1.1.7 **Storage of Materials*:*** Protect materials from dirt, water, chemical and mechanical damage before, during and after installation. Provide and install waterproof sheeting to protect insulation in unfinished areas as required. Remove any damaged materials from the site immediately. Remove and replace at no additional cost any installed materials which are damaged.

1.1.8 **Delivery**: Deliver insulation, coverings, cements, adhesive coatings, etc., to the site in Manufacturer’s original containers with the manufacturer's stamp or label affixed showing flame and smoke ratings of the products, name of manufacturer and brand.

1.2 **DEFINITIONS**

1.2.1 In this Specification, “exposed to view” means all surfaces of all services within Equipment Rooms, Service Corridors, plus all other areas of the building where the services are not enclosed within ceilings or shafts.

1.2.2 In this Specification, “exposed to weather” means all services located outdoors without an architectural enclosure.

1.3 **SHOP DRAWINGS**

1.3.1 Provide shop drawings which include product description, list of materials and thickness for each service and manufacturers' installation instructions.

1.3.2 Submit Shop Drawings in accordance with the Clause “Shop Drawings” in Section 15001 for the following equipment and materials:

- Canvas Covering
- Duct and Piping Insulation Types, noting application for each product
- Finishing Cement
- Lagging Adhesive

- Pipe and Duct Coverings
- Piping Insulation Inserts
- PVC Jackets

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 15001, “Mechanical General Provisions”, Clause “Material and Equipment”.

2.2 **PIPING INSULATION INSERTS**

2.2.1 Make rigid insulation inserts equal in thickness to the adjoining insulation. Use Johns Manville Thermo 12/Gold hydrous calcium rigid pipe insulation. Minimum width should be equal to 50% of pipe circumference. Use the following insert lengths:

| Nominal Pipe Size | | Insert Length | |
|---|---|---|---|
| mm | (inches) | mm | (inches) |
| 40 - 65 | (1-1/2 - 2-1/2) | 250 | (10) |
| 80 - 150 | (3 - 6) | 300 | (12) |
| 200 - 250 | (8 - 10) | 400 | (16) |

2.3 **PIPING INSULATION INSERT SHIELDS**

2.3.1 Use minimum 18 gauge galvanized metal shields. Form shields to fit insulation and extend up to the pipe centre line. Make length 100 mm (4″) less than length of associated insert.

2.4 **PIPE INSULATION**

2.4.1 **Piping**

2.4.1.1 Use Johns Manville Micro-Lok glass fibre insulation with factory applied AP-T Plus jacket. Jacket to consist of aluminum foil vapour barrier reinforced with fibreglass scrim and laminated to a fire resistant kraft facing.

2.4.1.2 In areas exposed to view, finish with Johns Manville Zeston 2000 PVC 0.51 mm (20 mil) thickness “Cut and Curled” jacketing. Use Zeston “Perma-Weld” solvent welding adhesive to permanently seal all PVC joints. Use white jackets.

2.4.2 **Valves and Fittings**: Insulate valves and fittings with factory precut Johns Manville Hi-Lo temp insulation inserts or Johns Manville Microlite 16 kg/m³ (1 lb/ft$^3$) density glass fibre insulation. Finish with Johns Manville Zeston 2000 PVC insulated fitting covers 0.51 mm (20 mil) thickness or finishing cement. Use white jackets.

2.4.3 **Pipe Thickness Schedule**

**Pipe Insulation Schedule**

| Fluid Design Operating Temperature Range (°C) | Insulation Conductivity | | Nominal Diameter (mm) | | | | |
|---|---|---|---|---|---|---|---|
| | Conductivity Range W/(m°C) | Mean Rating Temperature (°C) | less than 25 | 25 to 32 | 40 to 80 | 100 & 150 | 200 & up |
| Heat Pump Systems | | | | | | | |
| Below 4 | 0.033 - 0.039 | 24 | 25 | 40 | 40 | 40 | 40 |
| Domestic Hot Water | | | | | | | |
| 40 & greater | 0.035 - 0.040 | 38 | 25 | 25 | 40 | 40 | 40 |
| Domestic Cold Water (Sanitary and Condensate Drains) | | | | | | | |
| 4 - 24 | 0.033 - 0.039 | 24 | 25 | 25 | 25 | 25 | 25 |

2.4.4 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause “Material and Equipment”:

CertainTeed
Johns Manville
Knauf
Kooltherm
Manson
Ottawa Fibre
Owens Corning
Roxul

2.5 **AIR DUCTS**

2.5.1 On all round ducts, and on rectangular ducts not exposed to view with both dimensions 610 mm (24″) and smaller, use Johns Manville Microlite Type 75 flexible blanket fibreglass insulation with FSK facing. Product must meet the requirements of ASTM C 1290, and include aluminum foil vapour barrier reinforced with fibreglass scrim and laminated to a fire resistant kraft facing. Maximum thermal conductivity 0.042 W/m°C (0.29 Btu-in/hr$^2$ft2°F) in accordance with ASTM C 518. Use 40 mm (1-1/2″) thickness.

2.5.2 On rectangular ducts exposed to view, and on rectangular ducts not exposed to view with one dimension 660 mm (26″) or larger, use Johns Manville Spin-Glas Type 814 rigid fibreglass insulation board, 48 kg/m3 (3 lb/ft3) density, with FSK facing. Product must meet the requirements of ASTM C 612, and include aluminum foil vapour barrier reinforced with fibreglass scrim and laminated to a fire resistant kraft facing. Maximum thermal conductivity 0.033 W/m°C (0.23 Btu-in/hr$^2$ft2°F) at 24°C (75°F) mean temperature. Use 40 mm (1-1/2″) thickness.

2.5.3 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause “Material and Equipment”:

CertainTeed
Johns Manville
Knauf
Kooltherm
Manson
Ottawa Fibre
Roxul

2.6 **FINISHING CEMENT**

2.6.1 Use Ryder hydraulic setting finishing cement.

2.7 **LAGGING ADHESIVE**

2.7.1 Use white Childers CP-50A HV or Fosters 81-42W water based fire retardant lagging adhesive.

2.8 **CANVAS COVERING**

2.8.1 Use UL listed fabric 220 g/m² (6.5 oz/$y^2$) fire retardant canvas covering.

3 Execution

3.1 **GENERAL**

3.1.1 Install all insulation in strict accordance with manufacturer's published recommendations.

3.1.2 Install all insulation continuous through walls and sleeves.

3.1.3 Do not apply insulation until piping has been tested and approved.

3.1.4 Do not insulate unions or flanges at connections to equipment. In these locations, and in all other locations where insulation ends, finish with vapour resistant mastic.

3.1.5 Insulate ALL components of insulated systems unless specifically excluded.

3.1.6 Extend all surface finishes to protect all surfaces, ends and raw edges of insulation.

3.1.7 Patch and make good any existing insulation and covering which is damaged during the work of this Contract. Use material of the same quality as existing.

3.2 **FIRESTOPPING**

3.2.1 Where an insulated pipe passes through a fire separation, use only ULC labelled piping insulation in accordance with ULC Listed firestop system being used. See Section 15001, Clause “Firestopping”.

3.2.2 Extend ULC labelled pipe insulation through fire separation and 50 mm beyond fire separation on both sides. Tightly butt joints and wrap with approved joint tape.

3.3 **PIPING SYSTEMS**

3.3.1 **Sanitary Drainage Systems**: Insulate horizontal sections from funnel floor drains, floor drains, open hub drains, water closets, urinals and flushing rim sinks from fixture to point of connection with soil stacks.

3.3.2 **Other Systems**: Insulate the following piping systems in their entirety:

- Heat Pump Water and Geothermal Heat Pump Water
- Domestic Cold Water (potable, non potable)
- Domestic Hot Water
- Domestic Hot Water Recirculating
- Condensate Drains

3.3.2.1 Use the following Mean Rating Temperatures when selecting insulation thicknesses:

| | | | |
|---|---|---|---|
| Heat Pump Water | : | 4 - 40°C | ( 40 - 105°F) |
| Domestic Hot Water | : | 60 - 93°C | (141 - 200°F) |
| Domestic Cold Water | : | 4 - 13°C | ( 40 - 55°F) |
| Domestic Hot Water Recirculating | : | 60 - 93°C | (141 - 200°F) |

3.3.3 **Insulation Application**

3.3.3.1 **Hanger Points**: Provide an insulation insert and shield at each hanger point on all systems. On cold lines, vapour seal butt joints on each side of insert.

3.3.3.2 **Pipe**: Apply insulation over clean dry pipe. Butt all joints firmly together. Seal all jackets neatly in place. Wrap butt joints with a minimum 75 mm (3″) wide strip of the jacketing material. Use a vapour barrier adhesive on all "cold" lines. Finish with specified jackets in all areas where piping is exposed to view.

3.3.3.3 **Fittings and Valves**

3.3.3.3.1 For pipe sizes 40 mm (1-1/2″) and smaller, insulate with factory precut insulation inserts or with fibreglass blanket wrapped firmly under compression (minimum 2:1) to a thickness matching adjoining insulation. Finish with PVC fitting covers. In areas where insulation is not exposed to view, insulation ends may be mitred at elbows and sealed with tape.

3.3.3.3.2 For pipe sizes 50 mm (2″) and larger, insulate with factory precut insulation inserts. Finish with PVC fitting covers. In areas where insulation is not exposed to view, insulation ends may be mitred at elbows and sealed with tape.

3.3.3.3.3 **Cold Systems and Dual Temperature Systems**: Provide a continuous vapour barrier on the insulation for the following systems:

- heat pump water
- domestic cold water (potable, non potable)
- condensate drains

3.3.3.3.4 On components which require service, fabricate easily removable and reusable insulation sections e.g. suction guides for circulating pumps and pump casings. Test ports on balancing valves to be accessible outside of insulation.

3.3.4 **Pipe Insulation Covering**: In all locations where the insulation will be exposed to view, finish with PVC insulation covering. Use solvent welding adhesive to permanently seal all PVC joints. Taping or tacking of jackets will not be accepted. Follow strictly manufacturer's installation procedures for cold and hot systems. In Public spaces, use white covering.

3.4 **AIR DUCTS**

3.4.1 **General**

3.4.1.1 Seal all vapour retardant jacket seams and penetrations with UL Listed tape and adhesive.

3.4.1.2 See Section 15800, “Air Distribution”, for internal duct insulation. Where ducts are shown on the drawings to be internally lined, external duct insulation is not required.

3.4.1.3 Externally insulate all ductwork specifically identified on the Drawings.

3.4.1.4 Externally insulate all heat pump and other supply air ducts not located in return air plenums (i.e. located over washrooms, change rooms, etc.). External insulation is not required for sections of ductwork shown to have internal lining.

3.4.1.5 Externally insulate the first 1.5 m (5′) of all supply, return and exhaust ductwork adjacent to outside walls or roof.

3.4.1.6 Externally insulate fire damper sleeve assemblies where duct system is internally lined. See Detail Sheet in Section 15001.

3.4.2 **Application**

3.4.2.1 On round ducts adhere insulation to ducts with a flame resistant, quick tacking adhesive. Apply adhesive in 100 mm (4″) wide strips at 200 mm (8″) centres. Butt all circumferential joints and overlap all longitudinal joints a minimum 50 mm (2″). Staple all joints on 150 mm (6″) centres. Tape all joints with minimum 76 mm (3″) wide reinforced vapour barrier tape as recommended by insulation manufacturer.

3.4.2.2 On rectangular ducts, use adhesive and impale insulation over mechanical fasteners. Provide 100% coverage of adhesive on sheet metal, all exposed insulation edges, and all transverse joints. Provide mechanical fasteners per Insulation Manufacturer's published recommendations. Insulate behind duct balancing damper operators.

3.4.3 **Finish**

3.4.3.1 In locations where the insulation will be exposed to view, finish with canvas for rectangular ducts, and white PVC jackets for round ducts. Securely paste canvas on with a two coat application of lagging adhesive over the entire surface. Apply canvas between coats of adhesive, while first coat is still wet. Stretch canvas tight and smooth with overlapping seams located where least visible. Apply second coat of adhesive immediately following application of canvas. Do not use metal bands. For PVC jackets follow instructions for piping system jacketing.

3.4.3.2 Seal canvas with off-white sizing to leave a smooth non-porous surface ready to receive paint application.

3.4.3.3 Self adhesive aluminum covering will be acceptable in lieu of canvas. Follow manufacturer's installation recommendations.

**END OF SECTION**

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 15001, “Mechanical General Provisions”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Fire Extinguishers**: Provide portable fire extinguishers meeting all requirements of the Ontario Building Code and the Ontario Fire Code.

1.2.2 **Sprinkler System:** Extend the existing sprinkler system to completely protect the renovated area of the Building, as shown on the Drawings. Design the system in accordance with the requirements of NFPA No.13, the Ontario Building Code and Factory Mutual. Follow Factory Mutual guidelines for Occupancy Hazard Classification and water flow rate requirements.

1.3 **SHOP DRAWINGS**

1.3.1 Submit Shop Drawings in accordance with the Clause “Shop Drawings” in Section 15001 for the following equipment and materials:

- Fire Extinguishers and Cabinets
- Sprinkler Heads

1.3.2 See requirements for Design Drawings in Part 3 of this Section.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 15001, “Mechanical General Provisions” Clause “Materials and Equipment”.

2.1.2 Use only material and equipment which is Underwriters' Laboratories of Canada Listed and Factory Mutual approved for the application intended.

2.2 **PIPE AND FITTINGS**

2.2.1 Unless specified otherwise, use standard black steel pipe with screwed or flanged cast iron sprinkler fittings suitable for 1200 kPa (175 psig) pressure, cold water, non-shock. Use screwed or flanged type joints between pipe and fittings or valves. Mechanical type Victaulic or Gruvlok couplings, Canadian Underwriter's Listed and Factory Mutual approved, may be used. Ensure wall thickness of pipe is in accordance with NFPA No. 13 for the type of connections used.

2.3 **FIRE EXTINGUISHERS AND CABINETS**

2.3.1 Use National Fire Equipment Ltd. Model No. ABC-5, 2.3 kg (5 lb) multi-purpose dry chemical extinguishers with a rating of 2A10BC. Provide complete with wall brackets.

2.3.2 In cooking areas and Kitchens without automatic fire suppression systems, use National Fire Equipment Ltd. Model No. PDC-050WWD 5 lb. dry chemical extinguisher with a rating of 10BC.

2.3.3 The following manufacturer of the above equipment will be considered equal subject to requirements of Clause “Material and Equipment”:

Wilson & Cousins

2.4 **SPRINKLER HEADS**

2.4.1 Use ULC listed Tyco quick response sprinkler heads as follows:

- Model RFII concealed sprinkler with white finish in all areas with suspended ceilings, unless shown or noted otherwise
- Upright sprinkler, chrome finish in all areas without suspended ceilings, unless shown or noted otherwise
- Pendant or upright sprinkler, rough bronze finish, guard, in mechanical and electrical rooms without suspended ceilings only (corrosion resistant where noted)

2.4.2 Use wire sprinkler guards with baked synthetic red enamel finish where shown on the Drawings.

2.4.3 Provide Tyco Sprinkler Cabinets with spare sprinklers and accessories. Use minimum 0.9 mm thick (20 gauge) steel cabinets finished in red lacquer and suitably labelled. Cabinets to contain:

- Spare sprinklers of each type per NFPA 13

2.4.4 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Grinnell Fire Protection Systems
Reliable Automatic Sprinkler Co.
Tyco Fire and Building Products
Viking Corp.

3 Execution

3.1 **INSTALLATION**

3.1.1 **Sprinkler System**: Provide complete system extension designed, constructed, installed and tested in accordance with NFPA 13, Factory Mutual and the Ontario Building Code.

3.2 **WATER SERVICE**

3.2.1 Existing shop drawings will be available from the Owner upon request.

## 3.3 DRAWINGS

3.3.1 The Fire Protection Drawings show sprinkler types and locations, main piping layouts and zoning. Use this information as a basis to produce a set of Fabrication Drawings for a sprinkler system which will completely protect all of the building areas. Coordinate the preparation of these Drawings with all other trades to avoid conflict with other services.

3.3.2 Sprinkler systems are to be designed by a Fire Protection Engineer using hydraulic calculations. Engage an Engineer registered with Professional Engineers Ontario who specializes in Fire Protection Engineering and is both qualified and insured in accordance with the requirements of Division C of the 2006 OBC. The Fire Protection Engineer will apply his or her seal to all Fire Protection Drawings prepared for construction. Submit Engineer's proof of liability insurance with Shop Drawings.

3.3.3 The Fire Protection Engineer is to size all piping and indicate sprinkler head and pipe locations on working Drawings. Sprinkler head locations and quantities shown in the Bid Documents are for general layout purposes only, to identify approximate locations and quantities and sprinkler head types to be used. The Contractor is responsible for determining exact locations and quantities of sprinkler heads. Piping locations are shown where critical only. The Contractor is responsible for determining exact locations for piping.

3.3.4 Piping is to be sized to suit available pressure from the city water main without use of a fire pump. Use low pressure requirement sprinkler heads where required.

3.3.5 Provide sufficient number of sprinkler heads, whether shown on the drawings or not, to achieve coverage as required by NFPA 13 and Factory Mutual.

3.3.6 Prepare the Drawings in AutoCAD 2010. Show sprinkler heads on Architectural Reflected Ceiling Plans. Architect will provide AutoCAD drawing files for overlays.

3.3.7 Before starting installation, submit six copies of Fabrication Drawings and Hydraulic Calculations to Factory Mutual for approval. Submit copies of Drawings, duly approved by the Owner's Insurance Underwriters, to the Consultant for final review prior to commencing work. Submit two copies to local Building Department for plan review.

3.3.8 Use sprinkler heads, piping and fittings suitable for the temperature of the environment (e.g. extremes of hot or cold, humidity). Use high temperature heads in Mechanical and Electrical Rooms.

## 3.4 DRAINS, AIR VENTS AND TEST CONNECTIONS

3.4.1 Provide drain cocks with hose thread at all low points of the system not drainable through the main drain valve at service entrance. Provide air vents, flushing and test connections as required to comply with Canadian Underwriters' regulations.

## 3.5 COOPERATION

3.5.1 Cooperate with other trades on the job and so arrange work that no delay is caused to any other trade. Examine all Drawings paying particular attention to lighting fixtures, structural steel, heating and plumbing piping, ductwork and electrical conduit, so that the installation of the sprinkler system will not interfere with other

work.

3.6 **IDENTIFICATION**

3.6.1 Provide every valve with a tag indicating its purpose (i.e. sprinkler drain valve, sprinkler test valve and sprinkler control valve. This is in addition to the tag required for the valve chart. Securely fasten tags to the valves so they are not easily removed.

3.7 **SPRINKLER GUARDS**

3.7.1 Provide guards where specifically identified on drawings.

3.8 **TESTING**

3.8.1 Test complete system in accordance with Underwriters' Laboratories of Canada and Factory Mutual requirements. Notify the Consultant 48 hours prior to testing of all fire protection systems so arrangements can be made to have these tests witnessed.

3.8.2 Test the operation of every valve supervisory device, flow alarm switch and pressure switch.

3.9 **SYSTEM FLUSHING**

3.9.1 Flush the complete sprinkler systems after installation.

3.10 **FIRE EXTINGUISHERS**

3.10.1 Install fire extinguishers in accordance with the manufacturer's recommendations.

3.11 **SPACING OF SPRINKLERS**

3.11.1 Sprinkler heads must be centred **both** ways in ceiling tiles.

3.12 **EXPOSED AREAS**

3.12.1 In all areas exposed to view, provide a decorative grade installation. Pay particular attention to neat pipe layout. Degrease all pipe and fittings, to be suitable for painting. Chrome plate all exposed piping serving window sprinklers.

**END OF SECTION**

INDEX - SECTION 15400

PART 1 - GENERAL



PART 2 - PRODUCTS



PART 3 - EXECUTION

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 15001, “Mechanical General Provisions”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Domestic Cold Water**: Extend system complete with connections to fixtures and equipment requiring cold water connections as shown and/or as specified.

1.2.2 **Domestic Hot Water**: Extend system complete with connections to fixtures and equipment requiring hot water connections as shown and/or as specified.

1.2.3 **Sanitary Drainage**: Extend soil and waste drainage system complete with connections to fixtures and equipment as shown and/or as specified.

1.2.4 **Condensate Drainage**: Provide indirect condensate drainage system complete with connections to fixtures and equipment as shown and/or as specified.

1.3 **SHOP DRAWINGS**

1.3.1 Submit Shop Drawings in accordance with Section 15001, “Shop Drawings” for the following equipment and materials:

- Cleanouts
- Floor Drains
- Plumbing Fixtures
- Shock Absorbers
- Trap Seal Valves
- Valves

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 15001, “Mechanical General Provisions” Clause “Material and Equipment”.

2.2 **PIPE AND FITTINGS**

2.2.1 Select the most economical use of the materials named below. Unless specified or shown otherwise, either material may be used or a combination of materials, whichever provides the greatest economy.

2.2.2 For all piping systems, use only solder and fluxes containing no lead.

2.2.3 **Sanitary Drainage Piping (Including Vent Piping)**: Use cast iron Class 4000 with cast iron fittings and mechanical joints, or copper type DWV to ASTM B306 with cast or wrought copper fittings and soldered joints. For below grade sanitary piping, use PVC pipe and fittings in accordance with ASTM Standard D3034 and CSA B182.1.

2.2.4 **Condensate Drainage Piping**: Use copper Type DWV to ASTM B306 with cast or wrought copper fittings and soldered joints.

2.2.5 **Domestic Water Piping (Hot, Cold, Recirc.)**: Copper, Type "L" with soldered joints and wrought copper fittings. For below grade piping only use Wirsbo Aquapex or Rehau or copper tubing in a PVC sleeve.

2.3 **CLEANOUTS**

2.3.1 Standard TY branch or Y branch and bend, Watts Bolted Cover Cleanout No. CO-450-50. For stack cleanouts, use Watts Ancon No. CO-460 Series complete with "S" Series satin bronze wall access cover and gasketed plug.

2.3.2 Use cleanouts of the same size as drainage pipe on piping up to 100 mm (4″) diameter, not less than 100 mm (4″) on size 150 mm (6″) and 200 mm (8″), and not less than 150 mm (6″) on larger size pipe. No aluminum components will be permitted.

2.3.3 In floor with vinyl or similar finish, use Watts CO-200-T-1-34 inlay type cleanout with round recessed nickel bronze hinged access cover and frame and secondary closure plug.

2.3.4 In concrete floors, use Watts CO-200-RX-50-34 floor level type cleanout with secondary closure plug and XH CI cover.

2.3.5 In carpeted floors, use Watts CO-100-RC-1-34 with secondary closure plug and round nickel bronze access cover, with carpet marker.

2.3.6 In quarry tile floors, use Watts CO-200-S-1-34 square nickel bronze access cover with clear epoxy coating.

2.3.7 In terrazzo floors use Watts CO-200-U-1-34 square nickel bronze access cover with closure plug and clear epoxy coating.

2.3.8 Provide CO-100 bodies and membrane clamps where cleanouts are installed in floors with membranes. Use Watts CO-100-C-RFC-7-1-34 in floors with surface membrane.

2.3.9 Use clear epoxy coating on all nickel bronze finishes.

2.3.10. The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Enpoco
Jay R. Smith
Mifab
Zurn

2.4 **FLOOR DRAINS**

2.4.1 **General**: Use floor drains equipped with trap primer tappings. No aluminum components will be permitted. Provide flashing clamps on all drains installed in floors with membranes.

2.4.2 **All Finished Areas Not Specifically Designated**: Watts Ancon FD-200-5-1 cast iron floor drain with XH, adjustable 140 mm (5-1/2″) diameter Type NB, heavy duty nickel bronze strainer with clear epoxy coating. Provide separate cast iron "P" trap.

2.4.3 **Funnel Floor Drains in Millwork (Drawing Reference FFD)**: Watts Ancon FD-200-EF-1 cast iron floor drain with adjustable heavy duty cast iron grate. Provide separate cast iron “P” trap and Type NB, 100 mm (4″) round funnel.

2.4.4 **Funnel Floor Drains in Unfinished Floor (Drawing Reference FFD)**: Watts Ancon FD-300-G-50 cast iron floor drain with adjustable heavy duty cast iron grate. Provide separate cast iron “P” trap and Type CI, 100 mm x 230 mm (4″ x 9″) oval funnel.

2.4.5 In floors with surface membrane, use Watts Ancon FD-100-C-FC7-1 with strainer and surface membrane clamp.

2.4.6 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Enpoco
Jay R. Smith
Mifab
Zurn

2.5 **VALVES**

2.5.1 Use valves of same manufacturer except where approved otherwise by the Consultant.

2.5.2 Use the following valves for all piping systems provided by this Section, unless specified otherwise. Use rising stem where space permits. Use flanged, screwed or solder ends to suit pipe lines, and non-heating malleable iron handles.

2.5.3 Use only industrial class valves complying with ANSI, ASTM, ASME and applicable MSS Standards.

2.5.4 Unless otherwise specified, use valves designed for 1380 kPa (200 psig) CWP (cold working pressure) minimum. Use rising stem where space permits. Use flanged, screwed, or soldered ends to suit pipe lines, and non-heating malleable iron handles. Use valves which are repackable under pressure. Use valves with extended valve stems where piping is to be insulated.

2.5.5 All valves must have a valid and current Canadian Registry Number (CRN).

2.5.6 All new valves and fittings to be lead free to meet California Standard AB1953 for Lead Free Plumbing Fixtures with lead content below 0.25%.

2.5.7 **Domestic Water Systems**

2.5.7.1 **Ball Valves**: For sizes 50 mm (2") and under, use 1034 kPa (150 psig) / 600 W.O.G., Brass Body to ASTM C49300 (Lead Free Brass), Full Port, PTFE Seats, Double "O" Ring or Teflon packing, TEA Plated Forged Brass C49300 Vented Solid Ball, Blowout Proof Stem, Lever Handle.

Screwed Ends - Kitz 858
Solder Ends - Kitz 859

2.5.7.2 **Check Valves**: Check Valves: For sizes 50 mm (2") and under, use 860 kPa (125 psig) / 200 W.O.G. bronze body to ASTM C89530 (Lead Free Bronze), Screwed Cap C49300 (Lead Free Brass), Integral Seat, PTFE Disk.

- Swing "Y" Pattern
- Screwed Ends - Kitz 822T
- Solder Ends - Kitz 823T

2.5.7.3 **Drain Hose Connections**: Use Kitz 68C bronze body ball valve, 4140 kPa (600 psig) CWP complete with brass threaded cap and chain.

2.5.8 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

| | |
|---|---|
| Jenkins | (Industrial Class) |
| Kitz | (Industrial Class) |
| Nibco | (Industrial Class) |

## 2.6 SHOCK ABSORBERS

2.6.1 Provide Ancon SG Series or P.P.P. SC Series shock absorbers ahead of all solenoid valves, flush valves, or other quick-closing valves. Provide in other locations where shown on Drawings.

2.6.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Jay R. Smith
P.P.P.
Mifab
Zurn

## 2.7 ESCUTCHEON PLATES

2.7.1 Provide one piece, brushed aluminum escutcheon plates at all points where pipes pass through walls, floors or ceilings into finished areas.

## 2.8 TRAP SEAL VALVES

2.8.1 PPP, P Series trap primer valves. Provide chrome plated finish In exposed locations.

2.8.2 Proset trap guard drain inserts may be used in lieu of trap seal valves.

2.8.3 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Jay R. Smith
Zurn

## 2.9 PLUMBING FIXTURES

### 2.9.1 General

2.9.1.1 Provide white fixtures unless specified otherwise. Use only first quality fixtures. Warped or distorted fixtures will not be accepted. Use fixtures of a single manufacturer only where possible. Likewise use a single manufacturer for faucets, supplies and drains.

2.9.1.2 All plumbing fixtures and faucets to meet California Standard AB1953 for Lead Free plumbing fixtures, with lead content below 0.25%.

2.9.1.3 Provide rigid spouts in all faucets except in kitchen and staff room.

2.9.1.4 Use only new plumbing fixtures, certified by CAN/CSA-B45.0 and closet seats, fittings and trim, certified by CAN/CSA B125, and free from cracks, scratches, wrench marks, or imperfections of any kind. Replace any permanently stained, chipped or marred fixtures or connections.

2.9.1.5 Use factory chrome plated items for all visible parts of the fixture trim including faucets, escutcheons, waste, strainers, traps, supplies, stops, etc.

2.9.1.6 Unless specified otherwise, the following manufacturers of the above equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

- Plumbing Fixtures - American Standard, Kohler, Eljer
- Plumbing Brass - Delta Commercial, Chicago Faucets, T&S
- Water Closet Seats - Beneke, Centoco, Viceroy
- Stainless Steel Sinks - Franke/Kindred Canada, Architectural Metal Industries

### 2.9.2 Fixture Carriers

2.9.2.1 **Lavatories**: Watts Ancon Series 400 heavy duty carriers to support all wall hung lavatories independent of the wall.

2.9.2.2 The following manufacturers of the above equipment will be considered equal, subject to the requirements of Clause “Material and Equipment”:

Jay R. Smith
Watts
Zurn

### 2.9.3 Water Closet (Drawing Reference WC1) (Floor Mount Tank Barrier Free)

2.9.3.1 **Bowl**: American Standard Cadet3 Model 2386.500 barrier free, floor-mounted, two piece vitreous china water closet with elongated bowl, 80 mm (3″) flush valve, lined tank. 1 kg MaP test performance. Use brass floor flange.

2.9.3.2 **Supply**: McGuire H166LKN3-BALL heavy duty ball valve supply, chrome plated, polished, rigid horizontal with vandalproof loose key angle stop, escutcheon and flexible riser.

2.9.3.3 **Seat**: Centoco No. 820STS Seat, elongated, heavy duty solid plastic white open front seat with cover, reinforced stainless steel check hinges, stainless steel posts, washers and nuts.

2.9.4 **Lavatory (Drawing Reference LA1) (Wall Hung Barrier Free)**

2.9.4.1 **Lavatory**: American Standard 0954.000 Murro, barrier free vitreous china wall-hung basin with overflow, for concealed wall hanger, 100 mm (4″) centres.

2.9.4.2 **Faucet:** Chicago Faucets Ecast 802-V317XKCP faucet, chrome plated, 100 mm (4″) centres, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, with vandal resistant 1.9 lpm (0.5 gpm) spray aerator outlet and cast brass 100 mm (4″) blade handles.

2.9.4.3 **Supply**: McGuire H170BVRB supply, heavy pattern, chrome plated, polished, short rigid horizontal integral sweat tubes with vandalproof loose key ball valve angle stop, escutcheon and braided flexible riser.

2.9.4.4 **Drain:** McGuire 155A drain, chrome plated with open grid strainer. McGuire 8872C P Trap, 32 mm (1-1/4″), chrome plated, polished cast brass with cleanout and escutcheon.

2.9.5 **Double Compartment Sink (Drawing Reference SS1) ( Double Sink)**

2.9.5.1 **Sink**: Franke Kindred Commercial LBD6408, 790 mm x 520 mm x 200 mm (31-1/4″ x 20-1/2″ x 8″) 18 gauge, Type 304 stainless steel double bowl countertop sink, with back ledge drilled for 200 mm (8″) centre faucet set. Sink complete with 90 mm (3-1/2″) crumb cup strainers and 40 mm (1-1/2″) tailpieces, self-rimming with gasket and hold down clamps.

2.9.5.2 **Faucet**: Delta Commercial 26C3233 deck mounted faucet, chrome plated, 200 mm (8″) centres, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, 200 mm (8″) cast brass tubular swing spout with 6 lpm (1.5 gpm) vandal resistant flow aerator outlet and cast brass 80 mm (3″) lever handles. Provide stops on supply piping and wall escutcheons.

2.9.5.3 **Waste**: Cast brass P trap 40 mm (1-1/2″) with unions, cleanout and escutcheon.

3 Execution

3.1 **SANITARY PIPING**

3.1.1 Where pipe sizes are not shown on the Drawings and are not specified, size in accordance with the requirements of the Ontario Plumbing Code.

3.1.2 Install piping and connect to, or rough-in for, all fixtures as shown or as specified. Conceal piping in walls or ceilings in finished areas. Where sewers pass under footings, backfill with lean concrete.

3.1.3 Use the following minimum slopes on horizontal drains, unless indicated otherwise on the Drawings:

| | |
|---|---|
| Fixture waste or drains | 2% |
| Drains up to and including 80 mm (3″) | 2% |
| Drains 100 mm (4″) and up to 150 mm (6″) | 1% |
| Drains over 150 mm (6″) | 0.5% |

## 3.2 UNIT DRAIN CONNECTIONS

3.2.1 Connect up all drains, condensate drains from heat pumps. Run drains to funnel floor drains or open hub drains without crossing or interfering with walkways.

## 3.3 VENTING

3.3.1 Vent all fixtures in accordance with local and provincial regulations. Run vents as directly as possible and grade properly to drain back to the fixture connection. Connect the bottom of all vent stacks into soil or waste stacks for drainage. Conceal vents in walls and ceilings in finished areas. Carry vent stacks through roof where shown or where required and project at least 600 mm (24″) above roof deck.

## 3.4 FLASHING

3.4.1 Carry vent, waste and soil stacks through roof where shown on Drawings or where required. Use materials specified in Section 15001 and make a watertight joint at roof. Supply all flashing materials.

## 3.5 CLEANOUTS

3.5.1 Install cleanouts behind walls so that the bolted cover on the cleanout will be within 25 mm (1″) of the finished wall. Wall cleanout access doors to be installed minimum 200 mm (8″) above finished floor.

3.5.2 Conceal cleanouts in finished walls with access doors. See Section 15001 “Mechanical General Provisions” for access doors.

3.5.3 Place cleanouts where shown, at end of all drainage lines, at all changes of direction greater than 45°, and at the base of all stacks.

3.5.4 Bring cleanouts up to floor level in all buried pipe and in all horizontal runs above grade where specifically shown. For all other cleanouts in horizontal runs above grade, leave with access from ceiling space. Bring cleanouts in concealed vertical pipes to a wall surface.

3.5.5 Locate floor cleanouts clear of fixed furniture and equipment. In corridors, locate cleanouts near walls but clear of wall base.

## 3.6 WATER PIPING

3.6.1 Connect required service to plumbing fixtures, hose bibbs, etc., as shown or as specified.

3.6.2 After installation, thoroughly flush out complete system of water piping and remove all scale, etc.

3.7 **VALVES**

3.7.1 Install a valve at takeoff point in each main branch which takes off from main and in all locations shown.

3.7.2 Install drain valves with hose connections at all low points and at all branch valves for upfeed risers.

3.7.3 Use line size ball valves unless noted otherwise.

3.8 **PLUMBING FIXTURES**

3.8.1 Provide compression type shutoff valves or ball valves at each fixture in addition to the faucets on each fixture. For countertop sinks, use ball valves.

3.8.2 Where fixture connections pass into walls, floors, or ceilings, provide proper escutcheons.

3.8.3 When installing accessories, take great care to avoid marring chrome plating. Wrench or other tool marks on the plating will be sufficient cause for rejection.

3.8.4 Unless shown otherwise, use the following sizes of hot and cold water and waste connections to fixtures:

| Fixture | Hot Water | Cold Water | Waste |
|---|---|---|---|
| mm (in) | mm (in) | mm (in) | mm (in) |
| Lavatory | 15 (1/2) | 15 (1/2) | 32 (1-1/4) |
| Water Closet (Flush Tank) | ---- | 20 (3/4) | 80 (3) |

3.8.5 Caulk all around bases of water closets, lavatories, wash fountains and other built-in equipment. Seal all edges which abut walls and floors.

3.8.6 Mount fixtures with finished floor to rim dimensions as follows:

| **Drawing Reference** | **Height mm (in)** |
|---|---|
| LA1 | 610 (24) |

3.8.7 Confirm all mounting heights with Architect prior to roughing in.

3.9 **VACUUM BREAKERS AND BACKFLOW PREVENTERS**

3.9.1 Provide vacuum breakers and backflow preventers on all plumbing fixtures and equipment where required by Ontario Plumbing Code.

3.9.2 Size vacuum breaker to suit maximum design flow rates of fixture or equipment served.

3.9.3 Install backflow preventers in accordance with CAN/CSA-B64.10, Manual for the Selection, Maintenance and Field Testing of Backflow Prevention Devices, including mounting height and clearance recommendations.

3.10 **ROUGHING-IN**

3.10.1 Where shown on Drawings, rough-in hot and cold water systems, drain and vent.

3.10.2 Cap off all piping and provide shutoff valves on hot and cold water branch piping.

3.11 **STERILIZATION OF POTABLE WATER SYSTEMS**

3.11.1 All chlorination and sampling must be completed and tested by a person holding a Water Distribution Licence Class 1 thru 4 and sampling submitted to an accredited laboratory. Provide certified reports.

3.11.2 Thoroughly flush the domestic hot and cold water piping systems using clean potable water to remove dirt and other contaminants. Remove all faucet screens prior to flushing and reinstall after completion of flushing.

3.11.3 Disinfect domestic hot and cold water piping systems using a liquid chlorine solution. Introduce the liquid chlorine to ensure the chlorine is distributed throughout the sections being tested. Apply chlorine to a achieve a minimum chlorine concentration of 10 mg/L throughout the sections being tested. Leave the 10 mg/L chlorine solution in place for 24 hours.

3.11.4 Test the chlorine residual after 24 hours. If tests show a minimum chlorine residual of 5 mg/L, flush the disinfected sections and recharge with potable water. If the chlorine residual is found to be less than 5 mg/L, repeat the disinfecting procedure until satisfactory results are obtained.

3.11.5 After the systems have been flushed and recharged with potable water, arrange and pay for bacteriological tests to be conducted by an independent testing agency. Provide certified reports. If there is evidence of contamination, repeat the disinfecting procedure until satisfactory results are obtained. Obtain the Building Inspector’s permission before placing the systems in normal operation.

**END OF SECTION**

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 15001, “Mechanical General Provisions”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Heat Pump Water System**: The existing geothermal water source heat pump system serves the building and will be extended to serve the renovation.

1.3 **SHOP DRAWINGS**

1.3.1 Submit Shop Drawings in accordance with Section 15001, Clause “Shop Drawings”, for the following equipment and materials:

- Automatic Air Vents
- Combination Shutoff and Balancing Valves
- Flexible Connectors
- Heat Pumps
- Strainers
- Valves

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 15001, “Mechanical General Provisions” Clause “Material and Equipment”.

2.2 **PIPING AND FITTINGS**

2.2.1 **General**

2.2.1.1 Use the following materials for all piping systems provided by this Section.

2.2.1.2 Use long radius elbows. Where the mains are 100 mm (4″) diameter or greater and where branches are smaller by two pipe sizes or more, cut-ins will be permitted. For all other branch connections, use manufactured tees.

2.2.1.3 For flanged connections use stainless steel spiral wound graphite gaskets and high tensile strength bolts, nuts and washers. Use welding neck, RF flanges.

2.2.2 **Water Piping for Sizes 50 mm (2″) and Smaller**. Use either copper or steel pipe as follows:

2.2.2.1 **Copper**

**Pipe** - Type L hard drawn copper
**Joints** - Solder
**Fittings** - Wrought copper or cast bronze
**Unions** - 1030 kPa (150 psig) octagon end, bronze

2.2.2.2 **Steel**

**Pipe** - Black steel, Schedule 40, ASTM A-53B
**Joints** - Screwed
**Fittings** - 860 kPa (125 psig) cast iron
**Unions** - 1030 kPa (150 psig) malleable iron, brass to iron ground joint seat

2.2.3 **Water Piping for Sizes 65 mm (2-1/2″) and Larger:**

**Pipe** - Black steel, Schedule 40, ASTM A-53B
**Joints** - Welded and flanged
**Fittings** - 1030 kPa (150 psig) Schedule 40 steel
**Unions** - 1030 kPa (150 psig) slip-on

2.3 **VALVES**

2.3.1 **General**

2.3.1.1 Use the following valves for all piping systems provided by this Section, unless specified otherwise.

2.3.1.2 Use only industrial class valves complying with MSS Specification SP-80.

2.3.1.3 All valves supplied for this project shall have a current and valid Canadian Registration Number for the Province of Ontario with TSSA. Upon request, suppliers shall provide a copy of statutory declaration for valves, stamped, signed and dated by TSSA as validation of the CRN registration.

2.3.1.4 All valves to have extended locking handles complying with MSS Specification SP-80.

2.3.2 **Ball Valves**

2.3.2.1 Kitz 68/69, bronze body, full port (CGA approved) with stainless steel ball and stem. Use valves with extension stems when installed in insulated piping. Use locking lever handle where “lockable valve” is noted on the Drawings.

2.3.2.2 The following manufacturers of the above two items of equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Jenkins
Kitz
Nibco

2.3.3 **Combination Balancing and Shutoff Valves**

2.3.3.1 Use T&A combination balancing and shutoff valves with ANSI flanges and locking adjustment.

2.3.3.2 Balancing Valves will all be designed for flow measurement, flow balancing and positive shutoff. Size valves in accordance with manufacturer's published guidelines. Provide extended differential ports to enable access without removing insulation.

2.3.3.3 Valves to be calibrated globe style with differential ports providing flow measurement, balancing and positive shutoff. Do not exceed 910 mm (3′) head at fully open position.

2.3.4 **Drain Hose Connections**

2.3.4.1 Full port, bronze body ball valves with stainless steel stems and ball – Kitz 68 with brass hose adaptor, cap and chain.

2.3.4.2 The following manufacturers of the above item of equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Jenkins
Kitz
Nibco

2.4 **STRAINERS**

2.4.1 Use Spirax Sarco Y-type removable stainless steel strainers, maximum P. D. 6 kPa (0.9 psig). Use line size strainers. Ahead of all circulating pumps, use 3.2 mm (1/8″) perforations. Use 1.6 mm (1/16″) perforations in all other locations.

2.4.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Armstrong
A. S. Leitch
Colton
Morrison Brass
Victaulic

2.5 **FLEXIBLE CONNECTORS**

2.5.1 For connections to large circulating pumps, where noted on the vibration isolation equipment schedule, use Kinflex Model FTC rubber spherical pump connectors with restraining tie rods.

2.5.2 Use Flexonics BSF and BSN flexible connectors with stainless steel flexible metal hose, stainless steel braid and carbon steel ends. On pipes 50 mm (2″) and smaller, use screwed connections. On pipes 65 mm (2-1/2″) and larger, use flanged connections. Minimum 1030 kPa (150 psi) working pressure at 120°C (250°F). Use line sized connectors. Minimum lengths as follows:

| Pipe Size mm (in) | | Minimum Connector Length mm | (in) |
|---|---|---|---|
| 20 | (3/4) | 300 | (12) |
| 25 | (1) | 300 | (12) |
| 40 | (1-1/2) | 450 | (18) |
| 50 | (2) | 450 | (18) |
| 80 | (3) | 450 | (18) |
| 100 | (4) and larger | 600 | (24) |

2.5.3 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Thorburn Equipment
Vibrant Power

2.6 **AUTOMATIC AIR VENTS**

2.6.1 Use Spirax Sarco Canada Type 13W, AWN-150, 1030 kPa (150 psig) float type air vents with semi-steel body and cap, stainless steel float, stainless steel valve seat and neoprene valve head.

2.6.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Hoffmann

2.7 **HEAT PUMPS**

2.7.1 Use McQuay SmartSource water source heat pumps, A.R.I. certified and CSA approved and fully charged with R-410A in all sizes. All units to meet the efficiency requirements of ASHRAE 90.1-2010. Units to consist of DX air coil, compressor, blower, water coil, condensate drain pan, capillary tube expansion device, filter, reversing valve and controls. See Equipment Schedule for sizes and capacities. See the Schedule to determine if the heat pumps are vertical or horizontal.

2.7.2 Casing and cabinet fabricated from powder coated, heavy gauge galvanized steel. Internally insulated with 10 mm thick (3/8″) thickness closed cell foam. Provide removable panel for access to fan, compressor and control box compartment. Units to have insulated stainless steel drain pan and solid state electronic condensate overflow protection switch.

2.7.3 Refrigerant circuit to include a rotary compressor (sizes to 018) or scroll compressor (sizes 024 and larger), capillary expansion tubes, finned tube heat exchanger, reversing valve, water to refrigerant coaxial heat exchanger, access valves and safety controls. Equip compressors with external vibration mounts and thermal overload protection. Heat exchangers rated for 2756 kPa (400 psig) on water side and 3450 kPa (500 psig) on refrigerant side.

2.7.4 Unit to include direct drive, forward curved centrifugal fan with a multi-speed, ECM type fan motor isolated from the fan housing with integral mounting brackets. Include on board controller with manual ECM motor speed adjustment dial. Fan wheels to be dynamically balanced. See Drawings for locations of fan outlets.

2.7.5 Provide control box which includes: controls for compressor, reversing valve, and fan motor; 50 VA control power transformer, and a terminal block for low voltage field wiring connections. Operating and safety controls to include: low suction temperature (freezestat) switch; high refrigerant pressure lock out switch; compressor overload protection; and supply fan overload protection.

2.7.6 Provide means to remotely resetting each individual heat pump from the future Building Control System. Use a unit mounted relay to interrupt power to the heat pump control board on signal from the building automation system. Signal from the control system can be 24 V, 120 V or 0-10 V.

2.7.7 Units to have microprocessor based control system. Unit control logic to provide heating and cooling operation as required by the thermostat / temperature sensor. Each standalone control system to provide the following:

- time delay compressor operation
- delayed de-energization of the reversing valve
- compressor short cycle protection
- random unit startup
- high refrigerant pressure alarm
- low suction pressure alarm
- brownout alarm
- service diagnosis

In addition the microprocessor to include the following functions based on remote signals (future):

- emergency shutdown
- night setback override
- pump restart on night setback

The microprocessor control board to include the following diagnostic functions:

- normal node
- high pressure fault
- low temperature fault
- condensate overflow
- brown-out
- load shed
- unoccupied mode (future)
- emergency shutdown

Provide “Fan”, “Cool”, “Heat” inputs and dry contacts for alarm output (future).

2.7.8 Provide neoprene vibration isolation pads for vertical heat pumps, as well as 860 kPa (125 psi) at 50°C (120°F) working pressure flexible connector hoses with stainless steel braid, bronze ends and one swivel end.

2.7.9 All horizontal units to include hanger bracket and rubber isolator kit for field installation, as well as 860 kPa (125 psi) at 50°C (120°F) working pressure flexible connector hoses with stainless steel braid, bronze ends and one swivel end.

2.7.10 Provide 50 mm (2″) thick pleated typ MERV 13 filters serviceable from either side with a duct collar for ducted return connections. Provide gasketed filter rack to reduce leakage and filter bypass. Provide one additional set of filters for each unit.

2.7.11 Heat pump units to have extra quiet construction including mass plate and additional sound insulation. Include optional sound package which features sound attenuating compressor blankets combined with sound attenuating material strategically applied within the air handling compartment to further reduce sound transmission. Sizes 007 to 019 will have sound attenuating material in the compressor compartment in lieu of compressor blankets.

2.7.12 In addition to the one year full warranty as specified in Section 15001 “Mechanical General Provisions”, provide an additional three year warranty on all parts, including the ECM fan motor, compressor, and the entire refrigeration circuit.

2.7.13 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Florida Heat Pump
Trane
Carrier

3 Execution

3.1 **PIPING**

3.1.1 **General**

3.1.1.1 Use flanges or unions on all piping connections to equipment.

3.1.1.2 Support all piping connected to isolated equipment with spring hanger supports for at least the first three support points.

3.1.1.3 See Section 15001 “Mechanical General Provisions” Clause “Piping”.

3.1.2 **Water Piping**

3.1.2.1 Provide drain valves with hose connections at base of all risers, at all low points in piping distribution, and at low points on all equipment connections. Drain valves to be ball valves.

3.1.2.2 For upfeed take off top of pipe. For downfeed take off bottom of pipe.

3.2 **VALVES**

3.2.1 Unless specifically noted, shown or specified otherwise, shutoff valves may be either butterfly valves or ball valves. Do not use ball valves for sizes greater than 50 mm (2″). Where butterfly valves are required to isolate a piece of equipment, provide an extra set of flanges if necessary to allow removal or repair of equipment without disturbing valves.

3.2.2 Use line sized valves unless shown or specified otherwise.

3.3 **AIR VENTS**

3.3.1 Provide automatic air vents at all high points in piping system and at all points where piping drops to form loops.

3.3.2 Use manual air vents only where shown or specified.

3.3.3 See Detail Sheet included with Section 15001 “Mechanical General Provisions” for installation requirements.

## 3.4 VIBRATION CONTROL EQUIPMENT

3.4.1 Install all vibration control equipment supplied by the manufacturer for equipment provided by this trade.

3.4.2 Use vibration isolators on all piping connected to vibrating equipment in mechanical rooms. Install all flexible pipe connectors and hangers as per manufacturer's instructions.

## 3.5 HEAT PUMP SYSTEM

3.5.1 Provide the services of a factory trained representative to be present at system startup and to instruct the Owner in system operation.

3.5.2 Install isolators and control valves which are supplied with individual heat pump units.

3.5.3 Install heat pumps so that they can easily be removed for servicing.

3.5.4 Connect supply and return piping together to allow for chemical cleaning of system. Do not connect heat pump units to piping system until after system is chemically cleaned.

3.5.5 Wire the standalone controller to the heat pump. All work to be in accordance with the manufacturer’s recommendations.

## 3.6 ACCESS DOORS

3.6.1 Provide access doors with quick fastening latches for access to all dampers, coils, thermostats, valves and any other concealed devices which require servicing.

## 3.7 COMBINATION SHUTOFF AND BALANCING VALVES

3.7.1 Provide water flow balancing valves and flow meters in all locations shown. Install in accordance with manufacturer's recommendations.

## 3.8 FLEXIBLE CONNECTORS

3.8.1 Install flexible connectors where shown. See Detail Sheet included with Section 15001, “Mechanical General Provisions” for pump isolation.

## 3.9 AIR AND WATER SYSTEM TESTING AND BALANCING

3.9.1 Cooperate with and assist the air and water testing and balancing company. See Section 15200, “Testing and Balancing”.

3.9.2 Change wire taps on individual heat pump units to allow for proper air balancing.

3.9.3 Be responsible for the initial alignment and tension of all fan pulleys and belts.

3.9.4 Provide any changes to fan drives, pulleys and belts as required to allow a proper air balance as recommended by the Testing and Balancing Company for equipment supplied under this Contract.

**END OF SECTION**

INDEX - SECTION 15800

PART 1 - GENERAL



PART 2 - PRODUCTS



PART 3 - EXECUTION

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 15001, “Mechanical General Provisions”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Heat Pump Water System**: A geothermal water source heat pump system serves the building and will be extended to suit the renovations.

1.3 **SHOP DRAWINGS**

1.3.1 Submit Shop Drawings in accordance with Section 15001, Clause “Shop Drawings” for the following equipment and materials:

- access doors
- backdraft dampers
- duct sealer
- ductwork gauges, material and methods of support for each pressure type, shape (i.e. round, rectangular) and size range.
- exhaust fans
- flexible ductwork
- fire dampers
- grilles, registers and diffusers
- range hood

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 15001 “Mechanical General Provisions”, Clause “Material and Equipment”.

2.2 **DUCTWORK**

2.2.1 **Standards**: Construct all ductwork in accordance with the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Manual “HVAC Duct Construction Standards - Metal and Flexible”.

2.2.2 **Materials**: Unless specified otherwise, fabricate all ductwork from galvanized steel. Use SMACNA recommended thicknesses except where specified otherwise. Where aluminum construction is shown or specified, use utility grade aluminum. For aluminum construction, use equivalent to galvanized steel to aluminum thickness adjustments as listed in current SMACNA Manual “HVAC Duct Construction Standards - Metal and Flexible”.

2.2.3 **Rectangular - Low Pressure**: Use SMACNA 2″ W.G. pressure class. Use SMACNA recommended sheet metal thicknesses.

2.2.4 **Rectangular - Medium Pressure**: Fabricate according to current SMACNA standards for static pressures in duct up to 1490 Pa (6″ W.G.).

2.2.4.1 Where round ductwork is exposed to view, a decorative grade installation is required. Arrange for special handling and shipping to avoid dents and minimize scratches.

2.2.5 **Flexible Type Round Ducts**

2.2.5.1 Where not exposed to view, use Thermaflex Type M-KC or FlexMaster equivalent insulated flexible duct with a woven fibreglass fabric core with a flame resistant coating permanently bonded to a coated wire helix. Minimum positive pressure rating of 4 kPa (16"w.g.) for sizes 100 to 250 mm (4 to 10 ″) and 2.5 kPa (10″ w.g.) for sizes 300 to 410 mm (12 to 16″). Insulate duct with minimum 40 mm (1-1/2″) thickness of 12 kg/m³ (0.75 lb/ft³) density fibreglass and bidirectional reinforced metallized film outer vapour barrier.

2.2.5.2 Flexible ductwork will not be permitted where exposed to view.

2.2.5.3 Flexible duct must bear ULC approval labels and conform to flame spread and smoke developed ratings as required by the Ontario Building Code.

2.3 **FIRE DAMPERS**

2.3.1 Use only dynamic type fire damper assemblies tested in accordance with CAN4-S112-M "Standard Method of Fire Test of Fire Damper Assemblies" and listed in most recent ULC "List of Equipment and Materials" or by another recognized independent testing and certification agency acceptance to the Consultant. Label each damper to indicate compliance with these requirements. Provide fusible links with a 70°C (158°F) rating unless noted otherwise on Drawings. Links shall comply with ULC-S505 "Standard for Fusible Links for Fire Protection Service". Fabricate all dampers from galvanized steel except in copper and aluminum duct systems. In these systems, use all stainless steel construction.

2.3.2 Provide damper assemblies whose fire protection ratings comply with Ontario Building Code requirements for the fire resistance ratings of the fire separations through which the protected openings pass. Provide an approval label, stating the fire rating, from a recognized independent testing laboratory acceptable to the Consultant, on each assembly.

2.3.3 For ducts with either face dimension of 300 mm (12″) or less, and for all medium pressure ducts, use low resistance type dampers with 100% free area.

2.3.4 Provide with each fire damper, detailed installation instructions. Include illustrations and adequate information to attain proper and safe installation of the fire damper assemblies.

2.3.5 The products of the following manufacturers will be considered equal, subject to the requirements of Clause "Material and Equipment":

Alumavent
Controlled Air Mfg. Limited.
Nailor Industries Inc.
Ruskin

## 2.4 EXHAUST AIR FANS

### 2.4.1 General

2.4.1.1 See Equipment Schedules on Drawings for types, details and capacities.

2.4.1.2 Provide felt edged backdraft dampers on all systems which are not provided with automatic control dampers.

2.4.1.3 Provide lifting lugs with all fans

2.4.1.4 Size V-belt drives for 150% of motor nominal horsepower. Provide belt guards.

2.4.1.5 Use fixed drive pulleys on fans greater than 0.75 kW (1 hp). Use adjustable drive pulleys on fans 0.75 kW (1 hp) or less. See Section 15001 for required motor efficiencies.

2.4.1.6 All steel fan components to be coated with electrostatically applied, baked polyester powder coating. Each component to be coated with minimum 2 mil thick baked powder finish. Paint must exceed 1,000 hour salt spray under ASTM B117 test method.

2.4.1.7 Use arrangement and motor location to suit fan location.

2.4.1.8 Use heavy duty ball or roller type bearings, regreasable, designed specifically for HVAC applications. L10-200,000 hours minimum. Provide extended grease fitting where required for easy access.

2.4.1.9 Use fan classification in accordance with A.M.C.A. Pressure Limitations. Use a minimum of Class I construction on all fans unless specified otherwise. Ensure all selections are will accommodate at least 10% speed increase before class change is required. Upgrade to higher construction class if this condition is not met. Submit certified Fan Performance Curves and fan sound level ratings based on A.M.C.A. Standards to the Consultant with Shop Drawings.

2.4.2 **Ceiling Exhaust Fans**: Use Panasonic exhaust fan, complete with backdraft damper, acoustically insulated housing and air inlet grille. Use centrifugal wheel with motor suitably grounded and mounted on rubber vibration isolators. Locate terminal box inside housing.

## 2.5 BACKDRAFT DAMPERS

2.5.1 Use Ruskin Model CBD-6 heavy duty, extruded aluminum backdraft dampers with counter balance. Use 3.2 mm (0.13″) aluminum frame, 1.8 mm (1/16″) aluminum blades with vinyl edge seals and nylon bushings.

2.5.2 The following manufacturer of the above equipment will be considered as equal, subject to requirements of Clause “Material and Equipment”:

NCA
Price

## 2.6 INTERNAL DUCT LINING

2.6.1 Use Schuller/Manville “Permacote Linacoustic” fibreglass duct liner with air stream surface protected with “Permacote”, acrylic coating. Coating to be treated with anti-microbial agent so as not to support growth of fungus or bacteria as determined by ASTM G21 and G22. Liner to meet or exceed Life Safety Standards as established by NFPA 90A and 90B, have a NRC not less than 0.7, and a thermal conductivity of 0.36 W/m.K (0.0208 Btuh x ft x °F) at 23.9°C (75°F).

2.6.2 The following manufacturers of the above equipment will be considered as equal, subject to requirements of Clause “Material and Equipment”:

Knauf
Manson
Fiberglas

## 2.7 DUCT ACCESS DOORS

2.7.1 Use Nailor Industries Inc. 0800 Series duct access doors. For duct dimension up to 300 mm (12″) use 250 mm x 150 mm (10″ x 6″) door. For duct dimension up to 600 mm (24″), use 380 mm x 250 mm (15″ x 10″) door. For all larger ducts, use 660 mm x 510 mm (26″ x 20″) door.

2.7.2 For insulated ducts, use doors factory insulated with 25 mm (1″) thick fibreglass insulation.

2.7.3 The following manufacturer will be considered equal, subject to the requirements of Clause “Material and Equipment”:

NCA
Price

## 2.8 FLEXIBLE DUCT CONNECTORS

2.8.1 Use Duro Dyne “Durolon” or Ventfabrics “Ventlon” pre-assembled flexible duct connectors with 150 mm (6″) fabric width.

2.8.2 The following manufacturer will be considered equal, subject to the requirements of Clause “Material and Equipment”:

Thorburn

## 2.9 GRILLES, REGISTERS AND DIFFUSERS

2.9.1 Use E. H. Price Limited grilles, registers and diffusers. Provide types, accessories and finishes as noted in the Equipment Schedules. See Drawings for sizes.

2.9.2 The following manufacturers of the above equipment will be considered as equal, subject to requirements of Clause “Material and Equipment”:

Kreuger
Nailor
Titus
Tuttle & Bailey

2.10 **BALANCING DAMPERS**

2.10.1 For ducts 930 cm² (144 in²) and less in cross sectional area, use single blade dampers with locking quadrant and pin on far side. For larger ducts use, multi-blade, opposed blade dampers with external operator and locking quadrant. Provide spacers to maintain clearance between duct and damper blades.

2.11 **DUCT SEALER**

2.11.1 Use Duro Dyne DSW water based high pressure duct sealer.

2.11.2 The following manufacturers of the above material will be considered as equal, subject to requirements of Clause “Material and Equipment”:

Childers
Multi-Purpose
3M Canada Inc.
United Sheet Metal

2.12 **TURNING VANES**

2.12.1 Use Rouane turning vanes as manufactured by S.E. Rozell and Sons Ltd. in all square elbows. Assemble vanes with Duro Vane Rail JVR-2 for 50 mm (2″) radius vanes spaced 38 mm (1-1/2″).

2.13 **HEAT PUMPS**

2.13.1 See Drawings and refer to Section 15600 “Liquid Heat Transfer”.

2.14 **RANGE HOOD (Drawing Reference RH-1)**

2.14.1 Use Broan Allure QS2 range hood, 760 mm (30″) wide, three speed setting, cUL listed, HVI certified 1.5 sones at 47 l/s (100 cfm), stainless steel finish, ducted. Provide halogen lamps with units.

3 Execution

3.1 **DUCTWORK**

3.1.1 **General**

3.1.1.1 Construct ALL ductwork located inside Mechanical Equipment Rooms to Medium Pressure duct standards. Construct all ducts designated on Drawings as round to Medium Pressure duct standards. Unless specified otherwise, construct ALL other ductwork to Low Pressure duct standards.

3.1.1.2 Fabricate and install ductwork in accordance with the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Manual "HVAC Duct Construction Standards - Metal and Flexible".

3.1.1.3 Pay particular attention to Section 15001 “Mechanical General Provisions”, Clause “Cutting and Patching”. This will be strictly enforced on this project. Coordinate work with trades responsible for floor and wall construction to reduce difficulty of making tight seals.

3.1.1.4 Fabricate all ductwork to the clear inside dimensions shown on the Drawings. Where internal lining is specified, dimensions shown are inside insulation.

3.1.1.5 Do not suspend ducts from metal roof deck.

3.1.1.6 Make duct connections to fans and heat pumps with flexible duct connectors.

3.1.1.7 Install access doors for easy access to each damper, thermostat, coil, valve, or other concealed device which requires servicing.

3.1.1.8 Provide backdraft dampers where shown or specified.

3.1.1.9 Install fire damper assemblies in strict accordance with manufacturer's instructions provided with each fire damper. See Detail Sheet in Section 15001 for installation requirements where ducts are internally lined.

3.1.1.10 Where ductwork has to be altered from dimensions shown due to construction conditions, use the same effective cross sectional areas, without exceeding a 4 to 1 aspect ratio. Carry out such changes at no additional cost to the Owner.

3.1.1.11 Install ductwork to maximize clear floor to ceiling heights.

3.1.1.12 Transitions are described in the direction of air flow. For converging transitions, use a maximum slope of 1 in 4 and, for diverging transitions, use a maximum slope of 1 in 7.

3.1.1.13 Paint interior of ductwork for at least 610 mm (24″) behind supply, return and exhaust grilles and registers with matte black paint so as to render ductwork invisible from occupied space. Do not paint ductwork which is internally lined.

3.1.1.14 Apply one coat zinc chromate primer over all welded surfaces.

3.1.1.15 If there is a conflict between the duct sizes shown on the floor plans and the duct sizes shown on sections, elevations or details, the floor plans will govern.

3.1.1.16 Install duct smoke detectors supplied by Division 16.

3.1.2 **Low Pressure - Rectangular Ductwork**

3.1.2.1 Fabricate and install according to current SMACNA standards. Use 2″ W.G. pressure class. Use SMACNA recommended sheet metal thicknesses. Fabricate with all flat surfaces wider than 450 mm (18″) either cross broken or transverse beaded, regardless of whether the duct is insulated, lined or bare.

3.1.2.2 Use elbows in the following order of preference:

3.1.2.2.1 Full radius elbows with inside radius equal to duct width.

3.1.2.2.2 Square elbows with turning vanes.

See Detail Sheets included with Section 15001 “Mechanical General Provisions”.

3.1.2.2.3 For duct takeoff to a single register, diffuser, grille or branch, use balancing dampers. Do **NOT** use splitter dampers. See Detail Drawing in Section 15001, “Mechanical General Provisions”.

3.1.2.2.4 Fabricate all duct fittings in accordance with Detail Drawings in Section 15001, “Mechanical General Provisions”. Provide all balancing dampers as shown on Details. These details apply to supply, return and exhaust air systems.

3.1.2.2.5 Seal all transverse joints, longitudinal seams and duct wall penetrations to SMACNA Seal Class A standards.

3.1.2.3 **Round Ductwork**

3.1.2.3.1 Provide a decorative grade installation where ductwork is exposed to view, outside of Mechanical Rooms. Use satin coat finish, degreased and suitable for field painting without etching duct surfaces.

3.1.2.3.2 Make all joints in ductwork exposed to view using “Spiralmate” round duct connector system or equivalent.

3.1.2.3.3 Rotate spiral seams on duct-to-duct joints so that the seam provides a continuous helical pattern across the joint.

3.1.2.3.4 Fasten diffuser collars to duct using pop rivets. Provide a finishing filet of elastomer seal at the collar-duct junction.

3.1.2.3.5 Space hangers at equal intervals. Fasten hangers to duct system using ring collars as shown on the Drawings.

## 3.2 FLEXIBLE DUCTS

3.2.1 In lieu of the solid duct connections shown, flexible ducts may be used to connect diffusers to duct runouts.

3.2.2 Length of flexible duct must not exceed 1.8 m (6′) and maximum one 90º elbow will be permitted. Use hangers and supports to ensure duct does not sag. Make all duct connections using Duro-Dyne FT-2 high fibreglass tape, sheet metal screws, and Duro-Dyne S-W high pressure duct sealer. Installation to be UL Listed treatment as published by the manufacturer.

## 3.3 INTERNAL DUCT LINING

3.3.1 Install lining in accordance with liner manufacturer's published recommendations and SMACNA "HVAC Duct Construction Standards - Metal and Flexible". Use both adhesive and mechanical fasteners. Select pin lengths to limit insulation compression to 3 mm (1/8″). Butter butt joints with a fire resistant coating and extend 50 mm (2″) on either side of joint to stop air from lifting insulation. Repair liner surface penetrations with adhesive meeting ASTM C919. Pins must be welded to duct.

3.3.2 Internally line ducts where shown on Drawings. Use 25 mm (1″) thickness, unless designated otherwise.

3.3.3 Where acoustic plenums are not specified, internally line outside air intake ducts and plenums with 37 mm (1-1/2″) thickness. Finish with two 3 mm (1/8″) thick coats of asphalt or vinyl mastic. Apply glass reinforcing fabric between coats. Lap joints by 100 mm (4″).

## 3.4 GRILLES, REGISTERS AND DIFFUSERS

3.4.1 Cooperate on the job with other trades so that grilles, registers and diffusers do not conflict with lights, etc. Bring any conflict between grilles, registers and diffusers and the work of other trades to the attention of the Consultant before any ductwork is installed. See Architect's reflected ceiling plan for location of grilles, registers and diffusers.

3.4.2 Install frame for each grille, register and diffuser to suit the type of building construction.

## 3.5 FLEXIBLE DUCT CONNECTORS

3.5.1 Make all duct connections to fans and heat pumps with preassembled duct connectors.

## 3.6 TESTING AND BALANCING

3.6.1 Cooperate with the Testing and Balancing trade. See Section 15200, “Testing and Balancing”. Make any changes deemed necessary by the Testing and Balancing trade to permit proper testing and balancing of the systems.

3.6.2 Provide additional balancing dampers where required by the Testing and Balancing Company.

3.6.3 Be responsible for the initial alignment and tension of all fan pulleys and belts.

3.6.4 Provide any changes to fan drives, pulleys and belts as required to allow a proper air balance as recommended by the Testing and Balancing Company for equipment supplied under this Contract.

## 3.7 DUCT LEAK TESTING

3.7.1 Duct leakage tests are specified in Section 15200, "Testing and Balancing".

3.7.2 Cap and seal ducts for the test sections as directed by the Testing and Balancing trade. Provide all necessary fittings and duct connections as required for the leak testing procedure.

3.7.3 Ensure all required duct access doors are installed before tests are started.

3.7.4 Immediately correct defects discovered during test and arrange for retesting until satisfactory results are obtained.

## 3.8 EQUIPMENT CONNECTIONS

3.8.1 Be responsible for all connections to Owner’s equipment, whether equipped with duct connections or not.

**END OF SECTION**

INDEX - SECTION 16001

PART 1 - GENERAL



PART 2 - PRODUCTS

INDEX - SECTION 16001

PART 3 - EXECUTION

1 General

1.1 **GENERAL PROVISIONS**

1.1.1 This Section and Division 1 - General Requirements apply to and govern the work of all Sections of Division 16.

1.2 **VISITING SITE**

1.2.1 Visit the site and be familiar with working conditions and work involved before submitting Bids. **NO EXTRAS WILL BE GRANTED DUE TO LACK OF A THOROUGH PRELIMINARY INVESTIGATION.**

1.2.2 Remove and replace existing ceiling tiles to inspect ceiling for existing Mechanical, Electrical and Structural obstructions. Include cost of all necessary changes in Bid Price. No extras will be granted due to lack of a thorough preliminary investigation of accessible ceiling spaces.

1.3 **CONTRACT DRAWINGS**

1.3.1 Electrical Drawings show Electrical work only and are not intended to show Structural details, Mechanical details or Architectural features. Take building dimensions and details from Architectural or Structural Drawings or from job measurements only.

1.3.2 Electrical Drawings indicate only the general locations of equipment and outlets. Wiring requirements are shown diagrammatically. Responsibility for the detailed layout of equipment, outlets, raceways and wiring is part of the work of this Division. Specific outlet locations are detailed on elevations.

1.3.3 If shown, only the general location and route of conduit, cable trays and communication hooks are shown. Install all services neatly to conserve headroom. All conduit, cable trays and communication hooks are to be accessible after work by other trades is complete. Install all services parallel to building lines unless shown otherwise.

1.3.4 The Consultant reserves the right to revise the locations of equipment and outlets within any given room without altering the Contract Price provided Notice of Change is given prior to roughing-in.

1.3.5 In case of conflict between work of other trades and work of this Division, clarify the location of these items with the Consultant before roughing-in.

1.3.6 In the event of any discrepancies or ambiguity of any symbol, note, abbreviation, etc., used in this Specification or on the Contract Drawings, obtain clarification, in writing, from the Consultant prior to submitting Bid. No allowance will be made for additional costs arising from failure to obtain proper clarification of conflicting information before Bid.

1.3.7 All dimensions and sizes are in SI units, Generally units are in millimetres. All exceptions to this are noted.

**CONDUIT SIZES**

| Imperial (Inches) | ½ | ¾ | 1 | 1-¼ | 1-½ | 2 | 2-½ | 3 | 3-½ | 4 | 4-½ | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.I. (metric) (mm) | 16 | 21 | 27 | 35 | 41 | 53 | 63 | 78 | 91 | 103 | 116 | 129 | 155 |

1.4 **SHOP DRAWINGS**

1.4.1 Submit Manufacturers' Shop Drawings, Electrical Wiring Diagrams and Control System Drawings to the Consultant. Provide title sheet for Shop Drawing submitted. Include project name, Shop Drawing item (including Specification paragraph reference) and approval stamps. The Consultant reserves the right to have samples submitted of any specified products.

1.4.2 Before submitting shop drawings, provide a complete list of shop drawings to be submitted in Microsoft Excel format. List all shop drawings and approximate date of submission.

1.4.3 Submit all shop drawings electronically in Adobe® Acrobat® PDF format. File attachments to an email must total no more than 5 MB and must be submitted unzipped. If multiple items are submitted in single PDF file, each individual piece of equipment must be “book marked” using equipment labels as per Design Drawings. All shop drawings submitted electronically must be checked and stamped by Contractor as specified below.

1.4.4 Catalogues, manuals or price lists will not be accepted as Shop Drawings. Before submission, check Shop Drawings, make necessary corrections, apply stamp “Checked and Certified Correct”, sign and date.

1.4.5 Submit one reviewed set of Shop Drawings with each set of Maintenance and Operating Instructions.

1.4.6 The review of Shop Drawings by Chorley + Bisset Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review does not mean that Chorley + Bisset Ltd. approves the detail design inherent in the Shop Drawings, responsibility for which remains with the Contractor. Such review does not relieve the Contractor of his responsibility for errors or omissions in the Shop Drawings or of his responsibility for meeting all requirements of the Construction and Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all subtrades.

1.4.7 The Contractor is to review each shop drawing and document the differences between the shop drawing submission and the description listed in the specification. If there are no differences listed, the Contractor implicitly declares the shop drawing meets all requirements of the Specification.

1.4.8 Ensure at least one copy of the reviewed Shop Drawings is kept on site at all times for reference.

1.4.9 Prepare all Drawings in SI units.

1.4.10 Shop Drawings to include the following:

1.4.10.1 Indicate details of construction, dimensions, capacities, weight and electrical performance characteristics of equipment or material.

1.4.10.2 Where applicable, include wiring, single line and schematic diagram including interconnect with work of other sections.

1.4.10.3 Include manufacturer's special installation instructions where applicable.

1.5 **FIELD DRAWINGS**

1.5.1 Submit, to the General Contractor, Drawings accurately showing all openings for busducts, conduits, etc. Drawings must include the size of openings and their locations by dimensions, including the location of the structural members framing these openings. Each trade will be responsible for detail layout of their own work.

1.5.2 Assume full responsibility for the detailed coordination of all Division 16 work. Prepare Field Drawings to determine the exact location of each service. On these drawings, include all mechanical and electrical services, architectural features, and structural details. If a conflict becomes apparent after the installation of services, pay all costs associated with removing and reinstalling these services.

1.5.3 If the General Contractor separates the Communication, Security or similar work from the other work of Division 16, the General Contractor assumes full responsibility for this coordination work including the preparation of the Field Drawings.

1.6 **AS-BUILT DRAWINGS**

1.6.1 The Contractor will be provided with the Electrical Drawings in AutoCAD Version 2010 compatible electronic format. The Contractor is to plot and print Drawings from the disc.

1.6.2 Revise and maintain the prints as work progresses. Show all revisions, relocations and changes, to scale. Use colour markings.

1.6.3 Contractor shall take as-built measurements, prior to backfill, of all buried ductbanks and conduits under floor slab. Show routing, depths and dimensions from fixed points on as-built drawings.

1.6.4 Transfer information from the marked prints to AutoCAD format on a monthly basis. Have the marked prints and updated AutoCAD prints on site for review by the Consultant at all times. Monthly draws will not be approved unless all changes have been shown.

1.6.5 Prior to testing and final commissioning, complete the transfer of all information to the AutoCAD Drawings. The Drawing format is to match exactly the layering system of the Consultant. Mark Drawings “As-Built Drawings” and insert name and logo of Contractor. Bind all xrefs. Submit one set of As-Built Drawing prints for review by the Consultant. Remove Engineers Stamp. Include Contractors Name and Logo.

1.6.6 Submit completed As-Built Drawings in AutoCAD Version 2010 format and one set of Reproducible Drawings with the Operating and Maintenance Manuals.

1.6.7 For the purposes of Contract payments, As-Built Drawings will be assumed to have **a value of $1,000.** This will not be released until As-Built Drawings have been accepted as complete and acceptable by the Consultant. This amount is in addition to the normal 10% holdback required by the Construction Lien Act, 1983.

1.7 **SIMULTANEOUS PROJECTS**

1.7.1 Other projects may be under construction simultaneously on this site during the course of this construction project. The Owner will not be the "constructor" as defined by The Ontario Health & Safety Act & Regulations. This Contractor is to maintain a separation between this project and all other Contractors, by time or space, as defined by The Ontario Health & Safety Act & Regulations.

1.8 **CONFLICTS AND PRECEDENCE**

1.8.1 Immediately upon discovery of any conflict, ambiguity, error or omission in the Contract Documents, request clarification in writing from Consultant prior to starting the work in questions.

1.8.2 Failure to give such written notice will constitute an irrevocable waiver and release of any claim for additional compensation or delays incurred.

1.8.3 Where work fails to conform to Contract Documents, as clarified by Consultant, promptly remove and replace such work as directed, without adjustment to Contract price.

1.9 **FIRESTOPPING**

1.9.1 Before starting any work on site, submit detailed Shop Drawings to the Consultant for review and comments. Include:

1.9.1.1 Manufacturer's technical product data and installation instructions for each specific type and location of penetration.

1.9.1.2 Certification that proposed firestopping materials and assemblies comply with CAN4-115-M.

1.9.1.3 For each specific type and location of penetration, provide installation instructions from a recognized independent testing agency.

1.9.2 Mark penetration types and locations on set of white prints. At completion of project, transfer this information to As Built Drawings.

1.9.3 Comply with all requirements of Ontario Building Code Clause 3.1.9, “Building Services in Fire Separations and Fire Rating Assemblies”.

## 1.10 MAINTENANCE AND OPERATING INSTRUCTIONS

1.10.1 For the Electrical Division 16 work only, assemble three sets of equipment literature (cuts), operating instructions, maintenance instructions, voltage test results, certificate, other pertinent data and Letter of Warranty. Place in three ring binders, complete with index pages, indexing tabs and cover identification at front and side. Submit to Consultant for approval.

1.10.2 Make changes or submit additional information as required to obtain approval. Final Certificate of Completion will not be issued until the Consultant possesses three approved sets. Include copies of reviewed Shop Drawings and name and address of Spare Parts' Suppliers with manuals.

1.10.3 Provide two electronic copies of the maintenance and operating manual in Adobe Acrobat PDF format on a compact disc or DVD and submit with the final version of manuals. Electronic copy of manual to be provided as one file formatted with bookmarks in accordance with the sections of the hard copy manuals. Do not include separate files in sub folders. Divide the maintenance manuals into sections which correspond with Specification Sections.

1.10.4 The following information is to be contained within the Sections:

1.10.4.1 **Section 1:** A list of names, addresses and telephone numbers of the Consultants, General Contractor and Electrical Contractor. Written warranty of the Electrical systems.

1.10.4.2 **Section 2:** Electrical Safety Authority Inspection Permit, Fire Alarm Verification Report and Certificate, Emergency Lighting Verification Letter.

1.10.4.3 **Remaining Sections - By Specification Section**

1.10.4.3.1 A list of names, addresses and telephone numbers of all suppliers. A copy of all reviewed Shop Drawings.

1.10.4.3.2 A complete and comprehensive maintenance and operating instructions details D (daily), W (weekly), M (monthly), SA (semi-annually), A (annually) for maintenance.

1.10.4.3.3 Copies of warranties.

1.10.4.3.4 Complete control diagrams, wiring diagrams and description of applicable control systems and the functioning of the system.

## 1.11 REGULATIONS AND PERMITS

1.11.1 Carry out the work in accordance with the latest editions of relevant codes, local bylaws, and requirements of local Authority Having Jurisdiction. Apply for and obtain permits and pay all fees. Consultant will submit Drawings to Electrical Safety Authority if required.

1.11.2 Enforce all prevailing Provincial and local safety regulations at all times. Abide by all Owner’s safety and security policies and procedures and conform to all regulations of the current Occupational Health & Safety Act.

1.11.3 After completion of the work, furnish to Consultant a Certificate of Unconditional Approval from Inspecting Authorities.

1.12 **MATERIAL AND EQUIPMENT**

1.12.1 Where an item of material or any equipment is specifically identified by a manufacturer's trade name and/or catalogue number, make no substitution except as provided for in paragraphs 3, 4 and 5 below.

1.12.2 In the case of some items of equipment, one or more additional names of acceptable equal manufacturers are listed in the Clause describing an item or a group of items. The design, layout, space allocation, connection details, etc., are based on the products named first in the description of each item. The products named first in the description of each item establish the quality of manufacture and design standards for all other manufacturers of that item. The general approval indicated by listing the names of other manufacturers is subject to final review of Shop Drawings, performance data, test reports, production samples (if required) by Consultant, and equipment shipped to site. Ensure that the products used meet the requirements specified and as shown on the Contract Drawings.

1.12.3 Suppliers wishing to submit other items of equipment for approval as an equal to those specified must apply to the Consultant at least 8 working days before Bid closing date. Requests must be accompanied by complete description and technical data on the items proposed. Approval for substitution of equipment will only be given on the understanding that all details, accessories, features and performance meet the Specifications unless otherwise stated. Deviations from the Specifications must be stated in writing at time of application for approval.

1.12.4 Include in the Bid, the equipment named in the Specifications or approved as an equal as in paragraph 3 above. This will form the Base Bid. Any number of alternative bids, as defined below, may be included in addition to the Base Bid.

1.12.5 Items of equipment by Manufacturers not named in the Specifications may be offered as alternatives to the manufacturers named in the Specifications. The alternative proposals must be accompanied by full descriptive and technical data, together with the statement of amount of addition or deduction from the Base Bid, if the alternative is accepted. Prior approval by the Consultant is not required on items submitted as alternative bids.

1.12.6 After execution of the Contract, substitution of equipment will be considered only if equipment accepted cannot be delivered in time to complete the work in proper sequence, or if the manufacturer has stopped production of the accepted item. In such cases, requests for substitution must be accompanied by proof of equality and difference in price and delivery, in the form of Certified Quotations from Suppliers of both specified and proposed equipment. Credit any decrease in price involved in substitution to the Owner by reduction of the Contract Price. The Contractor will not be reimbursed for any such increase in price.

1.12.7 Where equipment other than the equipment used as a basis for design, layout and space allocation is used, produce and submit revised layouts of equipment, pipes, ducts, etc., in the areas affected. Submit these Drawings with the Shop Drawings. Failure to produce these Drawings is indication by the Contractor that they are not required and the original space allocations are adequate for the substituted equipment.

1.12.8 Name the Subcontractors and Manufacturers in the Bid as indicated in Clause “List of Electrical Subcontractors and Manufacturers”.

## 1.13 INTERPRETATION OF CONTRACT DOCUMENTS

1.13.1 The decision as to which trade provides required labour or materials rests solely with the Contractor. Extra payments will not be considered based on a difference in interpretation of the Contract Documents as to which trade involved provides materials or labour for specific items of work. The Consultant will not enter into such discussions.

## 1.14 SITE VISITS

1.14.1 The Electrical Contractor shall have an office representative (not site personnel) at each site meeting and deficiency review. Attendance at these meetings is mandatory.

## 1.15 PROGRESS DRAWS

1.15.1 Electrical Contractor shall review all supplier and subcontractor draws submitted to their office to ensure they are fair and reasonable for the amount of work completed on site to date prior to submitting to the General Contractor. Electrical Contractor will be responsible for the validity of supplier and subcontractor draw claims.

## 1.16 WARRANTY

1.16.1 Warranty all workmanship, material and equipment supplied by Division 16 for one year after Substantial Completion except where specifically specified otherwise. Make good damage caused due to defects and workmanship.

1.16.2 Where equipment specified in Sections of Division 16 to have an extended warranty period, e.g. five years, the first year of the warranty period will be governed by the terms and conditions of the warranty in the Contract Documents, and the remaining years of the warranty will be direct from the manufacturer and/or supplier to the Owner. Submit signed and dated copies of the extended warranties to the Consultant before applying for a Certificate of Substantial Performance of the Work.

## 1.17 DIMENSIONS AND QUANTITIES

1.17.1 Dimensions shown on Drawings are approximate. Verify dimensions by reference to Shop Drawings and field measurement.

1.17.2 Verify equipment access and coordinate with equipment supplier to ensure equipment can be physically transported to installation location. Under no circumstances will any claim be allowed for extra cost to disassemble and/or assemble equipment at the final location which will be considered as part of equipment installation.

1.17.3 Quantities or lengths indicated in any of the Contract Documents are approximate only and will not be held to gauge or limit the work. No adjustment to the Contract Price will be allowed to complete the work.

1.17.4 Provide labour, products and services specified, but not shown on Drawings and vice versa, and all other labour, products and services necessary for completion of the work.

1.17.5 Make any necessary changes or additions to routing of conduit, cables, cable trays, and the like to accommodate structural, mechanical and architectural conditions, without adjustment to Contract price.

1.17.6 Provide work in accordance with the approved Schedule to meet completion date and specified interim Schedules.

1.18 **COOPERATION BETWEEN TRADES**

1.18.1 Cooperate and coordinate with other trades as required for satisfactory and expeditious completion of work. Take field dimensions relative to work. Fabricate and erect work to suit field dimensions and field conditions. Pay cost of extra work caused by and make up time lost as result of failure to provide necessary cooperation information or items to be fixed to or built-in, in adequate time.

1.19 **COOPERATE WITH OWNER'S STAFF**

1.19.1 Maintain close cooperation with Owner's staff. The Owner will determine the times during which work may be carried out in certain areas. If the work cannot be completed in the allowed time, the Contractor may be required to clean up the area and finish the work at some future time.

1.19.2 Shutdowns will be scheduled during unoccupied times. Include any overtime wages due to conditions stipulated above in the Bid Price.

1.19.3 Provide seven day's minimum notice, in writing, prior to any interruptions of service or restriction of use of any service.

1.19.4 Provide all phase testing, as required, prior to disconnecting existing and connecting new to avoid damage to equipment.

1.19.5 The Owner's operations must take precedence over Contractors' operations at all times. Interruptions due to noise, drilling, etc., will not be allowed without Owner's prior approval.

1.19.6 Include any overtime wages due to conditions stipulated above in the Bid Price.

1.20 **EXAMINATION OF DAMAGED DEVICES**

1.20.1 Report all damaged, defective and non-functioning devices and equipment shown for reinstallation or relocation to the Consultant prior to removal and storage. All devices and equipment will be assumed to be fully functional unless reported otherwise prior to removal.

1.20.2 Devices and equipment damaged during removal, storage or reinstallation will be replaced at no cost to the Owner.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Clause “Material and Equipment”.

2.2 **CONCRETE**

2.2.1 Use concrete in accordance with the requirements of Division 3 unless specified or shown otherwise. Use red pigmentation when used as mechanical protection for electrical equipment.

2.3 **SLEEVES**

2.3.1 In general, sleeves are not required through walls or floors except in service room floors and foundation walls.

2.3.2 Use Schedule 40 steel pipe sleeves through concrete structural members, walls and floor slabs. Extend sleeves minimum 1″ AFF and seal pipe to sleeve.

2.3.3 For all conduits passing through foundation walls, use Link-Seal pre-engineered mechanical seals between sleeves and pipes.

2.3.4 For rated separation requiring a FT firestopping rating, use materials in conformance with manufacturer's recommendations.

2.4 **FIRESTOPPING**

2.4.1 Use only service penetration firestop components and assemblies tested in accordance with CAN.ULC S115 “Fire Tests of Firestop Systems” and listed in most recent ULC “List of Equipment and Materials” or by another recognized independent testing and certification agency acceptable to the Consultant.

2.4.2 Pipe sleeves through fire separations requiring a rating are to be installed as per firestopping manufacturer's recommendations, as some firestopping manufacturers do not allow pipe sleeves within their approved system. Confirm pipe sleeve compatibility prior to starting work on site.

2.4.3 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

Hilti
Tremco

2.5 **ACCESS DOORS**

2.5.1 Access doors to be flush to edge of frame, concealed continuous hinge with screwdriver operated cam latch. Non fire-rated door construction to be minimum 14 gauge, with 16 gauge frame. Fire-rated door construction to be a minimum 20 gauge insulated door with 16 gauge frame. Insulation thickness to provide required rating.

2.5.2 Size doors to allow adequate operating/maintenance clearance for devices. Doors to be a minimum 600 mm x 600 mm (24″ x 24″) for body entry, and 300 mm x 300 mm (12″ x 12″) for hand entry, unless noted otherwise. Use the following access doors:

| | |
|---|---|
| Masonry Walls | Acudor UF-5000 |
| Drywall Walls | Acudor DW-5040 |
| Drywall Ceilings | Acudor BP58, match ceiling thickness |
| Fire-Rated | Acudor FW-5050/FB-5060 to match fire separation |
| Wet Areas, Operating Rooms | Acudor UF-5000 (stainless) |

2.5.3 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause “Material and Equipment”:

Adam
Ancon LeHage
E. H. Price

## 2.6 SPRINKLER PROOF EQUIPMENT

2.6.1 This building will be fully sprinklered. Use sprinkler proof electrical equipment to prevent the sprinkler system water from entering electrical equipment for all surface mounted equipment.

## 2.7 IDENTIFICATION NAME LABELS

2.7.1 Provide white lamacoid identification labels with black uppercase lettering, minimum 14 pt Arial or Helvetica typeface, for identification of all MCCs, switchboards, distribution panels, panelboards, transformers and transfer switches.

2.7.2 Provide black lamacoid identification labels with white uppercase lettering, minimum 14 pt Arial or Helvetica typeface, for identification of all MCCs, switchboards, distribution panels, panelboards, transformers and transfer switches.

2.7.3 Submit a complete list of nameplate wording for review by Consultant prior to installation.

2.7.4 Warning plates are to be red with white letters, minimum 14 pt Arial or Helvetica typeface, as indicated on drawings.

## 2.8 FLASHING

2.8.1 For locations with roof penetrations serving a piece of equipment, such as for roof mounted split system condensing units, receptacles, use Portals Plus, Inc. Alumi-Flash system consisting of 100 mm (4″) high, one piece spun aluminum base with deck flange and EPDM rubber cap. Use caps suitable for required number and diameter of service penetrations. Flashing is for Division 16 use only.

2.8.2 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause “Material and Equipment”:

Portals Plus

3 Execution

3.1 **GENERAL**

3.1.1 Instruct and supervise other Sections doing related work.

3.1.2 Supply the measurements of equipment to other Sections to allow for necessary openings to be left in the work of other Sections.

3.1.3 Install conduit, which is to be concealed, neatly and close to building structure so that the necessary furring can be kept as small as possible.

3.1.4 Carry out all work in accordance with the latest regulations of the Ontario Electrical Safety Code and all applicable Municipal, Provincial and Federal Codes and Regulations. In no instance, however, is the standard established by the Drawings and Specifications, to be reduced by any of the Codes referred to above.

3.1.5 Install all ceiling components in direct accordance with reflected ceiling plans.

3.1.6 Electrical Drawings show approximate locations for wall-mounted devices. Clarify exact location and mounting height with Consultant prior to roughing-in.

3.1.7 All serviceable equipment installed on the roof (including receptacles) to be installed minium 3 m (10'-0") from roof edge unless otherwise noted on Drawings.

3.2 **STORAGE OF MATERIALS**

3.2.1 Provide proper weatherproof storage for the protection of materials and equipment on site. Blank off openings in all equipment until required for use. Consultant may require materials which are not properly stored to be discarded and removed from the site.

3.3 **CONCRETE WORK**

3.3.1 Arrange for the supply and pouring of all concrete required for the Electrical work. Include the cost of this in the Lump Sum Contract Price for the Electrical work of this project.

3.3.2 Carry out all concrete work in accordance with requirements of Division 3. Provide wire mesh, rebar and all necessary reinforcing.

3.4 **SUPPORTS AND BASES**

3.4.1 Provide structural work required for installation of equipment provided under this Division.

3.4.2 Set all floor-mounted equipment on concrete bases at least 100 mm (4″) high. Size concrete equipment bases to suit the equipment actually supplied and in accordance with the Shop Drawings of such equipment. Do not start concrete work until anchor bolts and other embedded parts required for the complete installation, as well as Shop Drawings, are available at the site.

3.4.3 Extend existing concrete bases as required for replacement or new equipment. Match existing height.

3.4.4 For new concrete bases or pads on existing floors, first scrape and remove existing floor finish. Scarify existing floor so that new concrete adheres to it. Dowel new pads to new and existing floors.

3.4.5 Provide all brackets and supports required in steel stud walls. All conduits and equipment must be supported on brackets or supports attached to steel studs. Do not support materials or equipment from wall sheathing.

3.4.6 Provide independent support; brackets and unistrut structures where required to install electrical equipment; disconnect switches, splitters, panels, etc:

- in areas where the equipment is located on walls/columns that are not suitable for direct installation.
- When installation away from structural building elements is called for.
- When it is necessary to elevate the electrical equipment to ensure code compliance or ergonomical operator access.

3.4.7 For all supports of suspended or wall hung electrical equipment, provide structural drawings stamped and signed by a structural engineer holding a P.Eng. designation and registered in the Province of Ontario. This engineer is to submit proof of professional liability insurance. Equipment to be supported from the bottom.

3.4.8 Do not mount starters, VFD's, etc. on building equipment.

3.4.9 Do not suspend luminaires greater than 11.3kg (25 lbs), cable tray, conduit racks, etc from metal roof deck. Provide supports as required to suspend from roof joists.

3.4.10 Provide lintels for double-width and adjacent tubs and multiple conduits running in parallel, where located in block and poured walls.

## 3.5 CONCRETE INSERTS

### 3.5.1 General

3.5.1.1 Anchors for the support of conduits and equipment from the underside of suspended structural concrete systems may be by cast-in-place inserts placed prior to the pouring of concrete or by the use of inserts placed in holes drilled after the forms are stripped.

3.5.1.2 The safe load capacity of concrete anchors is affected by a number of variables such as specific anchor type, embedment, spacing between individual anchors, edge distances, direction of loading, concrete strength and "prying action". Refer to the manufacturer's recommendations for each specific insert proposed, including any dynamic or vibratory loads.

3.5.1.3 Be responsible for the proper selection and installation of inserts, including number, type, spacing and accurate placement to provide the necessary safe load capacity and satisfactory long term performance.

3.5.2 **Installation of Inserts in Hardened Concrete:**

3.5.2.1 Use inserts placed in pre-drilled holes. Do not use powder driven inserts or self-drilling inserts. Before drilling holes, accurately locate all reinforcing bars in the affected areas using an electro-magnetic locator.

3.5.2.2 Do not drill through or otherwise damage reinforcing bars. If reinforcing is encountered, the inserts must be relocated. Ensure that hole diameter, depth of penetration, spacing, etc., are in strict accordance with the insert manufacturer's recommendations for the specific insert type and load condition.

3.5.2.3 Due to the relatively close spacing of reinforcing bars in the bottom of many of the beams and girders, the preferred location of drilled-in-place anchors in beams and girders is into the sides of these members, rather than upwards into the bottom.

3.5.2.4 Inserts to be zinc plated female concrete anchors. Nylon or plastic anchors are not acceptable.

3.5.3 Concrete screws without anchors are not acceptable.

3.6 **SLEEVES**

3.6.1 **Sleeves Embedded in Concrete**: Except as approved otherwise by the Consultant, install sleeves embedded in concrete in accordance with the following general guidelines:

3.6.1.1 Centre to centre spacing to be not less than 3 diameters of the maximum size adjacent sleeve.

3.6.1.2 Provide additional reinforcing at points of congestion as directed by the Consultant.

3.6.1.3 Sleeves through beams will be permitted only as directed by the Consultant.

3.6.1.4 The reinforcing in beams, slabs and columns must not be displaced from its intended position under any circumstances unless prior written approval is obtained from the Consultant.

3.6.2 Provide sleeves for all conduits which pass through service room floors and foundation walls. Sleeves to extend minimum 1" above finished floor.

3.7 **FIRESTOPPING**

3.7.1 Provide a listed firestop system in accordance with the Ontario Building Code to seal around all conduits, electrical wires and cables, and other similar electrical services which penetrate part of a building assembly required to have a fire resistance rating or a fire separation. Refer to Architectural Drawings and Specifications Section “Firestopping and Smoke Seals” for building assembly and fire separation types and locations.

3.7.2 For all penetrations through fire separations required to have a fire resistance rating, use firestop systems with an F rating not less than the fire resistance rating for the fire separation. This includes the sealing of any sleeves provided for future uses. Provide an FT rating where required by the Ontario Building Code. For all penetrations through a Service Room floor, provide a minimum W rating - Class 1 in addition to the fire resistance rating.

3.7.3 All firestopping must be thoroughly reviewed by the Technical Representative of the systems manufacturer on site before any firestopping is concealed and submit a report of compliance with the rating requirements. Technical Representative to complete 3 destructive tests to confirm compliance with ULC listing, minimum one floor test and one wall test, third test to be Contractor's choice. Contractor to replace fire stopping system after destructive test has been completed. Submit a copy of the report to the Consultant. Report to include as a minimum, confirmation fire stopping shop drawings were used during review, locations where destructive testing was completed, confirmation all fire stopping locations were reviewed and installed systems meet the manufacturer requirements.

3.7.4 Provide instruction wall labels on both sides of wall for all thru-wall penetrations using FlameStopper. Locate adjacent to penetration as required to be visible from standing position.

## 3.8 CUTTING AND PATCHING

3.8.1 Flash holes through walls and roof to make weatherproof.

3.8.2 Do not cut or drill holes through floors, roof or structural members before obtaining permission from the Consultant.

3.8.3 For penetrations through walls not required to have a fire rating, seal all spaces between pipe or pipe and surrounding wall construction with a fire-rated foam sealant. Use 3M Fire Barrier, Metacaulk, or Dow Fire Stop UL Classified fire rated foam sealants. Do this as the work progresses, to avoid leaving inaccessible holes at completion of the job. For penetrations through parts of the building assembly required to have a fire resistance rating or acting as a fire separation, see Clause "Firestopping" in this Section.

3.8.4 Before drilling holes through floors or roof slabs, accurately locate and note sizes for each required hole. Get approval of Consultant before any cutting is started.

3.8.5 Where conduits are required to pass through existing walls, floors, and roof, cut and patch the necessary openings.

3.8.6 Where recessed electrical equipment is removed or replaced with equipment of a smaller size, patch openings to match existing wall material.

3.8.7 Where wiring devices (switches, receptacles, etc) are removed from drywall walls, remove device box and patch opening to match existing wall.

3.8.8 Where wiring devices (switches, receptacles, etc) are removed from poured concrete or block walls, remove device and provide blank coverplate.

3.8.9 Include the cost of all cutting and patching in the Lump Sum Contract Price for the work of Division 16.

3.8.10 Remove and replace ceiling where necessary to complete the work of this Division unless this work is specifically included in another Division.

3.8.11 All cutting and patching to be done by the trade specializing in the materials to be cut.

## 3.9 PAINTING

3.9.1 Touch up minor damage to finish on equipment supplied with factory applied baked enamel finish. Completely refinish items suffering damage which, in the opinion of the Consultant, is too extensive to be remedied by touchup.

3.9.2 Paint both sides and edges of plywood backboards for electrical and communications equipment before installing equipment. Use one coat fire retardant primer and two coats fire retardant paint.

3.9.3 Paint disconnect switch or breaker for fire alarm and exit light systems in red enamel. Use one coat of primer and one finish coat.

3.9.4 Where walls are cut and patched for electrical work, paint walls to match existing. For walls less than 9.3$m^2$ (100 sq ft), paint entire wall. For walls larger than 9.3$m^2$ (100 sq ft), paint area of patch. Painting to be completed by painting contractor.

3.9.5 Include the cost of all painting in the Lump Sum Contract Price for the work of Divisions 16.

## 3.10 ACCESS DOORS

3.10.1 Supply access doors wherever equipment, junction boxes, life safety devices, etc., are concealed behind walls or inaccessible ceilings. All devices installed requiring periodic maintenance to be made accessible. Doors will be installed by the trade specializing in the materials receiving access doors.

## 3.11 IDENTIFICATION

3.11.1 Colour code control wiring consistently throughout the installation and generally match colour coding of internal wiring of pre-wired components. Match existing colour coding in use on site. Verify with Owner prior to installation.

3.11.2 All branch circuits shall be:

Phase A - red
Phase B - black
Phase C - blue

3.11.3 Identify all disconnects, starters, and other control equipment with lamacoid nameplates indicating the equipment controlled and all panels, transformers, etc identifying equipment name.

3.11.4 Lamacoid labels to be mechanically attached with self-tapping screws or rivets. Lamacoid labels attached using adhesive methods are not acceptable.

3.11.5 Identify the panel and circuit number for each wiring device with self-adhesive label on the coverplate. Use clear tape with black 14 pt Arial or Helvetica typeface. Locate labels for receptacles on front of coverplate and labels for switches on rear of coverplate.

3.11.6 Identify all pull boxes, junction boxes or octagon boxes located in the ceiling cavity with the exact use of the box, including circuits contained within. Felt pen is acceptable.

3.11.7 Where equipment is concealed above accessible ceilings, indicate location using coloured-coded marking devices, approved by Consultant, fastened to the ceiling components.

## 3.12 LOCKS AND KEYS

3.12.1 Where locked panelboards, control panels, terminal cabinets, etc., are specified, use a separate key pattern for each system with all locks in each system common to one key. Provide seven keys of each pattern to the Owner on a 25 mm (1″) key ring. Submit one set of keys with manuals.

## 3.13 TESTING

3.13.1 All systems must be thoroughly tested before arrangements are made for the final demonstration in the presence of the Owner's staff. Systems to be tested are:

1. Medium Voltage Cables and Switchgear
2. Emergency Lighting
3. Lighting Control Systems
4. Security
5. Voice / Data Cabling
6. PA / Intercom Systems

3.13.2 For the following systems, the manufacturer's Testing Representative must be present for the test period and submit a Certificate of Operation to the Consultant:

1. Fire Alarm

3.13.3 At the completion of the work, demonstrate operation of all systems to the Owner's representative and the Consultant. Promptly rectify any malfunction found.

## 3.14 TEMPORARY ELECTRICAL FACILITIES FOR CONSTRUCTION

3.14.1 Temporary electrical power is available at the site. Cooperate with owner for use of this power.

3.14.2 Tie in at one location only, as directed. Distribute temporary power from this location.

3.14.3 Arrange and pay for the cost of inspection of the temporary service.

3.14.4 Notify the monitoring company and Owner each and every time a part of the fire alarm system is shut down and reactivated.

3.14.5 Completely remove all temporary facilities when they are no longer required.

3.14.6 Provide fixed temporary lighting for open areas, stairwells and each enclosed room. In open areas and enclosed rooms use 150W A21 lamps, or equivalent, at spacings not exceeding 7.5m. In staiwells use one 100W A21 lamp, or equivalent, at each landing. Lighting to be on dedicated circuits.

3.14.7 Temporary lighting stipulated in this Section, do not include provisions for higher intensity lighting required for a specific operation (concrete finishing, plastering, etc.). This will be the responsibility of the specific trade requiring the higher intensity.

3.14.8 Provide minimum two 120V 20A GFCI receptacles, on dedicated circuits, per 150 m² construction area.

3.14.9 Temporary power requirements stipulated in this Section, do not include provisions for electric space heating, electric welders, or any other item of equipment which requires either a 3 phase supply or connection to a single phase circuit rated in excess of 20 amperes. Any trade using equipment which falls into above categories is to be responsible for providing additional facilities required for such equipment, including any increased sizing. This Division is responsible to see the connection to the temporary system is safe.

3.14.10 Use non-metallic sheathed cable, Type NMW-10, #12 AWG, manufactured in accordance with CSA Spec. C22.2 No. 38, for all temporary lighting branch circuit wiring.

3.14.11 **Temporary Fire Alarm Devices**

3.14.11.1 Notify the local Fire Department and Owner each and every time a part of the fire alarm system is shut down and reactivated.

3.14.11.2 Provide new temporary hard wired fire alarm detectors, pull stations and notification appliances within the construction area.

3.14.11.2.1 Provide one 135°F rate-of-rise heat detector for every 465 m² (5000 ft²) of floor area.

3.14.11.2.2 Provide smoke detectors in all temporary corridors spaced maximum 10m (30 ft).

3.14.11.2.3 Provide a manual pull station at every exit/entrance to the construction area.

3.14.11.2.4 Provide one surface mounted bell for every 560 m² (6000 ft²) of floor area.

3.14.11.3 Use #14 AWG, AC-90 cable for temporary wiring to devices.

3.14.11.4 Connect devices to dedicated fire alarm zones, grouped on a floor-by-floor basis. Provide zone cards as required to suit existing fire alarm panel.

3.14.11.5 Completely verify temporary fire alarm devices any time temporary devices are added, removed or relocated.

3.14.11.6 Once the permanent fire alarm system is operational completely remove all temporary devices and wiring. Turn devices over to the Owner.

## 3.15 EQUIPMENT SCHEDULE

3.15.1 Equipment Schedules are as shown on Drawings.

3.15.2 In general, the motor or item numbers shown in the Equipment Schedules coincide with those numbers shown for Mechanical Trades.

## 3.16 GROUNDING

3.16.1 Ground all components of the Electrical system in accordance with the requirements of Section 10 of the Ontario Electrical Safety Code latest edition and the Inspection Authority.

3.16.2 Provide a separate green ground conductor in all raceways.

3.16.3 Ground secondary neutrals of transformers to building ground conductor.

3.16.4 Where attached to equipment, conduits, cabinets, etc., use suitable approved solderless lugs, compression connectors. No soldered or split bolt type connections are to be used on grounding circuits at any point.

3.16.5 All compression connectors, lugs, etc., used in grounding circuits in any location are to have bolts, nuts, etc., of silicone bronze alloy equal to “Everdur” metal.

3.16.6 Clean all surfaces to which bus or cable are to be bolted, of all paint, rust, etc., and work to a bright, flat surface.

3.16.7 Conduit expansion joints and telescoping sections or metal raceways not thoroughly bonded otherwise, are to be provided with approved bonding jumpers or not less than #8 AWG stranded bare copper.

3.16.8 Provide a separate #14 green ground wire for all isolated ground receptacles.

## 3.17 START-UP SERVICES

3.17.1 Provide the services of a qualified person to be on call and available to the site within one hour, for 2 weeks after work of this Contract is taken over by the Owner. Assist Owner's staff to become familiar with the system operation.

## 3.18 MAINTENANCE OF EXISTING SERVICES

3.18.1 Take every precaution to locate and protect existing services so that no interruption occurs. If any existing service is damaged due to the work of this Division, arrange and pay for repair. Bear any costs due to interruption of existing services.

3.18.2 Be responsible for maintaining continuity of existing services, and for programming work so that the Owners can carry out their normal business uninterrupted, with the exception of scheduled shutdowns for connection to or rerouting of existing services, at a time agreed to by the Owners, on weekdays, over weekends or after normal working hours.

3.18.3 Permission from the Owner is required before making any connections to or rerouting of existing services. Give seven days prior notice to the Consultant and Owner.

## 3.19 PROTECTING AND MAKING GOOD

3.19.1 Be responsible for protection of Owner's property, as well as finished and unfinished work, from damage due to execution of work under this Contract. Repair damage resulting from failure to provide such protection to the satisfaction of the Consultant, at no expense to the Owner.

3.19.2 Attach and fasten fixture and fittings in place in safe, sturdy, secure manner so that they cannot work loose or fall or shift out of position during occupancy of building, as the result of vibrating or other causes in normal use of building.

3.19.3 Coordinate and cooperate with other trades, taking into account existing installations, to assure best arrangement of equipment in available space. For critical locations, prepare interference and installation drawing showing work of various sections as well as existing installations, for approval before commencing work.

3.19.4 All new equipment shall be delivered to site wrapped in plastic and removed only after room is thoroughly cleaned and painted, if applicable. Where existing or new equipment must be operational throughout construction in adjacent spaces, ensure door sweeps are installed and mechanical ventilation systems are fully operational. Provide filters with minimum filtration rate of 10 micron (MERV 5) on all make-up air and supply ducts. Ensure filters are regularly changed to maintain adequate airflow.

## 3.20 REMOVAL OF EXISTING MATERIAL AND EQUIPMENT

3.20.1 Remove existing material and equipment where shown or specified. Equipment such as Fire Alarm devices, and any other special devices are to be turned over to the Owner. Relocate these items to a designated storage site as directed by Owner. Other material and equipment which is removed becomes the property of the Contractor, and must be immediately removed from the site.

## 3.21 LOAD BALANCE

3.21.1 Measure phase current to distribution panels and MCCs with normal loads operating at time of acceptance.

3.21.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

3.21.3 Submit, at completion of work, a report listing phase and neutral currents on panelboards, dry-core transformers and motor control centre, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

## 3.22 REBATES AND INCENTIVES

3.22.1 Provide all invoices and proof of purchase documentation to Owner as requested for application by Owner for rebates and incentives. All incentives will be paid to the Owner.

## 3.23 CASH ALLOWANCES

3.23.1 Refer to Section 01020 for cash allowances carried by the General Contractor.

3.23.2 Include in the Base Bid price, cash allowances of:

3.23.2.1 $3,000.00 to cover the cost of unforeseen electrical deficiencies. Submit Electrical Safety Authority Inspection deficiencies to the Consultant.

3.23.2.2 $8,000.00 to cover the cost of Utility service to the building.

3.23.3 Any amounts in excess of the cash allowances will be paid by the Owner. Return any unused portions of the cash allowances in full to the Owner.

## 3.24 DEFICIENCY REVIEW

3.24.1 The Electrical Contractor shall confirm in writing that the work is complete and ready for inspection. The Consultant will schedule a site visit to review the work and provide a written deficiency list. Once deficiencies have been corrected, the Electrical Contractor shall confirm in writing to the Consultant that all deficiencies have been corrected. The Consultant will schedule a second site visit to review the correction of noted deficiencies. Should any noted deficiencies be found to be still outstanding, the Electrical Contractor shall correct them and again notify the Consultant in writing. Charges to the Electrical Contractor may result from repeat visits after the second visit.

3.24.2 The Electrical Contractor is required to complete all work above ceilings and allow time for deficiency reviews and correction of noted deficiencies in a timely manner in order to accommodate the current Construction Schedule. This includes time for reinspection as required prior to concealing (drywall enclosures, drywall ceilings and acoustic tile ceilings) of any service. The Electrical Contractor will be responsible for uncovering any concealed services for inspection.

## 3.25 LIST OF ELECTRICAL SUBCONTRACTORS AND MANUFACTURERS

3.25.1 In the Bid documents, name the Subcontractors and Manufacturers for the items listed below. Use only one name for each item. See Clause “Material and Equipment”. Where the name of a manufacturer is not entered on the Bid Form, the Contractor will be required to use the base specified manufacturer.

3.25.2 **Subcontractors**

Fire Alarm System
Data Wiring
PA System
Security System

3.25.3 **Manufacturers**

Disconnect Switches
Emergency Lighting / Exit Signs
Fire Alarm Devices
Intercom System
Luminaires (by Type)
Occupancy Sensors
Panelboards
Security System
Structured Wiring
Transformers
Wiring Devices

**END OF SECTION**

INDEX - SECTION 16100

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 16001, “Electrical General Provisions”.

1.2 **DESCRIPTION OF SYSTEM**

1.2.1 Provide all new wiring and raceways. Where possible, conceal all wiring and raceways above ceilings, in walls and partitions. See Section 16001, “Electrical General Provisions”.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Clause “Material and Equipment”.

2.1.2 All outlet boxes, wiring devices, equipment and accessories must be C.S.A. approved and be designed for the application intended.

2.2 **RACEWAYS**

2.2.1 Use E.M.T. in concealed locations in concrete block walls, drywall partitions and for main and branch circuit wiring above corridor ceiling spaces.

2.2.2 Use minimum 1/2″ (16 mm) conduit for power wiring and 3/4″(21 mm) conduit for motor circuits.

2.2.3 Refer to Section 16700 for communication raceways.

2.2.4 Use set screw steel couplings and connectors. Use raintight steel couplings and connectors complete with “O” rings, where exposed to sprinklers.

2.2.5 Use red conduit for Fire Alarm wiring concealed above ceilings, in concrete walls and in mechanical and electrical rooms.

2.2.6 For new devices on existing block or poured concrete walls exposed in finished areas, provide metallic single compartment raceway and appropriate bases.

2.2.7 Use conduit expansion coupling for expansion joint crossing.

2.2.8 Use flexible metal conduit for all final connections to motors and other equipment subject to vibration or which has adjustable mountings. Minimum size 1/2″ (16 mm).

2.2.9 Use rigid PVC underground and in concrete floors, unless otherwise noted. Provide marking tape for underground installations in accordance with Ontario Electrical Safety Code.

2.2.10 For exterior above grade installations, use rigid aluminum conduits and fittings. All boxes and conduit bodies shall be die-cast, copper-free aluminum with aluminum covers and neoprene gaskets.

2.2.11 Fasten all raceways with approved supports. Use clamps and all mounting hardware of the same material as the conduit or compatible material to prevent galvanic corrosion.

## 2.3 CONDUCTORS

2.3.1 Aluminum conductors are NOT permitted on this project.

2.3.2 Use minimum copper #12 AWG RW-90XLPE **stranded** for branch circuiting and receptacle wiring.

2.3.3 Use RWU-90XLPE wire in all below grade locations.

2.3.4 Use minimum size of #14 AWG RW-90XLPE for control wiring.

2.3.5 Use RWU-90XLPE-1000 volt rated cables from Variable Frequency Drives to motors.

2.3.6 Type AC-90 cable may be used for final drops (maximum 2 m [6.5′]) to lighting fixtures and devices in accessible ceiling spaces. **DO NOT USE AS MAIN BRANCH WIRING FROM PANELBOARDS OR FOR BRANCH CIRCUIT WIRING (i.e. RECEPTACLES, ETC.).**

2.3.7 For wiring to heating equipment, recessed lighting fixtures or where body of fluorescent fixture is used as raceway, use conductors with high temperature insulation of type approved by Electrical Safety Authority.

2.3.8 Use all wire and cable insulation rated 600 volts minimum unless specified otherwise.

## 2.4 OUTLET BOXES

2.4.1 Use only masonry approved boxes in concrete and masonry construction.

2.4.2 Use 100 mm (4″) square or utility type boxes for surface-mounted boxes and 100 mm (4″) octagonal boxes for ceiling outlet boxes. Use multi-gang boxes for grouped devices. Use wrap-around covers for utility boxes. Use cast aluminium FS type boxes where surface mounted in finished areas.

2.4.3 Use flush-mounted boxes complete with adjustable ears, extension rings and plate rings as required. Do not use shallow or narrow boxes.

2.4.4 Provide FS type boxes c/w rain tight fittings where surface mounted in service rooms or where exposed to sprinklers.

## 2.5 WIRING DEVICES

2.5.1 Use specification grade wiring devices, types and ratings shown on the Drawings.

2.5.2 Switched receptacles to be black. Use red devices for receptacles\switches fed from emergency circuits.

2.5.3 Confirm colour of wiring devices and plates with Consultant prior to ordering.

2.5.4 **Receptacles**

2.5.4.1 125 volt 15 amp white self-testing GFCI Duplex Receptacle (CSA 5-15R)
Hubbell Catalogue No. GFR-5252-W-ST

2.5.4.2 125 volt 15 amp white U-ground Tamper Resistant Duplex Receptacle (CSA 5-15R)
Pass &Seymour Catalogue No. TR62W, or equivalent.
Alternative manufacturers to provide equivalent grade or better.

2.5.4.3 125 volt 20 amp white self-testing GFCI Duplex Receptacle (CSA 5-20R)
Hubbell Catalogue No. GFR-5352-W-ST

2.5.4.4 125 volt 20 amp white U-ground Tamper Resistant Duplex Receptacle (CSA 5-20R)
Pass &Seymour Catalogue No. TR63W, or equivalent.
Alternative manufacturers to provide equivalent grade or better.

2.5.4.5 125/250 volt 50 amp Range Receptacle (CSA 14-50R)
Hubbell Catalogue No. 9450A

2.5.5 **Switches**

2.5.5.1 125 volt 20 amp white single pole switch
Hubbell Catalogue No. HBL-1221-W

2.5.5.2 125 volt 20 amp white three way switch
Hubbell Catalogue No. HBL-1223-W

2.5.6 **Cover Plates**

2.5.6.1 In general, use 302 stainless steel face plates for all flush-mounted devices and die-cast face plates for all surface-mounted devices.

2.5.6.2 All receptacles exposed to weather to have die-cast aluminum duplex gasketted spring door in-use covers.

2.5.7 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause “Material and Equipment”:

Cooper
Hubbell
Leviton
Pass & Seymour

2.6 **DISCONNECT SWITCHES**

2.6.1 Fused or unfused disconnect switches to be conditionally hp rated, heavy duty type with visible break industrial safety switches in general purpose or weatherproof enclosures as required.

2.6.2 All three phase greater than 30A: Fused or unfused disconnect switches to be conditionally hp rated, heavy duty type with visible break industrial safety switches in general purpose or weatherproof enclosures as required.

2.6.3 For 120V mechanical equipment, provide Hubbell Cat. #B100 toggle switch complete with lockable cover.

2.6.4 All 208/600V single phase and three phase 30A and below: Hubbell Cat # HBL1372 disconnect switch with aluminum housing.

2.6.5 The door to be mechanically interlocked with the operating handle to prevent it from being opened when the switch is in the “ON” position. The handle is to be capable of being padlocked in the “OFF” or “ON” position.

2.6.6 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause “Material and Equipment”:

Eaton
Schneider
Siemens

## 2.7 SURFACE RACEWAYS

### 2.7.1 Surface Metal Raceways

2.7.1.1 Provide surface metal raceways to supply power and/or low potential services as shown on the building plans.

2.7.1.2 Provide and install all surface metal raceways and appropriate fittings to provide a safe and complete installation.

2.7.1.3 Raceway and fittings are to be the DS4000 Series as manufactured by Wiremold Company. **ALTERNATIVE MANUFACTURERS MUST PROVIDE SAMPLE FOR APPROVAL.**

2.7.1.4 The two piece surface metal raceway is to consist of a base section having a nominal material thickness of .129 mm (0.50″) and have trade size knockouts, 32 mm (1-1/4″) from each end and one centre of approximately 450 mm (17-3/4″) throughout to facilitate mounting.

2.7.1.5 The cover sections will have a nominal material thickness of .1016 mm (.040″) and be furnished in 1500 mm (60″) lengths.

2.7.1.6 The base and cover sections are to be manufactured of galvanized steel and painted with colour selected by Consultant. The dimensions of the two compartment raceway when assembled will be a minimum of 120 mm x 44 mm (4-3/4″ x 1-3/4″) deep.

2.7.1.7 All raceway shown is to be divided into two equal but separate wiring compartments to facilitate installation of power and voice/data cabling.

2.7.1.8 Provide all necessary couplings, elbows, wire clips and end fittings. In addition, provide all device brackets to install the duplex receptacle device brackets horizontally within the raceway for both power and communication devices, using Wiremold V4048B/G4048B duplex receptacle device plate for receptacles and V4007C-1R/G 4007C-1R plate for voice/data outlets. Provide blank duplex coverplates on all communication devices shown on floor plan. For all communication devices on raceway, provide 32 mm x 75 mm (1-1/4″ x 3″) punch

plate opening CG 4007 C 1. Confirm communication device plate requirements with Owner prior to ordering. For receptacles in wireway, provide CG-4046-B.

2.7.1.9 The following manufacturer of the above equipment will be considered as equal subject to requirements of Clause “Material and Equipment”:

Hubbell
Wiremold

3 Execution

3.1 **GENERAL**

3.1.1 Unless shown otherwise, the minimum size of all raceways and conductors to be in accordance with the Ontario Electrical Safety Code.

3.2 **CONDUIT INSTALLATION**

3.2.1 Conceal all conduits except in equipment rooms, unfinished area, and where specifically noted. Flush mount all devices, starters, etc., in finished areas. Install all exposed conduits parallel to building walls and partitions.

3.2.2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

3.2.3 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

3.2.4 Run parallel or perpendicular to building lines.

3.2.5 Run conduits in flanged portion of structural steel. Do not pass conduits through structural members except as indicated.

3.2.6 Group conduits wherever possible on suspended surface channels.

3.2.7 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers. Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

3.2.8 Horizontal runs of conduit will not be permitted in walls unless noted otherwise.

3.2.9 In any case, horizontal runs must be located above level of door or transom frames in area.

3.2.10 Vertical conduits must be supported at each floor slab and at the top and bottom of each riser.

3.2.11 Conduits must be supported from building structure. Provide independent unistrut under obstructions such as ductwork for support as required. Support unistrut from structural members. Do not secure to underside of metal pan roof deck.

3.2.12 Conduit placement should follow the following priority:

- Below grade
- In walls or partitions
- In ceiling cavity
- Exposed

3.2.13 Maintain continuity of ground through all connection points. Use sealer lubricant on all threaded connections embedded in concrete, buried in ground or exposed outdoors.

3.2.14 Leave all conduit systems finished complete with outlet boxes, coverplates, bushings, caps, nylon fish wire, etc. Provide bushings for all sleeves.

3.3 **CONDUCTORS**

3.3.1 Join #8 AWG and larger conductors with compression connectors properly sized. On #10 AWG and smaller, relaxed wing-nut type connectors may be used. Ideal Industries 451, 452 or 453.

3.3.2 Size conductors for a maximum of 2% voltage drop from the supplying panel to the furthest outlet in the circuit. In calculating voltage drop, use 80% of overcurrent rating or design load where known, whichever is less.

3.3.3 Draw wiring into raceways only after all other work that may cause injury to the wire is completed. Use only wiring lubricants that do not shorten insulation life. Use continuous lengths for feeders to panels and large equipment. Do not splice without permission from Consultant.

3.4 **GROUNDING**

3.4.1 Ground all components of the Electrical system in accordance with the requirements of Section 10 of the Electrical Safety Code latest edition and the Inspection Authority.

3.4.2 **Provide a separate ground conductor in all raceways.**

3.4.3 Ground secondary neutrals of transformers to building ground conductor.

3.4.4 Where attached to equipment, conduits, cabinets, etc., use suitable approved solderless lugs, compression connectors. No soldered or split bolt type connections are to be used on grounding circuits at any point.

3.4.5 All compression connectors, lugs, etc., used in grounding circuits in any location are to have bolts, nuts, etc., of silicone bronze alloy equal to “Everdur” metal.

3.4.6 Clean all surfaces to which bus or cable are to be bolted, of all paint, rust, etc., and work to a bright, flat surface.

3.4.7 Conduit expansion joints and telescoping sections or metal raceways not thoroughly bonded otherwise, are to be provided with approved bonding jumpers or not less than #8 AWG stranded bare copper.

3.4.8 Provide a separate #14 green ground wire for all outlets connected to a GFCI circuit breaker.

## 3.5 OUTLET BOXES

3.5.1 Support all boxes independently of the conduits running to them. Use flush boxes in areas where concealed conduit is used.

3.5.2 Check the Drawings to ensure that no outlets are roughed-in at inaccessible locations, where built-in furniture, counters, etc., are to be installed. In such locations, install the outlets above and clear of the trim by approximately 100 mm (4″) unless shown otherwise on the Drawings.

3.5.3 **DO NOT INSTALL OUTLET BOXES OF ANY SYSTEM BACK TO BACK**. Offset as necessary to prevent sound transmission between areas.

## 3.6 WIRING DEVICES

3.6.1 Install light switches on lock jamb side of the door as finally hung. Check door swing before roughing-in. Install switches with the “ON” position up. Locate switch as close as practical to door jamb but not closer than 1″. Coordinate location with built-in and Owner supplied equipment and furnishings.

3.6.2 When two or more devices are grouped together, mount under a common coverplate unless shown otherwise.

3.6.3 Mount light switches at height as indicated on Drawings.

3.6.4 Mount duplex receptacles 25 mm (1″) above a countertop backsplash to bottom of device coverplate.

**END OF SECTION**

INDEX - SECTION 16155

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 16001, “Electrical General Provisions”.

1.2 **RELATED WORK**

1.2.1 **Power supply wiring and raceways for motors of mechanically driven equipment:** Supply and installation of wiring and disconnect at motor by Division 16, unless otherwise noted on Drawings.

1.2.1.1 Wiring and raceways for control devices and instruments, such as automatic temperature and pressure control systems, electrical interlocks between starters, field devices and control panels, heat sensors, water temperature controls, thermostatic controls, “ON-OFF” multi-speed controller for cabinet unit heaters: Supply and installation by Division 15.

1.2.1.2 Control wiring and conduit for unit heaters and forced flow units for their associated thermostats and control by Division 15.

1.3 **REFERENCES**

| | | |
|---|---|---|
| CSA C22.2 No. 14-05 | - | Industrial Control Equipment |
| CSA C22.2 No. 100-04 | - | Motors and Generators |
| CSA C390-10 | - | Energy Efficiency Test Methods for 3-Phase Induction Motors |

1.4 **SYSTEM DESCRIPTION**

1.4.1 **Design Requirements**

1.4.1.1 Divisions supplying motor-driven equipment are to supply and install factory-wired package assembly, field instruments and control devices, including relevant raceway and wiring forming an integral part of automated control system of equipment.

1.4.1.2 Division 16 is to supply and install “power train” such as power supply equipment (switchgears, distribution boards, distribution panels, panelboards), disconnect switches, circuit breakers and splitter boxes, complete with wiring and raceways to termination point at motor or designated power terminals of assembled equipment (packaged unit).

1.4.1.3 Division 16 is to install separately mounted starters and other specified motor control devices handed over by other Division, necessary to complete “power train”.

1.4.1.4 Division 16 is to incorporate into motor control centre all starters, controls, terminals, equipment and wiring as specified herein and/or as indicated on Drawings.

1.5 **SUBMITTALS**

1.5.1 Submit Shop Drawings as defined in General Conditions of the Contract, to include but not limit following:

1.5.1.1 **Starters and Controllers**: Mounting method and dimensions, starter size and type, layout of identified internal and front panel components, enclosure types, wiring diagram for each type of starter and interconnection diagrams.

2 Products

2.1 **PILOT DEVICES, RELAYS AND CONTACTORS**

2.1.1 Selector switches are to be standard duty, oil tight type. When separately mounted, they are to be located in their own enclosures.

2.1.2 Unless noted otherwise, pilot lights to be oil tight, long-life LED type, with transformer.

2.1.3 Install double voltage relays and/or CSA approved segregated auxiliary contacts as required to perform interlocking or other functions. Contacts to suit application.

2.1.4 Relays, other than double voltage, to be electrically operated and electrically held and to have coils of the voltage and the number of contacts to suit the details of the control scheme. Relays to be Square D Class 8502 or equal.

3 Execution

3.1 **INSTALLATION**

3.1.1 **Motor**

3.1.1.1 Installation by Division supplying motor-driven equipment is to comply with governing regulatory authority requirements, applicable Sections of Division 16, and with motor manufacturer's recommended methods.

3.1.1.2 Terminate power supply cables to motor terminal box using flexible conduit connection.

3.1.1.3 Check for correct direction of rotation, with motor not coupled from driven equipment. Cooperate with other Sections supplying motor-driven equipment, to ensure initial start of each motor is correct.

3.2 **TESTS AND INSPECTION**

3.2.1 Operate switches and contactors to verify correct functioning.

3.2.2 Operate selector switch or pushbuttons for performance of starting and stopping sequences of contactors and relays. Confirm delays and Fire Alarm override function as specified.

3.2.3 Inspect and test starter operation as per starter manufacturer's instructions.

3.2.4 Full responsibility for proper performance of motors is to be assumed by Division installing such motors.

**END OF SECTION**

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 16001, “Electrical General Provisions” and Section 16100, “Basic Materials and Methods”.

1.2 **DESCRIPTION OF WORK**

1.2.1 Provide breakers, panelboards and dry type transformers.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal.

2.1.2 This building will be fully sprinklered. Use sprinkler proof electrical equipment to prevent the sprinkler system water from entering electrical equipment for all surface mounted equipment.

2.1.3 Unless noted otherwise on the Drawings or in Specifications, user operated devices, display and controls shall be located between 125mm (5") and 1830mm (72") from bottom of floor mounted equipment.

2.2 **DISTRIBUTION EQUIPMENT**

2.2.1 **Distribution and Panelboard Circuit Breakers**

2.2.1.1 Unless noted otherwise on Drawings or panel schedules, circuit breakers are to be moulded case as rated below. Series rated breakers are not acceptable unless stated otherwise on the Drawings (ground fault breakers excluded).

2.2.1.2 Breakers are to be suitable for the panelboards provided. All breakers are to be bolted in place. Plug-in only type are not acceptable.

2.2.1.3 For 250V panelboards, main and branch breakers to be rated minimum 22,000 amperes RMS symmetrical at 208 or 240 volt.

2.2.1.4 For 600V panelboards, main and branch breakers to be rated minimum 22,000 amperes RMS symmetrical at 600 volt.

2.2.1.5 All circuit breakers smaller than 400A to be moulded case thermal-magnetic type providing inverse time-current tripping curves. Multi-pole breakers to have common-trip device with single handle.

2.2.1.6 All circuit breakers 400A and larger to have adjustable Long-time Short-time Instantaneous (LSI) solid state trip unit.

2.2.1.7 All 600V circuit breakers 1000A and larger, and all 208V circuit breakers 2000A and larger to have adjustable Long-time Short-time Instantaneous Ground Fault (LSIG) solid state trip unit. Each circuit breaker shall provide trip indication showing reason for trip (overload, short circuit, ground fault).

2.2.1.8 Shunt trip breakers to be 120V AC solenoid type. Electrically held shunt trip breakers are not acceptable.

2.2.1.9 Provide ground fault circuit interrupters breakers as indicated on Panel Schedules. Provide separate neutral conductors for each circuit. Unless noted otherwise, ground fault circuit interrupter breakers are Class A, Group 5mA.

2.2.1.10 Provide positive locking devices on the handles of breakers serving loads below. Trip units to remain free to function while locked in the ON position.

- exit signs
- emergency lighting and night light circuits
- door hardware

2.2.1.11 Provide quantity of spare breakers as called for on the Panel Schedules or Drawings

2.2.2 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause “Material and Equipment”:

Eaton
Schneider
Siemens

3 Execution

3.1 **PANELBOARDS**

3.1.1 Provide new typewritten directories for all existing panelboards affected by work.

3.1.2 Contractor to provide updated schedules complete with room numbers. Trace out existing circuits as required.

3.1.3 Include room number and description of load for each breaker. For circuits serving mechanical equipment, indicate room number mechanical equipment serves. Coordinate on site with Division 15.

3.2 **ARC FLASH HAZARD WARNING LABELS**

3.2.1 Provide generic shock and arc flash warning labels on all new panelboards, MCC’s and disconnect switches and splitters in accordance with Ontario Electrical Safety Code 2-306.

3.2.2 Label shall be located so that it is clearly visible to persons before examination, adjustment, servicing, or maintenance of equipment. Locate label on the inside door of panelboards.

**END OF SECTION**

Chorley + Bisset
CONSULTING ENGINEERS

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**PROJ. NAME:** Gregory Hogan Catholic School
**PROJ. NO :** 8209

| | |
|---|---|
| **PANEL ID:** | **B** |
| **MAINS:** | 225A |
| **VOLTAGE:** | 208/120V,3Ø, 4W |
| **MOUNTING:** | FLUSH |
| **NO OF CKT:** | 72 |

| | |
|---|---|
| **LOCATION:** | CORRIDOR 004 |
| **FED FROM:** | DISTRIBUTION PANEL DP1 |
| **COMMENTS:** | Shaded Breakers are Existing |

| CKT | BRKR | DESCRIPTION | WATTS | CKT | BRKR | DESCRIPTION | WATTS |
|---|---|---|---|---|---|---|---|
| 1 | 20 | EXISTING LOAD | | 2 | 20 | EXISTING LOAD | |
| 3 | 20 | EXISTING LOAD | | 4 | 20 | EXISTING LOAD | |
| 5 | 20 | EXISTING LOAD | | 6 | 20 | EXISTING LOAD | |
| 7 | 20 | EXISTING LOAD | | 8 | 20 | EXISTING LOAD | |
| 9 | 20 | EXISTING LOAD | | 10 | 20 | EXISTING LOAD | |
| 11 | 20 | EXISTING LOAD | | 12 | 20 | EXISTING LOAD | |
| 13 | 20 | EXISTING LOAD | | 14 | 20 | EXISTING LOAD | |
| 15 | 20 | EXISTING LOAD | | 16 | 20 | EXISTING LOAD | |
| 17 | 20 | EXISTING LOAD | | 18 | 20 | EXISTING LOAD | |
| 19 | 20 | EXISTING LOAD | | 20 | 20 | EXISTING LOAD | |
| 21 | 20 | EXISTING LOAD | | 22 | 20 | EXISTING LOAD | |
| 23 | 20 | EXISTING LOAD | | 24 | 20 | EXISTING LOAD | |
| 25 | 20 | EXISTING LOAD | | 26 | 20 | EXISTING LOAD | |
| 27 | 20 | EXISTING LOAD | | 28 | 20 | STAFF ROOM | |
| 29 | 20 | EXISTING LOAD | | 30 | 20 | EXISTING LOAD | |
| 31 | 20 | EXISTING LOAD | | 32 | 20 | STAFF ROOM | |
| 33 | 20 | EXISTING LOAD | | 34 | 20 | EXISTING LOAD | |
| 35 | 20 | EXISTING LOAD | | 36 | 20 | EXISTING LOAD | |
| 37 | 20 | EXISTING LOAD | | 38 | 15 | EXISTING LOAD | |
| 39 | 20 | EXISTING LOAD | | 40 | 60 | EXISTING LOAD | |
| 41 | 15 | EXISTING LOAD | | 42 | 2P | | |
| 43 | 20 | STAFF ROOM 004 | | 44 | 15 | RANGE HOOD | |
| 45 | 20 | W/R 005 HAND DRYER | | 46 | 20 | EXISTING LOAD | |
| 47 | 20 | EXISTING LOAD | | 48 | 20 | EXISTING LOAD | |
| 49 | | | | 50 | 20 | W/R 006 HAND DRYER | |
| 51 | | | | 52 | 20 | EXISTING LOAD | |
| 53 | | | | 54 | 50 | EXISTING LOAD | |
| 55 | | | | 56 | 2P | | |
| 57 | | | | 58 | | | |
| 59 | 20 | EXISTING LOAD | | 60 | | | |
| 61 | 20 | EXISTING LOAD | | 62 | | | |
| 63 | 20 | EXISTING LOAD | | 64 | | | |
| 65 | 20 | EXISTING LOAD | | 66 | | | |
| 67 | 15 | EXISTING LOAD | | 68 | | | |
| 69 | 15 | EXISTING LOAD | | 70 | | | |
| 71 | 15 | EXISTING LOAD | | 72 | | | |

Chorley + Bisset
CONSULTING ENGINEERS

369 YORK ST., SUITE 2B, LONDON ON, CANADA N6B 3R4
P: 519-679-8660 F: 519-679-2145 chorley.com

**PROJ. NAME:** Gregory Hogan Catholic School
**PROJ. NO :** 8209

| | |
|---|---|
| **PANEL ID:** | **C** |
| **MAINS:** | 225A |
| **VOLTAGE:** | 208/120V,3Ø, 4W |
| **MOUNTING:** | FLUSH |
| **NO OF CKT:** | 72 |

| | |
|---|---|
| **LOCATION:** | CORRIDOR 004 |
| **FED FROM:** | DISTRIBUTION PANEL DP1 |

**COMMENTS:**
Shaded Breakers are Existing

| CKT | BRKR | DESCRIPTION | WATTS | CKT | BRKR | DESCRIPTION | WATTS |
|---|---|---|---|---|---|---|---|
| 1 | 20 | RM 121 LTG | | 2 | 20 | RM 100/100A LTG | |
| 3 | 20 | RM 123 LTG | | 4 | | | |
| 5 | 20 | RM 125/CORRIDOR LTG | | 6 | 20 | RM 136 LTG | |
| 7 | 20 | OFFICE 003 | | 8 | 20 | CORRIDOR LTG | |
| 9 | 20 | OFFICE 002 | | 10 | 20 | EXIT SIGNS | |
| 11 | 20 | RM 121 REC | | 12 | 20 | RM 100 REC | |
| 13 | 20 | RM 121 REC | | 14 | 20 | RM 100A REC | |
| 15 | 20 | RM 123 REC | | 16 | 20 | RM 134 REC | |
| 17 | 20 | RM 123 REC | | 18 | | | |
| 19 | 20 | RM 125 REC | | 20 | | | |
| 21 | 20 | RM 125 COPIER | | 22 | | | |
| 23 | 20 | RM 136 REC | | 24 | | | |
| 25 | 20 | RM 136 REC | | 26 | 20 | RECEPTION 001 | |
| 27 | 20 | RM 104 REC | | 28 | | | |
| 29 | 20 | RM 108 REC | | 30 | | | |
| 31 | 20 | RM 114 REC | | 32 | | | |
| 33 | 20 | EXISTING CIRCUIT | | 34 | | | |
| 35 | 20 | EXISTING CIRCUIT | | 36 | | | |
| 37 | 15 | EXISTING CIRCUIT | | 38 | | | |
| 39 | 15 | EXISTING CIRCUIT | | 40 | | | |
| 41 | 15 | EXISTING CIRCUIT | | 42 | | | |
| 43 | 15 | EXISTING CIRCUIT | | 44 | | | |
| 45 | 15 | EXISTING CIRCUIT | | 46 | | | |
| 47 | 20 | EXISTING CIRCUIT | | 48 | | | |
| 49 | 20 | EXISTING CIRCUIT | | 50 | | | |
| 51 | 20 | EXISTING CIRCUIT | | 52 | | | |
| 53 | 20 | EXISTING CIRCUIT | | 54 | | | |
| 55 | 20 | EXISTING CIRCUIT | | 56 | | | |
| 57 | 20 | EXISTING CIRCUIT | | 58 | | | |
| 59 | | | | 60 | | | |
| 61 | | | | 62 | 15 | SPARE | |
| 63 | | | | 64 | 15 | SPARE | |
| 65 | | | | 66 | 20 | SPARE | |
| 67 | | | | 68 | 20 | SPARE | |
| 69 | | | | 70 | 20 | SPARE | |
| 71 | | | | 72 | 20 | SPARE | |

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369 YORK ST., SUITE 2B, LONDON ON, CANADA N6B 3R4
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**PROJ. NAME:** Gregory Hogan Catholic School
**PROJ. NO :** 8209

| | |
|---|---|
| **PANEL ID:** | **HP1** |
| **MAINS:** | 225A |
| **VOLTAGE:** | 208/120V,3Ø, 4W |
| **MOUNTING:** | FLUSH |
| **NO OF CKT:** | 66 |

| | |
|---|---|
| **LOCATION:** | CORRIDOR 004 |
| **FED FROM:** | DISTRIBUTION PANEL DP1 |

**COMMENTS:**
Shaded Breakers are Existing

| CKT | BRKR | DESCRIPTION | WATTS | CKT | BRKR | DESCRIPTION | WATTS |
|---|---|---|---|---|---|---|---|
| 1 | 35 | EXISTING LOAD | | 2 | 35 | EXISTING LOAD | |
| 3 | 2P | | | 4 | 2P | | |
| 5 | 45 | EXISTING LOAD | | 6 | 15 | EXISTING LOAD | |
| 7 | 2P | | | 8 | 2P | | |
| 9 | 30 | EXISTING LOAD | | 10 | 15 | EXISTING LOAD | |
| 11 | 2P | | | 12 | 2P | | |
| 13 | 15 | EXISTING LOAD | | 14 | 20 | EXISTING LOAD | |
| 15 | 2P | | | 16 | 2P | | |
| 17 | 35 | EXISTING LOAD | | 18 | 35 | EXISTING LOAD | |
| 19 | 2P | | | 20 | 2P | | |
| 21 | 45 | EXISTING LOAD | | 22 | 45 | EXISTING LOAD | |
| 23 | 2P | | | 24 | 2P | | |
| 25 | 20 | EXISTING LOAD | | 26 | 15 | EXISTING LOAD | |
| 27 | 15 | EXISTING LOAD | | 28 | 2P | | |
| 29 | 15 | EXISTING LOAD | | 30 | 20 | | |
| 31 | 15 | EXISTING LOAD | | 32 | | EXISTING LOAD | |
| 33 | 15 | EXISTING LOAD | | 34 | 3P | | |
| 35 | 40 | | | 36 | 15 | HP-402 | |
| 37 | | EXISTING LOAD | | 38 | 2P | | |
| 39 | 3P | | | 40 | | | |
| 41 | | | | 42 | | | |
| 43 | | | | 44 | | | |
| 45 | | | | 46 | | | |
| 47 | | | | 48 | | | |
| 49 | | | | 50 | | | |
| 51 | | | | 52 | | | |
| 53 | | | | 54 | | | |
| 55 | | | | 56 | | | |
| 57 | | | | 58 | 30 | | |
| 59 | 15 | SPARE | | 60 | | SPARE | |
| 61 | 15 | SPARE | | 62 | 3P | | |
| 63 | 20 | SPARE | | 64 | 15 | SPARE | |
| 65 | 20 | SPARE | | 66 | 2P | | |

INDEX - SECTION 16500

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 16001, “Electrical General Provisions” and Section 16100, “Basic Materials and Methods”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Lighting Systems**

1.2.1.1 Nominal 120 volt A.C.

1.2.1.2 Branch circuit wiring from 120/208 volt, 3 phase, 4 wire panelboards.

2 Products

2.1 **GENERAL**

2.1.1 Use materials specified herein or approved equal.

2.1.2 Use the product of only one manufacturer for each type of luminaire.

2.1.3 Refer to Luminaire Schedule on Drawings.

2.2 **FLUORESCENT LIGHTING**

2.2.1 **Fluorescent Lamps**

2.2.1.1 T8: Sylvania Octron FO32/841/XPS/ECO - life 36,000 hours at 12 hours/start, 3100/2945 initial/mean lumens.

2.2.1.2 T8 Reduced Wattage: Sylvania Octron Supersaver FO28/841/XP/SS/ECO3 - life 42,000 hours at 12 hours/start, 2725/2560 initial/mean lumens.

2.2.1.3 Fluorescent lamps shall use recycled mercury and be tested in accordance with EPA SW846 for low mercury content.

2.2.1.4 85 CRI or higher

2.2.1.5 Colour temperature to be 4100K unless shown otherwise.

2.2.1.6 The following manufacturers of lamps will be considered equal subject to the requirements of Clause “Materials and Equipment”:

General Electric
Osram Sylvania
Phillips
Standard

2.3 **LED LUMINAIRES**

2.3.1 All LED luminaires must bear an approved certification mark as per Ontario Electrical Safety Code Bulletin 2-7-29. A UL certification mark without the ‘c' is not an approved certification mark.

2.3.2 **Luminaires designed for LED lamps with integral driver** as specified below shall adhere to LED lamp manufacturer guidelines, certification programs, and test procedures for thermal management to guarantee the minimum lamp life and lumen maintenance as specified below.

2.3.3 **Luminaires designed with integrated custom LED’s.** shall be as specified on drawings or approved equal meeting the following requirements:

2.3.3.1 Only products from manufacturers that have been in the lighting manufacturing business for minimum of 10 years will be considered.

2.3.3.2 Modularity, shall be designed to allow for replacement of; driver, LED’s, without specialised tools and without removing luminaire from the ceiling.

2.3.3.3 Performance - LED luminaire with custom lamps must exceed LED lamp parameters specified below for efficacy and lumen maintenance by minimum 15%.

2.3.3.4 Lumen Maintenance - at least 70% of initial lumens for at least 50,000 hours.

2.3.3.5 Minimum luminous efficacy 50 lumens per watt (lm/W)

2.3.3.6 Warranty - Written warranty covering repair or replacement for a minimum of five (5) years from the date of purchase. Warranty must be included with maintenance manuals and have a toll-free (e.g., "800") number, or mailing address, or web site address for consumer complaint resolution and future LED replacement upgrade.

2.4 **EMERGENCY LIGHTING**

2.4.1 Emergency lighting units are to be Lumacell RSG12S-250-LD7 with or without two unit mounted floodlights and remote heads as shown on plans. Remote heads to be die-cast with white powder coat finish. All floodlights to be 4 watt LED MR16 type. Units to be 12 volt with an 8 year minimum battery life expectancy, capable of producing 250 watts for 1/2 hour at 120 volt, rated in accordance with CSA Standard C22-2-141.

2.4.2 Emergency lighting units located in Electrical Rooms and Generator Rooms are to be Lumacell RSG12S-250-LD7 with or without two unit mounted floodlights and remote heads as shown on plans. All floodlights to be 4 watt LED MR16 type. Units to be 12 volt with an 8 year minimum battery life expectancy, capable of producing 83 watts for 2 hours at 12 volt, rated in accordance with CSA Standard C22-2-141.

2.4.3 The following manufacturers will be considered equal subject to requirements of Clause "Material and Equipment":

Beghelli Luxnet
Emergi-lite
Hubbell
Lithonia

Lumacell
Lumaid
Stanpro
Uniglo

2.5 **SPARE LUMINAIRES**

2.5.1 Provide a quantity of 1% spare luminaries (minimum 1) of each type used on project and turn over to Owner at Substantial Completion.

3 Execution

3.1 **INDOOR LIGHTING**

3.1.1 Install luminaires complete with the necessary accessories, conduit supports, ball aligners, hangers, mounting yokes, etc.

3.1.2 Check the type of ceilings before placing an order for luminaires.

3.1.3 Provide independent supports from slabs or steel above hung ceilings. Luminaires are not to be supported solely by the hung ceiling. Nylon inserts are not on approved fastening method for poured concrete. Do not secure to underside of metal pan roof deck.

3.1.4 Obtain revised locations from the Consultant when pipes or ductwork interfere with the proper mounting location of recessed luminaires before roughing-in conduit.

3.1.5 Take all necessary precautions to ensure that all luminaires, diffusers and lamps are left clean at the completion of the job.

3.1.6 Ensure that all luminaires including ballasts and lamps are in good working order at the completion of the job. Replace at no extra cost any defective or burned-out lamps.

3.2 **LUMINAIRES IN SUSPENDED CEILINGS**

3.2.1 Provide adequate additional chain hanger supports for all luminaires in suspended ceiling systems to approval of the Consultant, and in accordance with Ontario Electrical Safety Code Bulletin No. 30-4-4.1996.

3.2.2 All existing luminaires to be removed and reinstalled are to have new chain hangers provided.

3.2.3 Coordinate with the Architect and Ceiling Contractor to determine which ceilings have been designed and constructed to carry the weight of the luminaires, so the support chains can be eliminated.

3.2.4 Ensure all luminaires are mechanically secured to the ceiling system with manufacturer approved clips.

3.3 **LUMINAIRE SCHEDULE**

3.3.1 Refer to Drawings for luminaire type and description.

3.4 **EMERGENCY LIGHTING**

3.4.1 Test emergency for 1/2 hour and verify that the entire system is working properly. Contractor is to complete the Emergency Lighting Test Form and providing a line item for each and every device. A sample copy of the form is attached in Appendix `A'. Submit a letter and the completed form indicating each device has been tested, prior to occupancy. Letter to state the following: "The emergency lighting system has been tested for 1/2 hour and is working in accordance with the Drawings and Specifications".

3.5 **REPLACEMENT LUMINAIRES**

3.5.1 Prior to ordering new luminaires to replace existing, Contractor to verify voltage of existing luminaires.

**END OF SECTION**

# A P P E N D I X “A”

**Emergency Lighting Test Form**

| Emergency Lighting Test Form | | | |
|---|---|---|---|
| **Project Name** | XYZ Project, City | | |
| **C+B Project #** | #### | | |
| **Contractor Name** | Your Name Electric Ltd. | | |
| **Date of Test** | Day, Month, Year | | |
| **Device Type** | **Device Location** | **Source (Battery # or CCT#)** | **Test Duration (min.)** |
| | | | |
| | | | |
| | | | |
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INDEX - SECTION 16550

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 16001, “Electrical General Provisions” and Section 16100, “Basic Materials and Methods”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Stand Alone Lighting Control**

1.2.1.1 Provide stand alone lighting control devices as shown as shown on plans and specified herein.

1.3 **SUBMITTALS**

1.3.1 Submit a lighting control sequence of operation schedule with shop drawings outlining control sequence for each type of room. Group rooms with identical sequence of operation and indicate room numbers.

1.3.2 Schedule to identify number of lighting zones, zone type (switching or dimming), auto-on operation (to preset lighting level if applicable), auto-off operation, daylight harvesting, work plane height and illumination as specified herein.

2 Products

2.1 **GENERAL**

2.1.1 Use materials specified herein or approved equal.

2.1.2 In general, switches and automatic wall switches to match wiring device colour. Faceplates for low-voltage switches to match wiring device faceplates. Refer to Section 16100.

2.2 **LINE VOLTAGE OCCUPANCY SENSORS**

2.2.1 Provide a complete occupancy sensor control system in each room indicated completed with sensor, control wiring and mounting hardware as indicated and specified herein and in manufacturer installation manuals:

2.2.2 The following Sensors to be provided:

2.2.2.1 **DSW-100 Automatic Wall Switch**

- 100/230/277 VAC; 50/60 Hz operation
- Minor motion coverage of 15' x 15' major motion coverage of 35' x 30')
- Time delays: SmartSet (automatic), fixed (5,10,15,20,or 30 minutes), walk-through, test-mode
- Sensitivity adjustment: SmartSet (automatic) or reduced sensitivity
- Compatible with all electronic ballasts and PL lamp ballast systems
- Occupancy sensor to match wiring device colour

2.2.3 Unless otherwise indicated, provide the following models according to the symbol type:

| Type | Symbol | Wattstopper Cat. No. | Mounting |
|---|---|---|---|
| 3 |  | DSW-100/200 | wall at switch height |

2.2.4 Provide DT-355 dual technology line voltage ceiling sensors in storage and service rooms.

2.2.5 Provide wire guards over sensors where indicated, plated steel 5mm (1/4") wire suitable for flat wall or corner mounting.

2.2.6 All Occupancy Sensors to be from one manufacturer, UL and cUL listed and have five year warranty.

2.2.7 **Power Packs**

2.2.7.1 Power pack shall be self-contained transformer and relay module in a NEMA 1 plenum use acceptable enclosure.

2.2.7.2 Power pack shall have two isolated relays rated for 100,000 cycles capable of switching 20 amp load utilizing zero crossing circuitry to protect from effects of inrush current and increase life.

2.2.7.3 Power pack shall have a switch input for each relay output which accept three-wire momentary, two-wire momentary push-button, or maintained low voltage switches as well as 24 VDC voltage devices.

2.2.7.4 Power pack shall have 16mm thread nipple for mounting to junction boxes.

2.2.7.5 Power pack shall provide separate an independent inputs for occupancy sensor, photocell, time clock and load shed signal devices.

2.2.7.6 Power pack shall provide a 24 VDC 150 mA output, with the relay connected for powering other devices.

2.2.7.7 Power pack time input shall provide selectable control scenarios for: hold-ON, to keep lighting controlled by occupancy sensors ON during timed occupancy; ON-only, to allow switches to only turn lighting ON and not OFF during timed occupancy; auto-ON, to turn ON lighting loads at the beginning of timed occupancy; after hour shut-off, to provide local switch operation of lighting loads after hours and then shutting them off after a selectable override time period of 30 minutes, 1 hour, 2 hours, or 4 hours.

2.2.7.8 Power pack shall have a standard 5 year warranty and be UL and CUL listed.

2.2.7.9 To be Wattstopper BZ-150 or approved equal.

2.2.8 **Momentary Switches**

2.2.8.1 Provide momentary, low voltage switches as indicated on Drawings and specified here in. Switches to be multi-button or centre spring return toggle/decora type.

2.2.8.2 LVS-1-W Series Low Voltage Momentary toggle Switch

- 3 amp, 24 VAC/VDC rated
- Single-pole, double-throw centre off spring return.
- designed to fit conventional toggle switch openings
- Minimum 5 year warranty
- cUL listed

2.2.9 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Materials and Equipment":

Douglas
Sensor Switch
Wattstopper
Greengate

## 2.3 DIGITAL LIGHTING MANAGEMENT

2.3.1 Provide a 100% digital lighting control system as shown on the drawings to meet space control requirements of AHSRAE/IESNA 90.1-2010. Provide occupancy/vacancy modes of operation. In general, provide two control circuits per lighting zone with one circuit configured in occupancy mode and other in vacancy mode.

2.3.2 Provide automatic shut-off of receptacles as shown on the drawings. Receptacles to be powered whenever spaces are occupied, regardless of overhead lighting.

2.3.3 System to be capable of adjustment, including programming and photosensors and occupancy sensor parameters, using software residing on a PC. Use of a handheld configuration tool may not be substituted for this programming ability. Room controllers to operate independent of programming PC.

2.3.4 All components to be self-configuring, digitally addressable, capable of ladderless configuration and will not have dip switches or potentiometers.

2.3.5 Provide native BACnet integration via hardware. Use of a software gateway is not acceptable.

2.3.6 Provide contact closure to BAS for occupancy status.

### 2.3.7 Digital Room Controllers

2.3.7.1 Provide digitally addressable two relay controllers. Controllers to be self-configuring, automatically binding the room loads to the connected control devices without commissioning or the use of any tools.

2.3.7.2 Housing to be plenum rated and complete with nipple to mount to standard junction box.

2.3.7.3 Room controllers to have two integral on/off zero-crossing relays rated for 20A at 120V and three connections for digital lighting network connection.

2.3.7.4 Dimming room controllers to have three integral on/off zero-crossing relays rated for 20A at 120V with three 0-10V dimming outputs and three connections for digital lighting network connection.

2.3.7.5 Provide receptacle controllers for circuits as shown on the drawings.

2.3.7.6 WattStopper LMRC-102, LMPL-101 or LMRC-210 (dimming).

2.3.8 **Digital Switches**

2.3.8.1 Low voltage momentary pushbutton switches to be in 2 equal-sized button configuration, white and compatible with standard decorator wall plates. Buttons to be field replaceable without removing switch from wall. WattStopper LMSW-102.

2.3.8.2 Low voltage switches shown connected to dimming room controllers to be momentary pushbutton switches with one button configuration and LED bar graph showing relative light level of controlled load, white and compatible with standard decorator wall plates. WattStopper LMDM-101.

2.3.8.3 Buttons to be field replaceable without removing switch from wall.

2.3.8.4 Switches to have two connection ports for digital network through-wiring.

2.3.9 **Digital Occupancy Sensors**

2.3.9.1 Digital occupancy sensors to provide automatic switching for specified load connected to a room controller. Sensors shall be interchangeable without the need for rewiring.

2.3.9.2 Sensors to have two connection ports for digital lighting network.

2.3.9.3 Sensors to use dual technology (passive infrared and ultrasonic or microphonic) for occupancy detection. Sensors must be initially trigged by both detection technologies.

2.3.9.4 Digital occupancy sensors shall provide digital calibration for sensitivity (0-100%), time delay (1-30 minutes) and test mode.

2.3.9.5 Multiple occupancy sensors shall be able to be added to the digital lighting network without additional configuration.

2.3.9.6 Unless otherwise indicated, provide the following models according to the symbol type:

| Type | Symbol | Wattstopper Cat. No. | Mounting |
|---|---|---|---|
| 1 |  | LMDX-100 | wall at ceiling |
| 2 |  | LMDC-100 | ceiling |
| 3 |  | LMDW-102-W | wall at switch height |

2.3.10 **BACnet Network Bridge**

2.3.10.1 Provide hardware BACnet MS/TP-compliant digital communications between each room and the building automation system (BAS). System to allow occupancy sensor status and sensitivity adjustment through BAS.

2.3.10.2 The network bridge shall automatically create standard BACnet objects for selected room device parameters to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM room devices on each local network. Standard BACnet objects shall be provided as follows:

- Read the detection state of the occupancy sensor
- Read/write the On/Off state of loads
- Read the button states of switches
- Read total current in amps, and total power in watts through the room controller
- Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
- Read/write daylight sensor fade time and day and night setpoints
- Read the current light level, in footcandles, from interior and exterior photosensors and photocells
- Set daylight sensor operating mode

2.3.10.3 WattStopper LMBC-300.

2.3.11 **Handheld Configuration Tool**

2.3.11.1 Provide two handheld configuration tools with two-way communication to allow complete configuration and reconfiguration of devices. Unit to have LED or LCD display and be capable of uploading and downloading all configuration settings.

2.3.12 Other manufacturers must meet all of the above requirements and must submit shop drawings to Consultant for review minimum six working days prior to close for compliance review. Equal manufacturers will be added via addendum.

2.3.13 The following manufacturers will be considered as equal, subject to the requirements of Clause “Material and Equipment”:

Greengate
Sensor Switch
Wattstopper

3 Execution

3.1 **STAND ALONE LIGHTING CONTROL**

3.1.1 Program all occupancy sensors, where applicable, to SmartSet mode.

3.1.2 Program all occupancy sensors without SmartSet mode to a time delay of 20 minutes.

3.1.3 Demonstrate to consultant correct operation of occupancy and photo sensors.

3.1.4 Program all intelligent power packs for automatic ON operation of one circuit and manual ON operation of second circuit with automatic OFF operation for both circuits.

## 3.2 DIGITAL LIGHTING MANAGEMENT

3.2.1 Provide CMP rated Category 5e with RJ-45 connectors for all control wiring. Wiring in accessible ceiling space may be free run, supported by conduit for other systems. Do not attach cable to ceiling grid supports. In inaccessible ceilings and all walls, provide conduit and back boxes.

3.2.2 Digital lighting network cabling to be green throughout building. Contractor to ensure cabling colour is unique from other low voltage cabling (data, voice, BAS controls, etc).

3.2.3 Program all rooms for 50% automatic ON operation and 100% automatic OFF operation of all circuits. Programming to be in accordance with ASHRAE 90.1.

3.2.4 Adjust time delay so that controlled area remains lit for 5 minutes after occupant leaves area.

3.2.5 Provide assistance to BAS contractor as required to integrate, at minimum, occupancy status with BAS.

3.2.6 Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a fully functioning system. Provide Consultant and Owner ten working days written notice of system startup and adjustment date.

3.2.7 Adjust high trim level for luminaires to obtain the following maximum lighting levels at the work plane. Provide high trim percentage and measured illuminance at work plane for each room in maintenance manual.

| Space | Work Plane Height | Illuminance |
|---|---|---|
| Classrooms | 760 mm | 30 fc |
| Offices | 760 mm | 35 fc |

3.2.8 Provide room-by-room documentation on the commissioning of the system including sensor parameters, time delays, sensitivities, daylighting setpoints, sequence of operation, (e.g. manual ON, Auto OFF. etc.) and load parameters (e.g. blink warning, etc.)

3.2.9 Resubmit updated sequence of operation schedule to include high trim setting for each lighting zone and measured illumination at work plane.

3.2.10 Upon completion of commissioning, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

3.2.11 Thirty days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner's specific requirements. Provide a detailed report to the Consultant of re-commissioning activity.

3.2.12 Turn handheld configuration tools over to Owner's representative at end of construction. Provide signed letter from Owner confirming receipt, and include in electrical manuals.

**END OF SECTION**

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 The requirements of the Instructions to Bidders, the Contract Forms, the General Conditions as amended, and the Supplementary General Conditions as hereinbefore written will form a part of the following Specifications and the Contractor will consult them in detail for instructions governing the work.

1.1.2 Conform to the requirements of Section 16001, “Electrical General Provisions”.

1.2 **REFERENCES**

ANSI/EIA/TIA-569B -Commercial Building Standard for Telecommunications Pathways and Spaces

1.3 **DESCRIPTION OF SYSTEMS**

1.3.1 **Data Communication System**: Provide a system of empty conduits and boxes, outlets and wiring, as indicated on Drawings. All conduits are to be complete with nylon fishwire. Refer to Section 16710 for cabling details.

1.3.2 **Security System**: Provide a system of empty conduits and boxes, outlets and wiring, as indicated on Drawings. All conduits are to be complete with nylon fishwire. Refer to Section 16705 for cabling details.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal.

2.2 **COMMUNICATION/SECURITY/ACCESS CONTROL SYSTEM CONDUIT**

2.2.1 Cables shall generally be installed in communication trays or conduit. All new conduit shall be thin wall EMT, sized for the cables required plus an additional 50% for future cables. Minimum conduit size shall be 3/4″.

2.2.2 In general, the following table shall be used for communication conduit fill:

| **Conduit Size** | **3/4" 21mm** | **1" 27mm** | **1-1/4" 35mm** | **1-1/2" 41mm** | **2" 53mm** | **2-1/2" 63mm** | **3" 78mm** |
|---|---|---|---|---|---|---|---|
| **Max UTP** | 2 | 3 | 6 | 7 | 14 | 17 | 20 |
| **Max Coax** | 2 | 4 | 6 | 9 | 17 | 26 | 38 |

2.2.3 Cables shall NOT be attached to pipe or conduit or ductwork, etc.

2.2.4 Conduit ends shall be provided with non-metallic bushings to provide a round edge, which will not abrade the cable jacket.

2.2.5 **Telephone/Data:** Provide single gang device wall boxes, complete with 21 mm (3/4″) conduit **up to the cable tray or J hook system**. Provide pull boxes and splice boxes as indicated, for every 30 m (100') fo conduit, and more than two 90° bends or equivalent.

2.2.5.1 Stainless Steel faceplates specified in Section 16710 do not fit in all device boxes. Confirm compatibility with Data contractor prior to rough-in.

2.2.6 **Security/Access Control System:** Provide single gang device wall boxes, complete with 16 mm (3/4″) conduit **up to the cable tray or J hook system**. Provide pull boxes and splice boxes as indicated, for every 30 m (100') fo conduit, and more than two 90° bends or equivalent. All conduits to have pull strings from device wall boxes to cable tray.

2.2.7 PVC conduit is not allowed inside and will be removed at the contractor's expense.

3 Execution

3.1 **COMMUNICATION/SECURITY/ACCESS CONTROL SYSTEM CONDUIT**

3.1.1 Provide all conduits, outlet boxes and wiring for a complete system. Minimum size conduit to be 21 mm (3/4"), except where noted.

3.1.2 Where possible, run all conduit in the ceiling space and conceal all conduit within ceiling spaces, walls or partitions. Mount outlets at the same elevation above finished floor level as duplex receptacles or as noted on the floor plans.

3.1.3 Rigidly install all conduits, adequately supported and properly reamed at both ends. Join sections of conduits by approved couplings and conduit terminations at boxes, pull boxes, etc. using approved fittings.

3.1.4 The inside radius of bends not to be less than: Six times the internal diameter of conduits 50mm (2") and smaller.

3.1.5 Install conduits and boxes as per TIA/EIA-569-A.

3.1.6 Minimum size of pull boxes and splice boxes to be sized as per conduits and Tables 5, 2-2 and 5, 2-3 in TIA/EIA-569-A.

3.1.7 Conduits shall be grounded minimum at one end.

3.1.8 Conduit fill capacity shall not exceed 35%.

3.1.9 Cables and raceway shall maintain minimum 150mm (6″) separation from sources of heat such as steam or hot water pipes, vessels and fittings, which are insulated, and minimum 610mm (24″) from the same, which are uninsulated.

3.1.10 Pull wires must be provided in all conduits.

**END OF SECTION**

INDEX - SECTION 16705

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 16001, “Electrical General Provisions”.

1.1.2 Products will comply with the latest edition of the following Standards:

CAN/ULC-S302-M91, Installation and Classification of Burglar Alarm Systems for Financial and Commercial Premises, Safes and Vaults
CAN/ULC-S303-M91, Local Burglar Alarm Units and Systems
CAN/ULC-S306-03, Intrusion Detection Units
CAN/ULC-S319-05, Electronic Access Control Systems
CAN/ULC-S525-99, Audible Signal Appliances

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Security System**

1.2.1.1 Provide devices suitable for use with existing DSC security system.

1.3 **SUBMITTALS**

1.3.1 Submit Shop Drawings in accordance with the General Conditions of the Contract and as specified in this Section.

1.3.2 Provide a written description of the proposed system configuration augmented with block diagrams identifying the location of all system components and associated cable routings.

1.3.3 Provide lists of all off-the-shelf and custom equipment, including equipment quantities.

1.3.4 Provide the mechanical, electrical and environmental specifications for all listed equipment and cable.

1.3.5 Provide an overview of any equipment installation techniques which may deviate from the standards contained in this Section. Expose all such installation techniques for prior approval by the Consultant.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal.

.2.1.2 Conductors in inaccessible ceiling spaces and partitions are to be installed in electrical metallic tubing in accordance with Specification Section 16700.

2.1.3 Conceal all wiring above finished suspended ceilings, except where otherwise noted.

2.1.4 Outlet boxes are to be code gauge, galvanized steel, of a depth necessary to accommodate the number of wires and the device contained therein.

2.2 **SECURITY SYSTEM**

2.2.1 **Detection Devices**

2.2.1.1 Door contacts are to be sleeved to fit flush in door frame. Provide repulsion type magnet contacts, suitable for wide gap 2.22 cm (.875″), SPDT contacts, white finish, type similar to Sentrol 1078 CAQ series.

2.2.1.2 Quad element motion detector with digital motion detection (no analog detection) circuitry and shielded from EMI and RFI signals, 12 m x 12 m (40′ x 40′) range with 110° viewing angle, complete with form C relay and anti-tamper switch. Paradox DG65-C.

2.2.2 **Wiring**

2.2.3 All wiring to be a minimum 22 gauge four conductor, CMP rated, as per manufacturer's recommendations.

2.2.4 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause “Material and Equipment”:

Chubb
Guardall

3 Execution

3.1 **GENERAL INSTALLATION**

3.1.1 Provide all necessary wiring, conduits, outlet boxes and devices for a complete system. Conceal all wiring.

3.1.2 Install all wiring to manufacturer's recommendations. Conceal all conduit within ceiling spaces, walls or partitions, where possible.

3.1.3 Submit complete detailed wiring diagrams with description of system upon completion as per Section 16100. Provide all required instructional support to permit correct use of system by staff members.

3.1.4 Coordinate with door hardware supplier all requirements for system components, door strikes, concealed door contacts in particular. Coordinate power and electrical parameters with the door hardware supplier.

3.1.5 Included in Base Bid for manufacturers representative to spend four hours on site for training Owner’s Staff on the operations, maintenance and setup of the access control system. Notify Consultant seven days in advance of scheduled training.

3.2 **SECURITY SYSTEM**

3.2.1 Flush-mount door contacts in new doors/frames. Wire and connect each door contact to a separate system alarm zone as indicated.

3.2.2 Do not install detectors and door contacts until all room finishes, door trim and seals have been installed.

3.2.3 Mount entry delay horns in ceiling space above key pad.

3.2.4 Provide all necessary programming with documentation and backup. Provide one installation manual, two programming worksheets, 10 sets of User manuals, and 20 quick reference cards. Provide hardware means of convenient backing up and restoring the system program.

3.2.5 Wire all detection devices using form C contact and end of line resistor to provide full supervision against open circuits. Where provided, wire NC tamper switch in series with end of line resistor to provide trouble at panel if activated.

3.3 **ACCESSORIES**

3.3.1 Turn accessories (reference cards, proximity cards, etc.) over to Owner at end of construction. Provide signed letter from Owner listing items and quantities of accessories confirming receipt, and include in electrical manuals.

**END OF SECTION**

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1 General

1.1 **CERTIFIED SYSTEM VENDOR**

1.1.1 Data Communications work as specified will be the responsibility of the Contractor and equipment Vendor to:

1.1.1.1 Provide a minimum 15 year complete system performance warranty.

1.1.1.2 Provide a certified CAT 6 compliant wiring system compliant wiring system for based on contract documents.

1.1.1.3 Perform the pulling of all voice and data system cables.

1.1.1.4 **ONLY** qualified technicians directly employed by the Contractor and Vendor trained technicians will terminate all cables (at both ends), test and perform cross-connects.

1.1.1.5 After completion, provide testing as per ANSI/EIA/TIA-568A Addendum 5 on all cable runs, and documentation of test results.

1.1.1.6 Provide and install equipment as specified herein.

1.1.1.7 Provide documentation of the installation.

1.1.1.8 Provide System Vendor Letter of Certification/Warranty upon completion of job, which will include the notification of a CAT 6 compliant performance level, the Certification/Warranty Number, the identification of the installation by the location and installation date.

1.1.2 Approved Certified System Vendors are required to provide a complete voice/data system including all cables, fibre optic cables, patch cable, outlet jacks, patch panels, fibre patch panels which meet compliance requirements.

1.1.3 The Contractor's technicians are to have extensive training by the Certified System Vendor on the installation, terminations, testing and verification of the Vendors complete CAT6 system.

1.1.4 The following manufacturers are considered as equal, subject to the requirements of Clause "Material and Equipment":

CAT 6: Hubbell or AMP

1.2 **PREAPPROVED CONTRACTORS**

1.2.1 AMP or Hubbell Certified System Vendors

1.3 **SUBMITTALS**

1.3.1 **Shop Drawings**

1.3.1.1 Supply Shop Drawings in accordance with Section 16001 "Electrical General provisions". Do work in accordance with reviewed Shop Drawings.

1.3.1.2 Submit complete cabling system layout for voice and data, cable routing summary and cable outlet designations.

1.3.1.3 All cabling to be CMP rated.

1.3.1.4 Submit detailed layout drawings for termination racks.

1.3.1.5 Manufacturer's data on all devices, cables, patch panel, etc.

1.3.1.6 Detail exact location of equipment indicating wiring raceways, pull, junction and terminal boxes.

2 Products

2.1 **HORIZONTAL DISTRIBUTION SYSTEM**

2.1.1 The Horizontal Distribution System delivers connectivity from the Patch panel in the LAN Room to the work area. Four pair CAT6 UTP CMP rated cables will be used for this purpose.

2.1.2 Horizontal cabling will be terminated within the LAN Room and at the Telecommunications outlet, using the products specified herein. Quantities must be determined by the cable system installer after review of the Drawings.

2.1.3 Provide horizontal cabling for analog phone outlets as shown on the drawings. Terminate on 110 punchdown block located in LAN Rooms.

2.2 **RACEWAY**

2.2.1 Refer to Section 16700 for raceway details.

2.3 **SYSTEM COMPONENTS**

2.3.1 **Jacks**: Provide suitable Cat 6 components to form an installed system.

2.3.1.1 **Jack Colours**

**DATA:** White
**Smart Board Link:** Orange
**Phone:** Black

2.3.1.2 Provide stainless steel flush mounted plates with label designations. Semtron FM-0E-AMP-LAB Series.

2.3.2 **Voice and Data Cable**: Provide cable solution to meet certification.

2.3.3 **Patch Panels**

2.3.3.1 ALL Patch Panels used must be of the same brand as the Cable and Modular Jack used. Patch panels must be installed in a specified location in a wall mounted rack or a wall bracket as required.

2.3.3.2 Patch panels must provide 24 or 48 ports, according to need and be wired to T568A. Patch panels must be augmented with horizontal management panels (front) and rear cable support, to properly dress, terminate and manage the installed cables and provided patch cords**. All cabling is to be terminated in numerical order according to the School's room number system. (Example: 100, 101, 101A, 101B, 102-1, 102-2, 103...).** The front of each module must be capable of accepting 9 mm to 12 mm labels. Patch panels must be UL Listed and CSA certified.

2.3.4 Provide minimum 25% spare capacity on all new patch panels.

2.3.5 Provide dedicated patch panels for telephone outlets.

2.3.6 **Patch Cables**

2.3.6.1 All patch cables supplied must be of the same brand as the terminations and horizontal cable used. Patch Cords used at the telecommunication rack and at the workstation must be prefabricated stranded Cat 6, 24 AWG, 4 pair assemblies.

2.3.6.2 In the wiring closet, 6′ patch cords must be provided to cross-connect between the patch panels and network equipment. One patch cord per terminated outlet is to be provided. Six foot patch cords are to be labelled with Brady style numbers on both ends corresponding to the patch panel port number for which the cable is intended. As well, each workspace outlet to include one 10′ Cat 6 patch cord.

3 Execution

3.1 **INSTALLATION**

3.1.1 The Contractor will supply, install, test, document and certify the cable system according to this specification and must comply with able plant installation and termination procedures as specified in the CSA T529-95 Standard for horizontal and backbone copper and fibre-optic cabling systems as well as the manufacturer's CSV cable installation practices.

3.1.2 The Contractor will correct deficiencies at no cost to the Owner.

3.1.3 Base Wiring includes:

1. Cable
2. Jacks/Patch Panel
3. Distribution and Termination
4. Testing and Labelling
5. Patch Cables

3.2 **IMPLEMENTATION**

3.2.1 **Horizontal Cabling and Termination**

3.2.1.1 Within the LAN Room, horizontal cable terminations and rack installation will be as per Drawing Details and specifications.

3.2.1.2 **The horizontal data cabling** will be terminated on Patch panels, mounted in 19″ standard racks within the LAN Room. Provide one dedicated data cable per telecommunications outlet (or as specified on Drawings). Horizontal data cable length to the farthest outlet will not exceed 90 m (295′) as specified in CAN/CSA-T529. All Data cabling is to be Category 6 CMP. CMR cable will not be permitted.

3.2.1.3 Provide sufficient vertical and horizontal wire managers on the rack for Patch Cord management.

3.2.1.4 Unused ports on faceplates will be filled with the appropriate blank insert.

3.2.1.5 Each 4 pair cable to be terminated in an eight position module. Data pin/pair assignment must meet T568A Standard.

3.2.1.6 All cable runs will be completed without splices.

3.2.2 Support cables using cable clamps or wiring harnesses. Utilize cable trays and/or cable hanger to manage cable in orderly fashion.

3.2.3 Route all cable in such a way as to ensure maximum separations from sources of EMI as defined in CAN/CSA T529. Do not run cables above light fixtures, motors, speakers, air diffusers or similar locations.

3.2.4 Designate all data and voice outlets as per Drawings and Specifications.

3.2.5 Place all exposed cabling in a neat and professional manner and route as per Specifications and Drawings. Comb and/or route cabling in such manner as to ensure bundled cabling is neat and parallel to other cables in bundle. Tie-wrap all exposed cable bundles at maximum of every 200 mm (8″).

3.2.6 Securely mount data and voice outlets at all work area locations using screws as opposed to self adhesive strips.

## 3.3 LABELLING

3.3.1 Labelling must conform to these following Standards:

3.3.1.1 Brady type labelling within 6″ of each end of the horizontal cable to be used to indicate room number behind the patch panel. Brady type labelling within 6″ of end of the horizontal cable to be used to indicate patch port number inside the receptacle box.

3.3.1.2 Labelling on the front coverplate of the outlet must be as follows: the word “DATA” and “PHONE” in capital letters, patch panel port number and closet number if more than one closet exists in the building.

3.3.1.3 Labelling on the label area of the patch panel using manufacturer supplied labelling material must indicate the room number and number of the drop within that room, if there is more than one.

3.3.1.4 All other labelling is to be done using mechanically printed labels on permanent self adhesive white labels with minimum 3/16″ height.

3.4 **TESTING**

3.4.1 All cables will be tested as per ANSI/EIA/TIA-568B. All test records will be completed by the CSV. All test instrumentation, test records, and labour required for the testing will be supplied by the CSV/Contractor.

3.4.2 All cable faults will be corrected by the CSV/Contractor at no cost to the Owner. Splicing of cable pairs is not permitted for the repair of any cables. If a cable is found to be defective, it must be replaced.

3.4.3 Provide test result documentation within two weeks of completion of cable installation.

3.4.4 Inform Consultant 10 working days before testing is carried out so that the Consultant can witness all tests. Rectify wiring deficiencies immediately.

3.4.5 Carry out testing only after installation and termination/labelling of communications cabling at; floor tiles, surface-mounted telecommunications outlets, wall-mounted telecommunications outlets after substantial completion.

3.5 **DOCUMENTATION**

3.5.1 Provide complete documentation of the installation and testing.

3.5.2 Provide Vendor Certification upon completion of cable installation.

3.5.3 Provide records and AutoCAD Drawings complete with all jack locations and numbers (voice and data).

**END OF SECTION**

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 16001, “Electrical General Provisions”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Overhead Paging**: Provide modifications and extension of existing public address system as shown on the Drawings.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal.

2.2 **PUBLIC ADDRESS SYSTEM**

2.2.1 **Recessed Paging Speakers:** Provide AEG 86-7025L-11 speaker assembly, complete with 350mm white round baffle, 25/70 volt 5 watt transformer and speaker. Unit to be installed in AEG E10 backbox in ceiling tiles.

3 Execution

3.1 **PUBLIC ADDRESS SYSTEM**

3.1.1 Provide a complete functioning public address system as specified within and as indicated on the Drawings.

3.1.2 Provide all conduits, outlet and wiring for a complete system. All wiring to be FT6 minimum. Provide 3/4" conduit minimum for all cabling above hard ceilings. Cabling in accessible ceiling spaces may run free-air in communication cable tray / J hooks.

3.1.3 Cables to be colour coded to manufacturer's recommendation.

3.1.4 **Testing**

3.1.4.1 Entire system is to be installed and tested by a qualified sound technician.

3.1.4.2 Upon completion, test each speaker and provide a comprehensive room-by-room report to the Consultant.

3.1.4.3 Any buzzing, hissing or other sounds during when not actively paging will not be accepted. Eliminate all artifacts prior to Owner’s training sessions.

3.1.4.4 Allow for a minimum of one hour's instruction of operation on two different occasions. (Total of two hours). Training sessions to be completed at a time suitable to the Users.

3.1.4.5 The Contractor to provide up to four service calls for instruction of personnel or checking and adjustment of the systems at the Owner's request and at no cost to the Owner.

**END OF SECTION**

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 16001, “Electrical General Provisions”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Fire Alarm System**

1.2.1.1 Supply and install all equipment and accessories to extend the existing conventional Edwards Quickstart system. Fire alarm devices are to be in accordance with the Ontario Building Code and associated standards.

2 Products

2.1 **NON-ADDRESSABLE DEVICES**

2.1.1 Provide suitable wire guards for all devices where indicated on the drawings.

2.1.2 **Manual Pull Stations:** Manual single stage, single action break-glass pull stations to be Edwards 270-SPO. Provide flush box for all new installations. Provide auxiliary contacts as required for release of magnetic locks where noted.

2.1.2.1 Provide STI Series Stopper II UL/ULC pull station cover with integral local alarm where indicated on the drawings.

2.1.3 **Photoelectric Smoke Detectors**: Photoelectric smoke detectors to be Edwards C2M-PDC with auxiliary alarm relay contacts as indicated on the drawings.

2.1.4 **Automatic Heat Detectors**: Fixed temperature/rate-of-rise sensing automatic heat detectors to be Edwards 281B-PL, 282B-PL, 283B-PL or 284B-PL. Temperature and rate-of-rise sensing as indicated on the drawings.

2.1.5 **End-of-line Resistors:** To be sized to ensure correct supervisor current flows in each circuit. Provide faceplates for mounting on single gang plate bearing ULC label. Fire alarm faceplates material and colour are to match wiring device faceplate.

2.2 **NOTIFICATION APPLIANCES**

2.2.1 Provide suitable wire guards for all devices where indicated on the drawings.

2.2.2 **Horn:** Wall mounted horn devices are to have red housing with white “FIRE” lettering. Edwards G1RF-HD.

2.2.3 **Horn-strobes (Wall Mounted):** Wall mounted horn-strobe devices are to have red housing with white “FIRE” lettering with field selectable 15, 30, 75 or 110 candela, 1 Hz synchronized xenon high output strobe. Edwards G1RF-HDVM.

2.2.4 **Horn-strobes (Ceiling Mounted):** Ceiling horn-strobe devices are to have white housing with red “FIRE” lettering with field selectable 15, 30, 75 or 110 candela, 1 Hz synchronized xenon high output strobe. Edwards GCF-HDVM.

## 2.3 PASSIVE GRAPHIC ANNUNCIATOR

2.3.1 Provide updated passive graphic mounted adjacent to the main panel and annunciator panels. Graphic is to be minimum 410 mm x 410 mm (16″ x 16″) graphic outline of building, minimum five zone identification colour, mounted in a frame behind a acrylic faceplate with tamperproof screws of building identifying each zone.

2.3.2 The graphic is to be designed with each zone a different colour to the adjacent zone for easy identification. All zones are to be displayed and labelled same as annunciator. Location of fire alarm system panels to be shown on passive graphic.

2.3.3 In partially sprinklered buildings, identify areas that are sprinklered utilizing hatching.

2.3.4 Identify locations of supervised valves, flow switches and other fire suppression systems. Passive graphic, annunciator and field device identification tags must be displayed and labelled verbatim.

2.3.5 Floor plans to be shown in ‘track up’ orientation based upon location of passive graphic.

## 2.4 WIRING

2.4.1 Provide new wiring to conform with requirements of Ontario Electrical Safety Code Section 32, and applicable Codes and Standards. Size wiring in accordance with Class 2 requirements, but protected from mechanical injury or other injurious conditions such as moisture, excessive heat or corrosive action in accordance with Class 1 requirements.

2.4.2 General wiring with a floor area, conductors to be solid copper Securix II, Type 105°C PVC, 300 volt. Minimum size of any conductor: for alarm receiving circuits and remote annunciators, #16 AWG solid. Wire resistance in these circuits not to exceed 50 ohms. For audible signal circuits minimum #16 AWG solid. Voltage drop to any signal not to exceed 10%.

2.4.3 Conductors in multi-conductor cables to have allowable temperature rating of at least 105°C (200°F).

2.4.4 All conductors to be as per Ontario Electrical Safety Code and installed in metallic raceway.

2.4.5 Install conductors entirely independent of all other wiring and do not enter fixture, raceway, box or enclosure occupied by other wiring.

2.4.6 Splices will not be permitted unless otherwise indicated on the Drawings or specified. Where splices are necessary and approved by the Consultant, use approval metal contact electrical crimp type connectors.

2.4.7 All wiring must be clear of shorts, open and grounds on completion of work.

## 2.5 MANUFACTURER

2.5.1 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause “Materials and Equipment”:

Edwards

3 Execution

3.1 **FIRE ALARM SYSTEM INSTALLATION**

3.1.1 Fire alarm system installation to be in accordance with the latest edition of CAN/ULC S-524 “Standard for the Installation of Fire Alarm Systems”.

3.1.2 **Wiring**

3.1.2.1 Riser diagrams and drawings show general design intent. Obtain complete wiring diagrams from Fire Alarm manufacturer prior to rough-in.

3.1.2.2 Provide all wiring in conduit and in accordance with Fire Alarm equipment manufacturer's requirements.

3.1.2.3 Identify signal circuit, 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.

3.1.2.4 All conventional initiating wiring to be Class B.

3.1.2.5 All initiating and D.C. signal circuits extending from the fire alarm control to be current limited and protected, in accordance with Ontario Electrical Safety Code requirements.

3.1.2.6 The extended circuit wiring to each alarm receiving circuit or signal circuit is to be individually supervised with no common wiring.

3.1.2.7 Install all wiring in EMT metal conduit above ceilings, and surface in mechanical spaces, and in maintenance/storage spaces with exposed ceilings.

3.1.3 **Control Panels, Transponders and Annunciators**

3.1.4 Passive graphic, annunciator and field device identification tags provided by Fire Suppression Contractor must be displayed and labelled verbatim.

3.1.4.1 Review zone identification with Fire Inspection Department prior to programming, labelling and manufacturing passive graphics.

3.1.5 **Devices**

3.1.5.1 Install detectors in accordance with CAN/ULC Standard S524 latest edition “Installation of Fire Alarm Systems”.

3.1.5.2 Location of devices shown on Drawings are approximate and must be adjusted to site conditions. If location of existing device to be replaced is not properly centred in individual rooms, adjust to suit.

3.1.6 Mount detectors on ceiling as per CAN/ULC Standard S524 standard unless otherwise specified herein, with the minimum and maximum distances as required for the respective type of detector, at the highest point where variations in ceiling height exist. Do not mount detectors on sides, on undersides, or less than 600 mm

(20″) from walls, beams, joints, ducts, open web steel joists, bulkheads or any structure projecting below actual ceiling height and less than 450 mm (18″) from air handling or heating outlets.

3.1.7 Should interference from obstruction, lamp positions, air outlet or heat radiating surfaces be encountered in locating any detector where shown, locate the detector as near as possible to the indicated position, clear of obstacles, to the satisfaction of the Consultant, but maintain a clear space of 600 mm (24″) on the ceiling, below and around.

3.1.7.1 Duct detectors to be mounted in supply air ducts unless otherwise indicated on the Drawings.

3.1.7.2 Mount end of line resistors beside last device. Document location of end of line resistors and place inside fire alarm control panel and in maintenance manuals. Provide PTouch labels on end of line faceplates indicating circuits contained within.

3.1.8 Locate all addressable monitor modules adjacent to equipment being monitored.

3.1.9 Locate all addressable control modules for motors adjacent to starters/motor control centres or building automation control panels as site directed.

3.1.10 Locate all addressable control modules not controlling motors within 3' of device being controlled, where practicable.

## 3.2 VERIFICATION AND CERTIFICATION OF FIRE ALARM EQUIPMENT

3.2.1 The Contractor is to provide a full set of Electrical Drawings and Specifications to the fire alarm system representative prior to starting the verification of the fire alarm system. Failure to do so may require the entire fire alarm system to be reverified. Fire alarm system representative to review drawings and provide comments to Consultant prior to commencing verification.

3.2.2 All construction work must be complete before verification of fire alarm system is started. Any modifications to the fire alarm installation after the verification has been commenced will require the entire system to be reverified. Where partial occupancies occur, the fire alarm system for the area to be occupied (including control units) shall meet the requirements of this Standard. Upon system completion, those parts of the fire alarm system tested to this Standard shall be retested in accordance with the requirements of CAN/ULC-S536, Standard for the Inspection and Testing of Fire Alarm Systems, prior to the release of the Verification Report.

3.2.3 Fire alarm technician to review existing building prior to date of verification and review any existing conditions requiring repair. Submit report minimum one week before commencing verification. Consultant will review and issue appropriate instruction.

3.2.4 Where a field device is replaced, the device shall be verified in accordance with CAN/ULC-S537-04.

3.2.5 Testing of all flow switches is to be with actual water flow activation. Supervised valve switches and other supervisory zones to be tested by closing valves or replicating the abnormal condition.

3.2.6 The Contractor is to engage the services of the Fire Alarm manufacturer's representative to verify the fire alarm system in accordance with CAN/ULC-S537-04.

3.2.7 The manufacturer's representative is to supply to the Electrical Contractor a reasonable amount of technical assistance with respect to any changes necessary.

3.2.8 During the period of inspection by the manufacturer's representative, make available to the manufacturer's representative as many electricians as designated by the manufacturer's representative to complete the verification within the specified time frame.

3.2.9 Contractor is to supply Consultant with a list of deficiencies indicating areas where installation deviates from ULC Standards or Ontario Building Code. This list will be reviewed and authorized or rejected by Consultant prior to acceptance of certificate.

3.2.10 **Inspection Certification:** On completion of the inspection and when all the above conditions have been complied with, the Contractor is to provide to the Consultant:

3.2.10.1 A verification report identical to Appendix C of CAN/ULC-S537 completed by the fire alarm manufacturer's technician. Document C1 from CAN/ULC-S537 must be signed and dated by the technician upon completion of the verification.

3.2.10.2 A certificate of verification confirming that the inspection has been completed showing the conditions upon which such inspection and certification have been rendered. Certificate must be free of conditions noted. No additional exceptions or conditions are acceptable.

3.2.10.3 Proof of liability insurance for the inspection.

3.2.10.4 A letter separate from the Verification Report stating “All door hold open devices, including latch retraction/release have been tested by the fire alarm verifier and are installed and working, in accordance with Ontario Building Code 3.1.8.12".

3.2.10.5 Provide ESA Inspection Certificate.

3.2.11 **Description of Fire Alarm System**

3.2.11.1 Upon completion of the project, provide to the Owner a copy of CAN/ULC-S536-13 Appendix E "Description of Fire Alarm System for Inspection and Test Procedures". Provide type written copy of this form and provide soft copy with maintenance manuals.

## 3.3 FIRE WATCH - ALTERNATIVE MEASURES FOR OCCUPANT FIRE SAFETY

3.3.1 In the event of any shutdown of fire protection equipment or part thereof, the Fire Department and building occupants/owner should be notified. Instructions should be posted as to alternate provisions or actions to be taken in case of an emergency. These provisions and actions should be acceptable to the Chief Fire Official and be in accordance with the accepted Fire Safety Plan.

3.3.2 An attempt to minimize the impact of inoperative equipment should be made (i.e. where portions of a sprinkler, fire alarm system and standpipe system are taken out of service, the remaining portions will be maintained). Assistance and direction for specific situations should be sought from the Fire Department and be in accordance

with the accepted Fire Safety Plan.

3.3.3 Procedures to be followed in the event of shutdown of any part of a fire protection system are as follows:

3.3.3.1 Notify the Fire Department and the monitoring station. Give your name, address and a description of the work and when you expect it to be corrected. The Fire Department should be notified in writing of shutdowns longer than 24 h;

3.3.3.2 Post notices on all floors by elevators and at entrances, stating the work and when it is expected to be completed;

3.3.3.3 Unless noted otherwise in the Fire Safety Plan, have staff or other reliable person(s) patrol the affected area(s) at least once every hour; and

3.3.3.4 Notify the Fire Department, the fire signal receiving centre, and building occupants/owner when work has been completed and systems are operational.

## 3.4 INSPECTION COSTS

3.4.1 Include all costs involved with this inspection in the total Bid Price.

## 3.5 TESTING

3.5.1 Tests of the complete system in the presence of the Owner and the Consultant are to include:

3.5.1.1 Spot check of devices to ensure proper connections and supervision.

3.5.1.2 Operation of an alarm initiating device on each detection circuit is to verify the required operation of alarm devices, annunciators, etc.

3.5.1.3 Operation of all other alarm initiating devices in a convenient, silent method (buzzer, light, meter, etc.) are to ensure connection to the proper circuit and function of the device.

3.5.1.4 Live smoke or open flame are not to be used for testing.

3.5.1.5 Test each area in stages to match the Work Schedule.

3.5.1.6 Demonstrate to Consultant and Owner the operation of ancillary functions (ie maglock and door hardware release, elevator recall, etc).

3.5.2 Provide assistance to the Fire Inspection Department for testing a minimum of 25% of the installed field devices and up to 100% of sprinkler/ standpipe devices (supervised valves, flow switches, etc). Correct deficiencies and retest any devices or zones operating incorrectly as directed by the Fire Inspection Department.

### 3.5.3 Integrated Systems Testing

3.5.3.1 Provide Integrated Systems Testing as indicated in CAN/ULC-S1001-11 "Integrated Systems Testing of Fire Protection And Life Safety Systems.

3.5.3.2 Contractor to engage with Fire Alarm manufacturer at testing phase or a 3rd party commissioning type contractor to arrange for this work. In general, systems to be tested for proper integration with the fire alarm system are noted in CAN/ULC-S1001-11 and include but are not limited to elevators, cooking equipment fire suppression systems, hold-open devices, electromagnetic locks, smoke control systems, emergency generators, audio/visual and/or lighting controls, notification systems, sprinkler systems, standpipe systems, fire pumps, water supplies, water supply control valves, freeze protection systems, fixed fire suppression systems.

3.5.3.3 Contractor to provide to consultant for approval, all proposed testing procedures and proposed reports prior to commencing test.

3.5.3.4 Provide completed reports upon completion of fire alarm verification and submission of verification reports and certificate.

3.6 **TRAINING**

3.6.1 The Contractor shall provide 2 hours training for the complete operation of fire alarm system.

**END OF SECTION**

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1 General

1.1 **GENERAL PROVISIONS**

1.1.1 Conform to the requirements of Section 16001, “Electrical General Provisions” and Section 16100, “Basic Materials and Methods”.

1.2 **DESCRIPTION OF WORK**

1.2.1 Provide electric hand dryers, as indicated.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal and must be CSA approved, ULC tested and listed.

2.2 **ELECTRIC HAND DRYERS**

2.2.1 Electric hand dryers to be no-touch type control, 120/208 volt single phase auto sensing, maximum 1500 watts, surface-mounted, stamped steel housing with white epoxy finish. Provide 5 year limited warranty.

2.2.2 Automatic, activated by infrared optical sensor. Operates while hands are under blower. Shut-off within 2 seconds when hands removed, or in 35 seconds if hands or other obstruction is not removed.

2.2.3 Combination Motor and Blower: vacuum type with automatic resetting thermal protector. 5/8hp, 14,000 - 28,000 RPM adjustable. Air velocity: 10,000 - 19,000 LFM adjustable.

2.2.4 Heater: resistance coil to provide an air temperature of 58°C (135°F) measured at average hand position of 102 mm (4″) below air outlet.

2.2.5 Complete with HEPA filter and 4 spare filters, or cold plasma clean technology to sanitize hands and purify surrounding air, killing up to 99.6% of pathogens on hands.

2.2.6 Sound level not to exceed 83 dB at high air velocity, 69 dB at low air velocity.

2.2.7 The following manufacturers will be considered as equal subject to the requirements of Clause “Material and Equipment”:

American Dryer Extreme Air CPC Series
XCELERATOR Hand Dryer c/w noise reduction nozzle
World Dryer VERDEdri

3 Execution

3.1 **ELECTRIC HAND DRYERS**

3.1.1 Mount electric dryers securely to wall, as indicated, to prevent easy removal.

3.1.2 Dryer units are not to be installed until all wall, ceiling and floor finishes are applied, and all work within the room space is completed. Any units installed and damaged will be replaced at the expense of this Contractor.

3.1.3 Mounting height and location of dryers:

3.1.3.1 In washrooms with one dryer, mount at barrier free level. In washrooms with two or more dryers, mount one at barrier free level.

3.1.3.2 Mounting heights: (from bottom edge of dryer):

| | |
|---|---|
| Washroom | 1041 mm (41") |

3.1.3.3 Ensure a minimum clear floor space of 760mm by 1220mm (30" by 48") is provided in front of or parallel to hand dryers mounted at barrier free level.

3.1.3.4 Ensure hand dryers mounted at barrier free height are located within 610mm (24") horizontally from edge of barrier free lavatories or wash fountains. Notify Consultant prior to rough-in where hand dryer cannot be installed in this location.

3.1.3.5 Ensure a minimum of 510mm (20") is provided between adjacent hand dryers.

3.2 **TESTING AND CLEANING**

3.2.1 Inspect installation to verify secure and proper mounting. Test each dryer to verify operation, control functions, and performance. Correct deficiencies.

3.2.2 Clean surfaces and wash with mild soap.

**END OF SECTION**

Chorley+Bisset
CONSULTING ENGINEERS

# GREGORY HOGAN CATHOLIC SCHOOL

## OFFICE RENOVATIONS

## SARNIA ONTARIO

## ST. CLAIR CATHOLIC DISTRICT SCHOOL BOARD


CHORLEY + BISSET LTD
CONSULTING ENGINEERS
LONDON ONTARIO



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MAY 2017



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GREGORY HOGAN CATHOLIC SCHOOL

OFFICE RENOVATIONS

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# G E N E R A L  I N D E X

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PART 1 - GENERAL



PART 2 - PRODUCTS

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PART 3 - EXECUTION



DETAIL SHEETS

| Detail No. | Title |
|---|---|
| 1 | Identification of Piping Systems |
| 2 | Typical Detail of Automatic Air Vent |
| 3 | Typical Detail of Manual Air Vent |
| 4 | Air Seal for Drains from Air Handling Equipment |
| 5 | Typical Low Velocity Air Duct Turns |
| 6 | Duct Fittings |
| 7 | Vertical Fire Damper Installation |
| 8 | Duct Main and Branch Takeoffs |
| 9 | Duct Liner Installation at Fire Damper |

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 This Section and Division 1 - General Requirements applies to and governs the work of all Sections of Division 15.

1.2 **VISITING SITE**

1.2.1 Visit the site and be familiar with working conditions and work involved before submitting Bids. No extras will be granted due to lack of a thorough preliminary investigation of the site.

1.2.2 Remove and replace existing ceiling tile to inspect ceiling space for existing Mechanical, Electrical and Structural obstructions. Include cost of all necessary changes in Bid Price. No extras will be granted due to lack of a thorough preliminary investigation of accessible ceiling spaces.

1.3 **CONTRACT DRAWINGS**

1.3.1 Mechanical Drawings show Mechanical work only and are not intended to show Structural details, Electrical details or Architectural features. Take building dimensions and details from Architectural or Structural Drawings or from job measurements. Any dimensions shown on Drawings are approximate. Verify dimensions by reference to Shop Drawings and field measurement.

1.3.2 Only the general location and route of piping and ductwork is shown. Install all piping and ductwork neatly to conserve headroom. All piping and ductwork to be installed parallel to building lines unless shown otherwise.

1.3.3 The Consultant reserves the right to revise the locations of equipment and outlets within any given room without altering the Contract Price provided Notice of Change is given prior to roughing-in.

1.3.4 In case of conflict between work of other trades and work of this Division, clarify the location of these items with the Consultant before roughing-in.

1.3.5 In the event of any discrepancies or ambiguity of any symbol, note, abbreviation, etc., used in this Specification or on the Contract Drawings, obtain clarification, in writing, from the Consultant prior to submitting Bid. No allowance will be made for additional costs arising from failure to obtain proper clarification of conflicting information before Bid.

1.3.6 Quantities or lengths indicated in any of the Contract Documents are approximate only and will not be held to gauge or limit the work. No adjustment to the Contract Price will be allowed to complete the work.

1.3.7 Verify equipment access and coordinate with equipment supplier to ensure equipment can be physically transported to installation location. Under no circumstances will any claim be allowed for extra cost to disassemble and/or assemble equipment at the final location which will be considered as part of equipment installation.

1.3.8 Provide labour, products and services specified, but not shown on Drawings and vice versa, and all other labour, products and services necessary for completion of the work.

1.3.9 All dimensions and sizes are in SI units. Generally, units are in millimetres. All exceptions to this are noted. Pipe sizes are in accordance with ANSI Standards.

1.4 **SHOP DRAWINGS**

1.4.1 Submit Manufacturers' Shop Drawings, Electrical Wiring Diagrams and Control System Drawings to the Consultant. Provide title sheet for Shop Drawing submitted. Include project name, Shop Drawing item (including specification paragraph reference) and approval stamps. The Consultant reserves the right to have samples submitted of any specified products.

1.4.2 Before submitting shop drawings, provide a complete list of shop drawings to be submitted in Microsoft Excel format. List all shop drawings and approximate date of submission.

1.4.3 Submit all shop drawings electronically in Adobe Acrobat PDF format. File attachments to an email must total no more than 5 MB and must be submitted unzipped. If multiple items are submitted in single PDF file, each individual piece of equipment must be “book marked” using equipment labels as per Design Drawings. All shop drawings submitted electronically must be checked and stamped by the Contractor as specified below.

1.4.4 Catalogues, manuals or price lists will not be accepted as Shop Drawings. Before submission, check Shop Drawings, make necessary corrections, apply stamp “Checked and Certified Correct”, sign and date.

1.4.5 Submit one reviewed set of Shop Drawings with each set of Maintenance and Operating Instructions.

1.4.6 The review of Shop Drawings by Chorley + Bisset Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review does not mean that Chorley + Bisset Ltd. approves the detail design inherent in the Shop Drawings, responsibility for which remains with the Contractor. Such review does not relieve the Contractor of his responsibility for errors or omissions in the Shop Drawings or of his responsibility for meeting all requirements of the Construction and Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all subtrades.

1.4.7 The Contractor is to review each shop drawing and document the differences between the shop drawing submission and the description listed in the specification. If there are no differences listed, the Contractor implicitly declares the shop drawing meets all requirements of the Specification.

1.4.8 Ensure at least one copy of the reviewed Shop Drawings is kept on site at all times for reference.

1.4.9 Prepare all Drawings in SI units.

1.5 **FIELD DRAWINGS**

1.5.1 Submit, to the General Contractor, Drawings accurately showing all openings for ducts, pipes, etc. Drawings must include the size of openings and their locations by dimensions, including the location of the structural members framing these openings. Each trade will be responsible for detail layout of their own work.

1.5.2 Assume full responsibility for the detailed coordination of all Division 15 work. Prepare Field Drawings to determine the exact location of each service. On these Drawings, include all mechanical and electrical services, architectural features, and structural details. If a conflict becomes apparent after the installation of services, pay all costs associated with removing and reinstalling these services.

1.6 **AS-BUILT DRAWINGS**

1.6.1 The Contractor will be provided with the Mechanical Drawings in AutoCAD 2010 compatible electronic format. The Contractor is to plot and print Drawings from the discs.

1.6.2 Revise and maintain the prints as work progresses. Show all revisions, relocations and changes, to scale. Use colour markings.

1.6.3 Transfer information from the marked prints to AutoCAD format on a monthly basis. Have the marked prints and updated AutoCAD prints on site for review by the Consultant at all times. Monthly draws will not be approved unless all changes have been shown.

1.6.4 Prior to testing, balancing and final commissioning, complete the transfer of all information to the AutoCAD Drawings. The Drawing format is to match exactly the layering system of the Consultant. Mark Drawings “As Built Drawings” and insert name and logo of Contractor. Bind all xrefs. Submit one set of As Built Drawing prints for review by the Consultant. Remove Engineers Stamp. Include Contractors name and Logo.

1.6.5 Submit completed As Built Drawings disks in AutoCAD 2010 format and one set of Reproducible Drawings with the Operating and Maintenance Manuals.

1.6.6 For the purposes of Contract payments, As Built Drawings will be assumed to have a value of $2,500.00. This will not be released until As Built Drawings have been accepted as complete and acceptable by the Consultant. This amount is in addition to the normal 10% holdback required by the Construction Lien Act, 1983.

1.7 **CONFLICTS AND PRECEDENCE**

1.7.1 Immediately upon discovery of any conflict, ambiguity, error or omission in the Contract Documents, request clarification in writing from Consultant prior to starting the work in questions.

1.7.2 Failure to give such written notice will constitute an irrevocable waiver and release of any claim for additional compensation or delays incurred.

1.7.3 Where work fails to conform to Contract Documents, as clarified by Consultant, promptly remove and replace such work as directed, without adjustment to Contract price.

1.8 **FIRESTOPPING**

1.8.1 Before starting any work on site, submit detailed Shop Drawings to the Consultant for review and comments. Include:

1.8.1.1 Manufacturer's technical product data and installation instructions for each specific type and location of penetration.

1.8.1.2 Certification that proposed firestopping materials and assemblies comply with CAN-ULC S115 “Standard Method of Fire Test for Firestop Systems”.

1.8.1.3 For each specific type and location of penetration, provide installation instructions from a recognized independent testing agency.

1.8.2 Mark penetration types and locations on set of white prints. At completion of project, transfer this information to “Record” Drawings.

1.8.3 Comply with all requirements of Ontario Building Code, Clause “Building Services in Fire Separations and Fire Rated Assemblies”.

1.8.4 Submit one sample of the components of each firestop system to the Consultant for review.

1.9 **MAINTENANCE AND OPERATING INSTRUCTIONS**

1.9.1 Assemble three sets of equipment literature (cuts), operating instructions, maintenance instructions, pressure test results, certificate, other pertinent data and Letter of Warranty. Place in three ring binders, complete with index pages, indexing tabs and cover identification at front and side. Submit to Consultant for approval.

1.9.2 Make changes or submit additional information as required to obtain approval. Final Certificate of Completion will not be issued until the Consultant possesses three approved sets. Include copies of approved Shop Drawings and name and address of Spare Parts' Suppliers with manuals.

1.9.3 Provide two electronic copies of the maintenance and operating manual in Adobe Acrobat PDF format on a compact disc or DVD and submit with the final version of manuals. Provide separate files on the disc in accordance with the sections of the hard copy manuals. Divide the maintenance manuals into sections which correspond with Specification Sections.

1.9.4 The following information is to be contained within the Sections:

1.9.4.1 A list of names, addresses and telephone numbers of the Consultants, General Contractor and Mechanical Contractor. Written warranty of the Mechanical systems. A copy of the valve directory, giving number, valve location, normal valve position and purpose of valve.

1.9.4.2 A copy of all pressure tests and operational tests for pumping systems. A list of names, addresses and telephone numbers of all suppliers. A copy of all approved Shop Drawings.

1.9.4.3 A complete and comprehensive lubrication, maintenance and operating instructions details D (daily), W (weekly), M (monthly), SA (semi-annually), A (annually) schedule for maintenance and lubrication.

1.9.4.4 A complete list of all air filter sizes, quantities and types, corresponding with unit designations.

1.9.4.5 Copies of warranties.

1.9.4.6 Complete control diagrams, wiring diagrams and description of control system and the functioning of the system.

1.9.4.7 Copy of the project Testing and Balancing Report.

1.10 **REGULATIONS AND PERMITS**

1.10.1 Carry out all work in accordance with the latest editions of applicable municipal and provincial codes, regulations, bylaws, and requirements of local Authority Having Jurisdiction. In no instance, however, is the standard established by the Drawings and Specifications to be reduced by the codes referred to above. Apply for and obtain any necessary permits. Pay any necessary fees.

1.10.2 Enforce all prevailing Provincial and local safety regulations at all times. Abide by all Owner's safety and security policies and procedures and conform to all regulations of the current Occupational Health and Safety Act.

1.10.3 Submit copies of CRN Certificates for all boilers and registered pressure vessels.

1.10.4 Arrange and pay for TSSA inspection and certification.

1.11 **MATERIAL AND EQUIPMENT**

1.11.1 Where an item of material or any equipment is specifically identified by a manufacturer's trade name and/or catalogue number, make no substitution except as provided for in paragraphs 3, 4 and 5 below.

1.11.2 In the case of some items of equipment, one or more additional names of acceptable equal manufacturers are listed in the Clause describing an item or a group of items. The design, layout, space allocation, connection details, etc., are based on the products named first in the description of each item. The products named first in the description of each item establish the quality of manufacture and design standards for all other manufacturers of that item. The general approval indicated by listing the names of other manufacturers is subject to final review of Shop Drawings, performance data, test reports, production samples (if required) by Consultant, and equipment shipped to site. Ensure that the products used meet the requirements specified and as shown on the Contract Drawings.

1.11.3 Suppliers wishing to submit other items of equipment for approval as an equal to those specified must apply to the Consultant at least 8 working days before Bid closing date. Requests must be accompanied by complete description and technical data on the items proposed. Approval for substitution of equipment will only be given on the understanding that all details, accessories, features and performance meet the Specifications unless otherwise stated. Deviations from the Specifications must be stated in writing at time of application for approval.

1.11.4 Include in the Bid, the equipment named in the Specifications or approved as an equal as in paragraph 3 above. This will form the Base Bid. Any number of alternative bids, as defined below, may be included in addition to the Base Bid.

1.11.5 Items of equipment by Manufacturers not named in the Specifications may be offered as alternatives to the manufacturers named in the Specifications. The alternative proposals must be accompanied by full descriptive and technical data, together with the statement of amount of addition or deduction from the Base Bid, if the alternative is accepted. Prior approval by the Consultant is not required on items submitted as alternative bids.

1.11.6 After execution of the Contract, substitution of equipment will be considered only if equipment accepted cannot be delivered in time to complete the work in proper sequence, or if the manufacturer has stopped production of the accepted item. In such cases, requests for substitution must be accompanied by proof of equality and difference in price and delivery, in the form of Certified Quotations from Suppliers of both specified and proposed equipment. Credit any decrease in price involved in substitution to the Owner by reduction of the Contract Price. The Contractor will not be reimbursed for any such increase in price.

1.11.7 Where equipment other than the equipment used as a basis for design, layout and space allocation is used, produce and submit revised layouts of equipment, pipes, ducts, etc., in the areas affected. Submit these Drawings with the Shop Drawings. Failure to produce these Drawings is indication by the Contractor that they are not required and the original space allocations are adequate for the substituted equipment.

1.11.8 Name the Subcontractors and Manufacturers in the Bid as indicated in Clause “List of Mechanical Subcontractors and Manufacturers”.

## 1.12 INTERPRETATION OF CONTRACT DOCUMENTS

1.12.1 The decision as to which trade provides required labour or materials rests solely with the Contractor. Extra payments will not be considered based on a difference in interpretation of the Contract Documents as to which trade involved provides materials or labour for specific items of work. The Consultant will not enter into such discussions.

## 1.13 SITE VISITS

1.13.1 The Mechanical Contractor shall have an office representative (not site personnel) at each site meeting and deficiency review. Attendance at these meetings is mandatory.

## 1.14 PROGRESS DRAWS

1.14.1 Mechanical Contractor shall review all supplier and subcontractor draws submitted to their office to ensure they are fair and reasonable for the amount of work completed on site to date prior to submitting to the General Contractor. Mechanical Contractor will be responsible for the validity of supplier and subcontractor draw claims.

1.15 **WARRANTY**

1.15.1 Warranty all workmanship and make good any defects for one year after Substantial Completion. Warranty material and equipment supplied by the manufacturers for one year after Substantial Completion. Make good damage caused due to defects and workmanship.

1.15.2 Where equipment specified in Sections of Division 15 to have an extended warranty period, e.g. five years, the first year of the warranty period will be governed by the terms and conditions of the warranty in the Contract Documents, and the remaining years of the warranty will be direct from the manufacturer and/or supplier to the Owner. Submit signed and dated copies of the extended warranties to the Consultant before applying for a Certificate of Substantial Performance of the Work.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Clause “Material and Equipment”.

2.2 **BACKFILL**

2.2.1 Use backfill material in accordance with the requirements of Division 2 unless specified or shown otherwise.

2.3 **CONCRETE**

2.3.1 Use concrete in accordance with the requirements of Division 3.

2.4 **SLEEVES**

2.4.1 In general, sleeves are not required through walls or floors except for penetrations through Service Room walls or floors.

2.4.2 For all pipes passing through foundation walls, use Link-Seal pre-engineered mechanical seals between sleeves and pipes.

2.4.3 For sleeves through mechanical room floors, use Schedule 40 steel pipes with annular fins continuously welded at midpoint.

2.4.4 For rated separation requiring a FT firestopping rating, use materials in conformance with manufacturer's recommendations.

2.5 **FIRESTOPPING**

2.5.1 Use only service penetration firestop components and assemblies tested in accordance with CAN/ULC S115 Fire Tests of Firestop Systems and listed in most recent ULC “List of Equipment and Materials” or by another recognized independent testing and certification agency acceptable to the Consultant.

2.5.2 All pipe insulation passing through the fire separation to be approved with the listing of the firestop system.

2.5.3 Pipe sleeves through fire separations requiring a rating are to be installed as per firestopping manufacturer's recommendations, as some firestopping manufacturers do not allow pipe sleeves within their approved system. Confirm pipe sleeve compatibility prior to starting work on site.

2.5.4 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause “Material and Equipment”:

Tremco

## 2.6 FIRE CLOSURES

2.6.1 Use only fire damper assemblies tested in accordance with CAN/ULC S115 Fire Tests of Firestop Systems and listed in most recent ULC “List of Equipment and Materials” or by another recognized independent testing and certification agency acceptable to the Consultant.

## 2.7 ESCUTCHEON PLATES

2.7.1 Use chrome or nickel-plated brass, solid type, with set screws for ceiling or wall mounting.

## 2.8 ACCESS DOORS

2.8.1 Access doors to be flush to edge of frame, concealed continuous hinge with screwdriver operated cam latch. Non fire-rated door construction to be minimum 14 gauge, with 16 gauge frame. Fire-rated door construction to be a minimum 20 gauge insulated door with 16 gauge frame. Insulation thickness to provide required rating.

2.8.2 Size doors to allow adequate operating/maintenance clearance for devices. Doors to be a minimum 600 mm x 600 mm (24″ x 24″) for body entry, and 300 mm x 300 mm (12″ x 12″) for hand entry, unless noted otherwise. Use the following access doors:

| | |
|---|---|
| Masonry Walls | - Acudor UF-5000 |
| Drywall Walls | - Acudor DW-5040 |
| Drywall Ceilings | - Acudor BP58, match ceiling thickness |
| Fire-Rated | - Acudor FW-5050/FB-5060 to match fire separation |

2.8.3 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause “Material and Equipment”:

Adam
Ancon LeHage
E. H. Price

## 2.9 ELECTRICAL EQUIPMENT

2.9.1 This building will be fully sprinklered (future). Use weatherproof electrical equipment in vaults and electrical rooms or shield equipment in such a way as to prevent the sprinkler system water from entering the electrical equipment and/or interfering with its operation.

## 2.10 ELECTRIC MOTORS

2.10.1 Provide motors of adequate size and type for intended service. Use CSA approved motors with the following characteristics:

| | | |
|---|---|---|
| 250 watts (1/3 hp) and under | - | 115 volt, 60 hertz, single phase |
| 370 watts (1/2 hp) and over | - | 60 hertz, three phase, voltage as shown on Drawings. |

2.10.2 Motors are to be the voltage specified. Step down or step up transformers will not be accepted.

2.10.3 Motors 250 watts (1/3 hp) and under: Use continuously rated squirrel cage induction type with capacitor start, NEMA Design Class “B” with NEMA “N” or better starting characteristics and a minimum of Class "B" insulation, unless specified otherwise..

2.10.4 Motors 370 watts (1/2 hp) and over: Use continuously rated squirrel cage induction type NEMA Design Class “B” with NEMA “B” or better starting characteristics and a minimum of Class “B” insulation.

2.10.5 Use open drip-proof type motor with a 1.15 service factor for motors located in dry locations indoors, unless specified or required otherwise by the motor location.

2.10.6 Use totally enclosed motors outdoors and in locations subject to water spray. Totally enclosed motors must be fan cooled and have a 1.0 service factor.

2.10.7 Use totally enclosed explosion-proof (TEXP) motors where indicated to prevent ignition of external gas.

2.10.8 All enclosures shall be rolled steel band or cast iron construction. Motor nameplate shall be mounted on enclosure with stainless steel fastening pins and shall have, as a minimum, all information as described in CSA C22.2 No 100-04 (R2009).

2.10.9 Unless specified otherwise, starters for electric motors will be provided by Division 16. Where multi-speed motors are specified, ensure that motors are compatible with starters supplied under Division 16. All two speed motors to be single winding, unless specified otherwise. Provide inverter duty motors where indicated on drawings.

2.10.10 All motors 0.75 kW (1 hp) and above, use premium efficiency type motors in accordance with NEMA Premium efficiency standard.

## 2.11 ELECTRICAL WIRING

2.11.1 Meet all requirements of Division 16 for all wiring included in Division 15 and pre-wired equipment provided by Division 15.

2.11.2 Ensure all pre-wired electrical equipment is CSA approved. Where this is not possible, arrange and pay for special Electrical Safety Authority approval.

2.11.3 All electrical wiring, both line voltage and low voltage, for equipment supplied by Division 15 is the responsibility of Division 15. Line voltage wiring from power panels to starters and from starters to motors will be supplied and installed by Division 16.

2.12 **IDENTIFICATION NAME LABELS**

2.12.1 Identification name labels, directional arrows and colour bands for ductwork and piping to be plastic coated pressure sensitive “Brady” or “Westline” selfstick labels, waterproof, colourfast, dirt and grease resistant. For pipes up to and including 65 mm (2-1/2″) diameter, use markers 28 mm (1-1/8″) high. For pipes 80 mm (3″) diameter and over, and all ductwork, use markers 57 mm (2-1/4″) high. For all piping exposed to view, use Smillie McAdams Summerlin Coil - Mark pipe covers.

2.13 **VALVE AND CONTROLLER TAGS**

2.13.1 Use brass valve and controller tags with 32 mm (1-1/4″) stamped code lettering and numbers filled with black paint. Hang a copy of the valve chart in Mechanical Room.

2.14 **EQUIPMENT NAMEPLATES**

2.14.1 Use minimum size 90 mm x 40 mm x 2.4 mm (3-1/2″ x 1-1/2″ x 3/32″) thick laminated phenolic plastic nameplates with black face and white lettering. Lettering to be minimum 6 mm (1/4″) high.

2.15 **BELT AND MACHINE GUARDS**

2.15.1 Provide OSHA compliant expanded metal guards in steel frames to protect drives of all belt driven equipment and all equipment with exposed rotating or moving parts. Firmly bolt guards in place and make easily removable for servicing. Provide openings in metal guards to permit use of a tachometer without removing the guard.

2.16 **FLASHING**

2.16.1 For locations with multiple roof penetrations serving a single piece of equipment, such as for roof mounted split system condensing units, use Portals Plus, Inc. Alumi-Flash system consisting of 100 mm (4″) high, one piece spun aluminum base with deck flange and EPDM rubber cap. Use caps suitable for required number and diameter of service penetrations.

2.16.2 For plumbing vent roof penetrations, use Thaler SJ-38 “Stack Jack” insulated flashing consisting of 330 mm (13″) high, one piece spun aluminum base with deck flange, urethane insulation liner and EPDM base seal. Size seals to suit pipe diameter.

2.16.3 For electrical conduit roof penetrations use Lexsuco Flash-Tite ‘Gooseneck’ insulated wire and cable flashing consisting of 220 mm (9″) high, one piece spun aluminum base with deck flange, 50 mm (2″) diameter 430 mm (17″) high stainless steel gooseneck and neoprene insulation liner.

3 Execution

3.1 **GENERAL**

3.1.1 Instruct and supervise other Sections doing related work.

3.1.2 Supply the measurements of equipment to other Sections to allow for necessary openings to be left in the work of other Sections.

3.1.3 Install pipes, ducts and tubing, which are to be concealed, neatly and close to building structure so that the necessary furring can be kept as small as possible.

3.1.4 Install all ceiling components in direct accordance with reflected ceiling plans.

3.1.5 Mechanical Drawings show approximate locations for wall-mounted devices. Clarify exact location and mounting height with Consultant prior to roughing-in.

3.1.6 All serviceable equipment installed on the roof (including boiler vents) to be installed minium 3m (10'-0") from roof edge.

## 3.2 DISSIMILAR METALS

3.2.1 Separate dissimilar metals by means of gaskets or shims of approved material or use dielectric unions or flanges in order to prevent electrolytic action. Where piping of dissimilar metals is connected, use approved dielectric unions or couplings. A brass fitting or brass valve may also be used in making connections between copper and steel piping.

## 3.3 STORAGE OF MATERIALS

3.3.1 Provide proper weatherproof storage for the protection of materials and equipment on site. Blank off openings in all equipment until required for use. Consultant may require materials which are not properly stored to be discarded and removed from the site.

## 3.4 EXCAVATION AND BACKFILL

3.4.1 Be responsible for any excavation and backfill required for work of Division 15. Slope or shore all trenching in accordance with all current regulations and safety standards. Where any pipes pass under building footings, backfill under footings with lean concrete.

3.4.2 Use materials and standards of compaction for backfill in accordance with Division 2 unless specified otherwise.

3.4.3 If changes are required in locations, depth of excavating or related data, advise the Consultant in reasonable time to avoid disruption of work sequence.

## 3.5 SUPPORTS AND BASES

3.5.1 Provide structural work required for installation of equipment provided under this Division.

3.5.2 Where piping and/or equipment is to be supported by steel stud walls, use brackets and supports which attach to steel studs. Support equipment independently of wall sheathing.

3.5.3 Provide sleeves for insulated pipe large enough to permit free movement of pipe without crushing the insulation.

3.5.4 Set all floor-mounted equipment on concrete bases at least 100 mm (4″) high Provide bases, anchor bolts and any special isolation bases. Concrete bases for air handling equipment are to be sized to suit unit drain air seal requirements, but 100 mm (4″) to remain as minimum. Size concrete equipment bases to suit the equipment actually supplied and in accordance with the Shop Drawings of such equipment. Do not start concrete work until anchor bolts and other embedded parts required for the complete installation, as well as Shop Drawings, are available at the site.

3.5.5 Carry out all concrete work in accordance with requirements of Division 3. Provide wire mesh, rebar and all necessary reinforcing.

3.5.6 For new concrete bases or pads on existing floors, first scrape and remove existing floor finish. Scarify existing floor so that new concrete adheres to it. Dowel new pads to existing floors.

## 3.6 CONCRETE INSERTS

### 3.6.1 General

3.6.1.1 Anchors for the support of pipes, ducts and equipment from the underside of suspended structural concrete systems may be by cast-in-place inserts placed prior to the pouring of concrete or by the use of inserts placed in holes drilled after the forms are stripped. The use of inserts cast into the concrete is the preferred option.

3.6.1.2 The safe load capacity of concrete anchors is affected by a number of variables such as specific anchor type, embedment, spacing between individual anchors, edge distances, direction of loading, concrete strength and “prying action”. Refer to the manufacturer's recommendations for each specific insert proposed, including any dynamic or vibratory loads.

3.6.1.3 Be responsible for the proper selection and installation of inserts, including number, type, spacing and accurate placement to provide the necessary safe load capacity and satisfactory long term performance.

3.6.2 **Installation of Cast in Place Inserts**: Ensure that anchors are accurately placed and "fixed" in position with sufficient rigidity to maintain their position during the placement of concrete. Do not displace reinforcing to install anchors without the prior permission of the Consultant.

3.6.3 **Installation of Inserts in Hardened Concrete**:

3.6.3.1 Use inserts placed in pre-drilled holes. Do not use powder driven inserts or self-drilling inserts. Before drilling holes, accurately locate all reinforcing bars in the affected areas using an electro-magnetic locator.

3.6.3.2 Do not drill through or otherwise damage reinforcing bars. If reinforcing is encountered, the inserts must be relocated. Ensure that hole diameter, depth of penetration, spacing, etc., are in strict accordance with the insert manufacturer's recommendations for the specific insert type and load condition.

3.6.3.3 Due to the relatively close spacing of reinforcing bars in the bottom of many of the beams and girders, the preferred location of drilled-in-place anchors in beams and girders is into the sides of these members, rather than upwards into the bottom.

3.6.4 **Sleeves Embedded in Concrete**: Except as approved otherwise by the Consultant, install sleeves embedded in concrete in accordance with the following general guidelines:

3.6.4.1 Centre to centre spacing to be not less than 3 diameters of the maximum size adjacent sleeve.

3.6.4.2 Provide additional reinforcing at points of congestion as directed by the Consultant.

3.6.5 Sleeves through beams will be permitted only as directed by the Consultant.

3.6.6 The reinforcing in beams, slabs and columns must not be displaced from its intended position under any circumstances unless prior written approval is obtained from the Consultant.

## 3.7 SLEEVES

3.7.1 Provide sleeves for insulated pipe large enough to permit free movement of pipe without crushing the insulation.

3.7.2 Provide sheet metal framing around ducts through masonry walls in exposed areas to ensure a clean finish around ducts.

## 3.8 FIRESTOPPING

3.8.1 Provide a listed firestop system in accordance with the Ontario Building Code to seal around all piping, tubing, ducts, conduits, electrical wires and cables, and other similar mechanical services which penetrate part of a building assembly required to have a fire resistance rating or a fire separation. Refer to Architectural Drawings and Specifications Section “Firestopping and Smoke Seals” for building assembly and fire separation types and locations.

3.8.2 For all penetrations through fire separations required to have a fire resistance rating, use firestop systems with an F rating not less than the fire resistance rating for the fire separation. This includes the sealing of any sleeves provided for future uses. Provide an FT rating where required by the Ontario Building Code.

3.8.3 All firestopping must be thoroughly reviewed by the Technical Representative of the systems manufacturer on site before any firestopping is concealed and submit a report of compliance with the rating requirements. Technical Representative to complete 3 destructive tests to confirm compliance with ULC listing, minimum one floor test and one wall test, third test to be Contractors choice. Submit a copy of the report to the Consultant.

3.8.4 Install duct fire damper assemblies in strict accordance with manufacturer's instructions provided with each assembly.

## 3.9 CUTTING AND PATCHING

3.9.1 Do not cut or drill holes through floors, roof or structural members before obtaining permission from the Consultant. All cutting and patching to be done by the trade specializing in the materials to be cut.

3.9.2 For penetrations through walls not required to have a fire rating, seal all spaces between pipe or pipe and surrounding wall construction with a fire-rated foam sealant. Use 3M Fire Barrier, Metacaulk, or Dow Fire Stop UL Classified fire rated foam sealants. Do this as the work progresses, to avoid leaving inaccessible holes at completion of the job. For penetrations through parts of the building assembly required to have a fire resistance rating or acting as a fire separation, see Clause "Firestopping" in this Section.

3.9.3 Where pipes and ducts are shown on the Mechanical Drawings passing through existing walls, floors, and roof, cut and patch the necessary openings. Include the cost of all cutting and patching in the Lump Sum Contract Price for the work of Division 15. Before drilling holes through floors or roof slabs, accurately locate and note sizes for each required hole. Get approval of Consultant before any cutting is started. Electrical conduits with live wiring may be embedded in concrete floor slabs.

3.9.4 Remove and replace ceiling where necessary to complete the work of this Division unless this work is specifically included in another Division.

## 3.10 ELECTRICAL EQUIPMENT

3.10.1 Where electrical equipment provided by this Division is not of sprinkler proof design, provide shields to prevent the sprinkler system water from entering the electrical equipment and/or interfering with its operation.

## 3.11 ELECTRICAL WORK

3.11.1 Perform all electrical work included in the work of this Division in accordance with the requirements of Division 16.

## 3.12 PAINTING

3.12.1 With the exception of prime painting of miscellaneous steel, painting of interior of ductwork behind grilles and other specific requirements as specified under the respective sections of Division 15, all painting will be provided under general trades, including painting of exterior of ductwork and interior piping exposed to view unless specifically noted below.

3.12.2 Touch up minor damage to finish on equipment supplied with factory applied baked enamel finish. Completely refinish items suffering damage which, in the opinion of the Consultant, is too extensive to be remedied by touchup.

3.12.3 Paint all steel framework provided by this Division with a chromium oxide primer.

3.12.4 Paint all exposed piping on roof. Use two coats of paint. Use colours as selected by the Consultant.

3.12.5 Paint all new and existing gas piping. Use bright yellow colour. Use two coats of paint.

## 3.13 ACCESS DOORS

3.13.1 Supply access doors wherever equipment, valves, dampers, life safety devices, etc., are concealed behind walls or inaccessible ceilings. All devices installed requiring periodic maintenance to be made accessible. Doors will be installed by Division 9.

## 3.14 IDENTIFICATION

3.14.1 Identify all piping and ductwork using name labels. Apply labels at 7 m (24′) intervals and at all branch connections, valves, and access panel locations. Neatly stencilled labels will be acceptable above accessible ceilings on insulated piping and on ductwork.

3.14.2 Mark each pipe in a space or area less than 7 m (24′) at least once with a name label. Apply flow directional arrows beside each name label.

3.14.3 To ensure permanent bond, apply 3M Adhesive EC-1341 to the surface of the insulation or pipe material. Apply the label with its own adhesive on this surface. Remove any labels “lifting”or “peeling”. Clean the surface and repeat the procedure specified with a new label. Where labels do not adhere, use pipe banding tape spirally wrapped for full length of label. Apply label over the banding tape.

3.14.4 Provide nameplate identifying equipment type, identification number, service and area served on each piece of mechanical equipment. Contractor is to complete a SCCDSB Bar Code/Asset Tag Information Form for new and/or replaced piece of equipment. Obtain form from SCCDSB.

3.14.5 Identify all manual and automatic control valves on all systems using brass tags attached with non-ferrous chains. Prepare a schedule of all tags for each system showing designating number, service and function. Include these schedules in the Operating and Maintenance Manuals and in the Mechanical Room.

3.14.6 Provide identification of all duct balancing dampers. Identify both support points of balancing damper and bottom of duct. Fluorescent orange spray paint is acceptable.

3.14.7 Where equipment is concealed above accessible ceilings, indicate location using coloured-coded marking devices, approved by Consultant, fastened to the ceiling components.

## 3.15 PIPING

### 3.15.1 General

3.15.1.1 Conceal all piping except in equipment rooms, unfinished areas, and where specifically noted. Unless shown otherwise, install all above ground piping parallel to building walls and partitions.

3.15.1.2 Install escutcheon plates at walls, floors and ceilings where piping is exposed. Install piping to conserve headroom.

3.15.1.3 In locations where space is provided for future or other equipment requiring connection to systems installed under this Contract, install services with shutoff valves and caps to allow connection to the system without interruption.

3.15.2 **Drain Hose Connections**: Provide drain hose connections at the base of all risers, on the suction side of all pumps and in all locations shown on Drawings.

3.15.3 **Supports and Hangers**

3.15.3.1 Provide all hangers, supports and sway braces in accordance with ANSI B31.1 and the Ontario Building Code. Support all piping in accordance with the Ontario Building Code.

3.15.3.2 Use Anvil beam clamps.

3.15.3.3 Use line size adjustable wrought steel clevis type hangers for horizontal piping 32 mm and less (1-1/4″ and less). For copper pipe, wrap pipe with tape at all hangers or use Anvil Figure CT-99C adjustable tubing ring hangers.

3.15.3.4 For piping 40 mm and over (1-1/2″ and over) use adjustable wrought steel clevis type hangers large enough for pipe insulation. See Section 15260 for insulation shields.

3.15.3.5 Where specified and/or shown on Drawings and in schedules, use spring hangers. See Drawings for details.

3.15.3.6 Unless specified otherwise, support piping at maximum spacing as shown and within 460 mm (18″) of each side of all valves and bends.

3.15.3.7 Support all plumbing piping in accordance with the Ontario Plumbing Code.

3.15.3.8 Support horizontal cast iron drainage piping at 1.5 m (5′) maximum spacing. Where the drain has successive fittings with no pipes between the fittings exceeding 800 mm (1′)in length, support the drain at intervals not exceeding 1 m (3′). Where mechanical joints are used, provide double hangers and sway bracing.

3.15.3.9 Where cast iron pipe with mechanical joints is used, support piping on both sides of horizontal joints within 460 mm (18") of joint each side, at all branch ends, and at all points where there is a change in direction. Where the pipe is 150 mm (6″) or larger in horizontal runs, brace to prevent horizontal movement at each branch or change in direction. Use braces, blocks, rodding or other suitable method recommended by the joint manufacturer. Provide Inspection Report from the manufacturer's representative certifying the installation is in accordance with their published installation data.

3.15.3.10 Do **not** support piping from other piping or equipment, or from metal roof decking.

3.15.3.11 **Schedule**:

| **Pipe Size mm** | **20** | **25** | **32** | **40** | **50** | **65** | **80** | **100 to 200** |
|---|---|---|---|---|---|---|---|---|
| Max. Span m | 1.8 | 2.1 | 2.4 | 2.4 | 3 | 3.4 | 3.7 | 4.3 |

3.15.4 **Anchors**: Install anchors where shown and where required. Use “U” bolts for piping 80 mm (3″) in diameter and less. For piping over 80 mm (3″) diameter, use steel fabricated anchors welded directly to pipe.

3.15.5 **Provision for Expansion**: Make proper allowance for thermal expansion and contraction whether shown on the Drawings or not. Use adequate offsets on all takeoffs to allow for expansion and contraction of mains. Weld all steel pipe forming an expansion loop regardless of size. Silver solder all copper pipe forming an expansion loop regardless of size. Use Flexonics or Anvil pipe alignment guides where shown and where required. Provide pipe guides for piping on either side of expansion loops, expansion joints and expansion compensators in accordance with "Standards of the Expansion Joint Manufacturers Association, Inc.".

## 3.16 USE OF FANS

3.16.1 Do not use any fan supplied under this Contract for ventilation while the building is under construction. The building must be "broom clean" and all painting finished before permission will be granted for testing fans.

3.16.2 The Consultant reserves the right to use any piece of equipment, device, or material for such reasonable lengths of time and at such times as may be required to make a complete and thorough test of the same before final completion and acceptance of the work. Such tests are not to be construed as evidence of acceptance of the work, and it is agreed and understood that no claim for damage will be made for injury or breakage to any part or parts of the equipment and/or materials due to the aforementioned tests, where such injuries or breakage are caused by a weakness or inaccuracy of parts, or by defective materials and/or workmanship of any kind. Supply all labour and equipment required for such tests. Trial usage will not initiate or affect in any way the warranties required for devices being tested.

## 3.17 INSPECTION AND TESTING

3.17.1 **General**: Inspect and test all piping. Repair any leaks and retest until satisfactory. Do not cover or close in piping until inspection and tests are completed. Thoroughly test all systems before making arrangements for the final demonstration in the presence of the Owner's staff. At the completion of the work, demonstrate operation of all systems to the Owner's representative and the Consultant. Promptly rectify any malfunction found and retest.

3.17.2 **Soil, Waste, Vent and Building Drains**: Seal all openings in section under test, then fill with water to a height of 3 m (10′) above top of section. Maintain water level for at least two hours. Test in sections as the work progresses. After all fixtures have been placed, apply a smoke test to the satisfaction of the local Plumbing Inspector.

3.17.3 **Domestic Hot and Cold Water - Heat Pump Water**: Apply a hydrostatic test of 1034 kPa (150 psig) or 1-1/2 times working pressure, whichever is greater, for two hours.

## 3.18 PERFORMANCE VERIFICATION

3.18.1 All systems must be thoroughly tested by the Technical Representative of the system manufacturers before arrangements are made for the final demonstration in the presence of the Owner's staff.

3.18.2 At the completion of the work, demonstrate operation of all systems to the Owner's representative and the Consultant. Promptly rectify any malfunction found.

3.18.3 For the following Systems, the manufacturer's representative must be present for the test period and submit a Certificate of Operation to the Consultant:

Controls
Heat Pumps

3.18.4 The manufacturer's representative must be present for the test period and submit a Certificate of Operation to the Consultant.

3.19 **START-UP SERVICES**

3.19.1 Provide the services of a qualified person to be in the building daily from 0800 hours to 1700 hours Monday through Friday for one week after work of this Contract is taken over by the Owner. Assist Owner's staff to become familiar with the system operation. Provide a similar service for one week after switchover to the opposite air conditioning cycle (heating or cooling).

3.20 **WELDING**

3.20.1 All welding is to be compliant with CSA W59-03 (for steel) or CSA W59.2-M (for aluminum). Welding is to be performed by tradesmen certified to CSA W47.1 (steel) or CSA W47.2 (aluminum). Inspectors shall be qualified to CSA W178.2. Provide proof of certification upon request.

3.20.2 For welding of stainless steel, use the provisions of the American Welding Society standard AWS D1.6/1.6M. When provisions of this standard conflict with provisions of applicable CSA standards, the CSA standards shall take precedence.

3.20.3 Welding and cutting tasks shall be carried out in accordance with CSA 117.2.

3.21 **PLACING IN OPERATION**

3.21.1 Upon completion of all work and before turning over the job, test each system for proper operation.

3.21.2 Flush through all drains and properly adjust flush valves and other fixtures.

3.21.3 Open and clean all new and existing traps, strainers and scale pockets after two weeks' operation.

3.21.4 Clean out all new and existing room heating units, terminal heating units, heat pumps and all air handling equipment with a vacuum cleaner when building is completed.

3.21.5 For each new filter bank, provide one extra set of filters.

3.21.6 Engage chemical treatment vendor of Owner’s choice to oversee cleaning and treatment of hydronic system. Completely flush system and refill with chemical cleaning compound. Operate the system for 24 hours at as high a temperature as possible with all control valves wide open, so that the compound reaches all parts of system. Drain, thoroughly flush and refill. Add corrosion treatment chemicals in recommended quantity to final filling. Provide report from chemical treatment vendor at completion of work.

## 3.22 COOPERATION BETWEEN TRADES

3.22.1 Cooperate and coordinate with other trades as required for satisfactory and expeditious completion of work. Take field dimensions relative to work. Fabricate and erect work to suit field dimensions and field conditions. Pay cost of extra work caused by and make up time lost as result of failure to provide necessary cooperation information or items to be fixed to or built-in, in adequate time.

## 3.23 MAINTENANCE OF EXISTING SERVICES

3.23.1 Take every precaution to locate and protect existing services so that no unscheduled interruption occurs. If any existing service is damaged due to the work of this Division, arrange and pay for repair. Bear any costs due to interruption of existing services.

3.23.2 The operation of the building by the Owner for day-to-day activities takes precedence over all construction related scope of work. The Contractor may be asked to cease work immediately in these instances and directed to work at another time. Assume all construction related activities which will impact the day-to-day operations of the facilities will be done after hours. Include all costs associated with after hours and overtime hours in the Base Bid. Additional costs related to after hours or overtime hours after Award of Contract will not be entertained.

3.23.3 Permission from the Owner is required before making any connections to or rerouting of existing services. Before any interruptions of service or restriction of use of any service, provide seven days prior written notice to the Consultant and Owner.

## 3.24 PROTECTING AND MAKING GOOD

3.24.1 Be responsible for protection of Owner's property, as well as finished and unfinished work, from damage due to execution of work under this Contract. Repair damage resulting from failure to provide such protection to the satisfaction of the Consultant, at no expense to the Owner.

3.24.2 Provide temporary heating, cooling and humidification systems for protection of existing Gymnasium wood floor at all times when central systems are not fully operational. This area must be maintained between 22 and 24C (72 to 75F) and 30 to 55% RH at all times during the work of this contract. Provide temporary vapour tight barrier between the Gymnasium and all adjacent areas where environmental conditions are not closely maintained. Provide a minimum of two temperature and humidity sensors in the area with LCD displays, for the duration of the contract. Monitor conditions in this space regularly. Pay for repair/replacement of any and all damage to the floor which occurs during the work of this contract.

3.24.3 Attach and fasten fixture and fittings in place in safe, sturdy, secure manner so that they cannot work loose or fall or shift out of position during occupancy of building, as the result of vibrating or other causes in normal use of building.

## 3.25 REMOVAL OF EXISTING MATERIAL AND EQUIPMENT

3.25.1 Remove existing material and equipment where shown or specified. Unless noted or specified otherwise, all material and equipment which is removed becomes the property of the Contractor and must be immediately removed from the site.

3.26 **FIRE SAFETY IN EXISTING BUILDINGS**

3.26.1 Where temporary shutdown of sprinkler systems, standpipe systems or other fire protection systems is required, do all work in compliance with Article 1.1.1.2, Clause 2.8.2.1.1.G and Subsections 6.4.1 and 6.5.2 of the Fire Code.

3.27 **DEFICIENCY REVIEW**

3.27.1 The Mechanical Contractor shall confirm in writing that the work is complete and ready for inspection. The Consultant will schedule a site visit to review the work and provide a written deficiency list. Once deficiencies have been corrected, the Mechanical Contractor shall confirm in writing to the Consultant that all deficiencies have been corrected. The Consultant will schedule a second site visit to review the correction of noted deficiencies. Should any noted deficiencies be found to be still outstanding, the Mechanical Contractor shall correct them and again notify the Consultant in writing. Charges to the Mechanical Contractor may result from repeat visits after the second visit.

3.27.2 The Mechanical Contractor is required to complete all work above ceilings and allow time for deficiency reviews and correction of noted deficiencies in a timely manner in order to accommodate the current Construction Schedule. This includes time for reinspection as required prior to concealing (drywall enclosures, drywall ceilings and acoustic tile ceilings) of any service. The Mechanical Contractor will be responsible for uncovering any concealed services for inspection.

3.28 **OWNER SUPPLIED EQUIPMENT**

3.28.1 The heat pumps will be purchased by the Owner and turned over to the Contractor. Contractor is responsible for receiving, installing and commissioning the heat pumps.

3.29 **LIST OF MECHANICAL SUBCONTRACTORS AND MANUFACTURERS**

3.29.1 In the Bid documents, name the Subcontractors and Manufacturers for the items listed below. Use only one name for each item. See Clause “Material and Equipment”. Where the name of a manufacturer is not entered on the Bid Form, the Contractor will be required to use the base specified manufacturer.

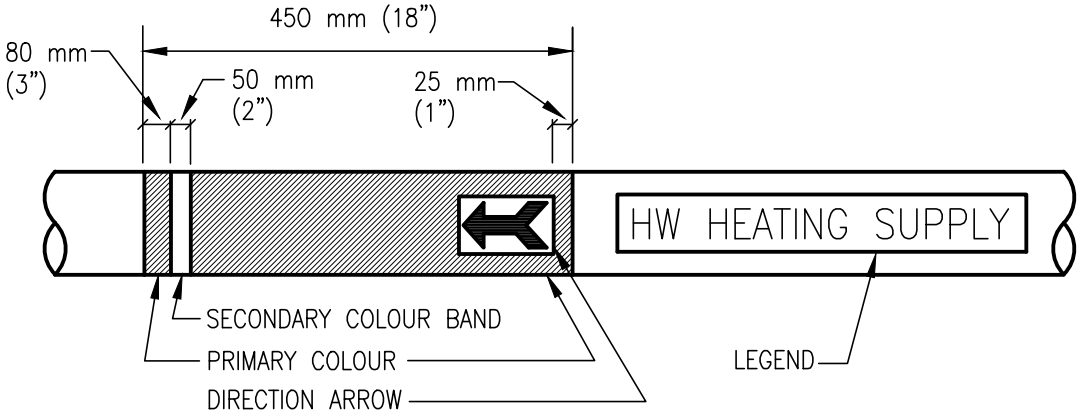
3.29.2 **Subcontractors**

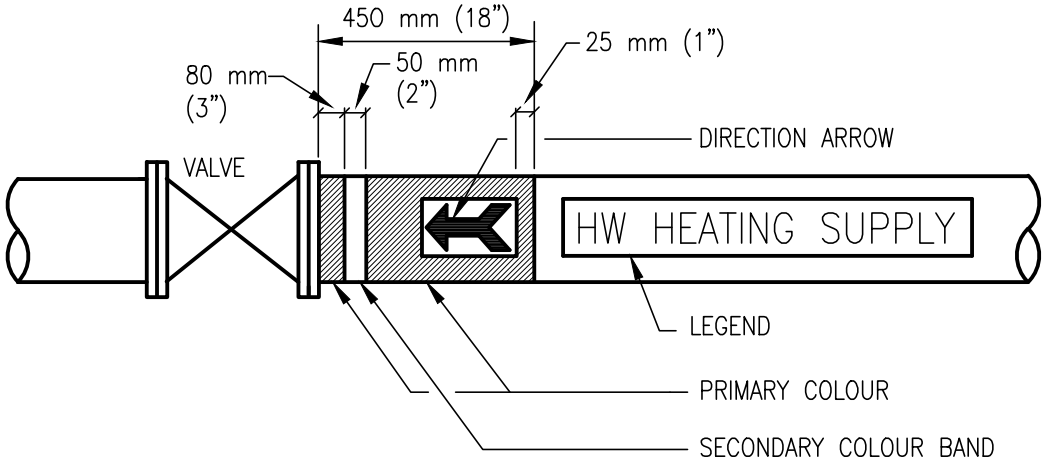
Sheet Metal
Testing and Balancing

3.29.3 **Manufacturers**

Drains
Grilles, Registers and Diffusers
Heat Pumps
Plumbing Brass
Plumbing Fixtures

**END OF SECTION**




| | | |
|---|---|---|
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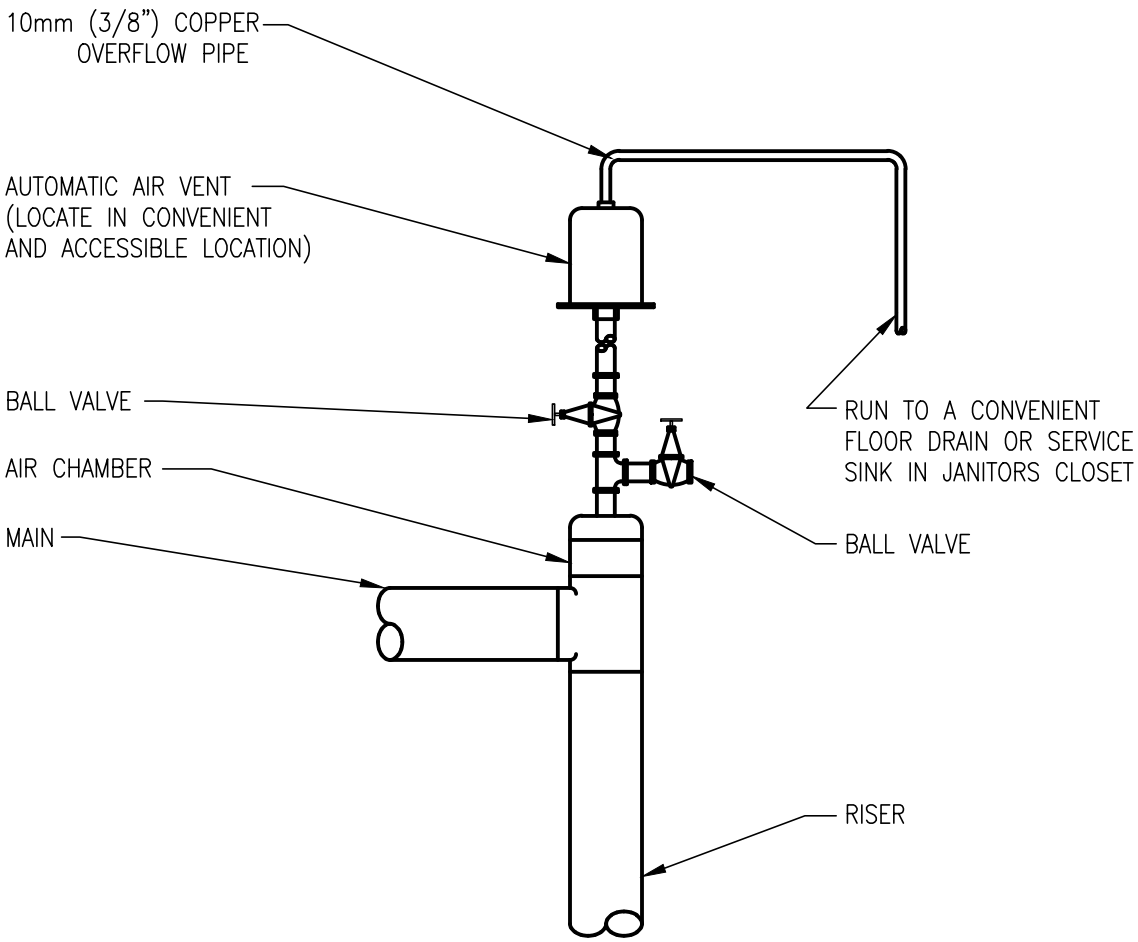
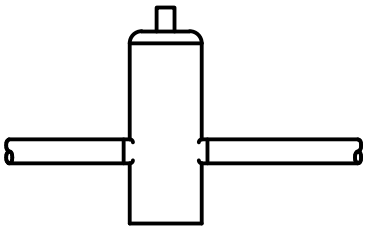
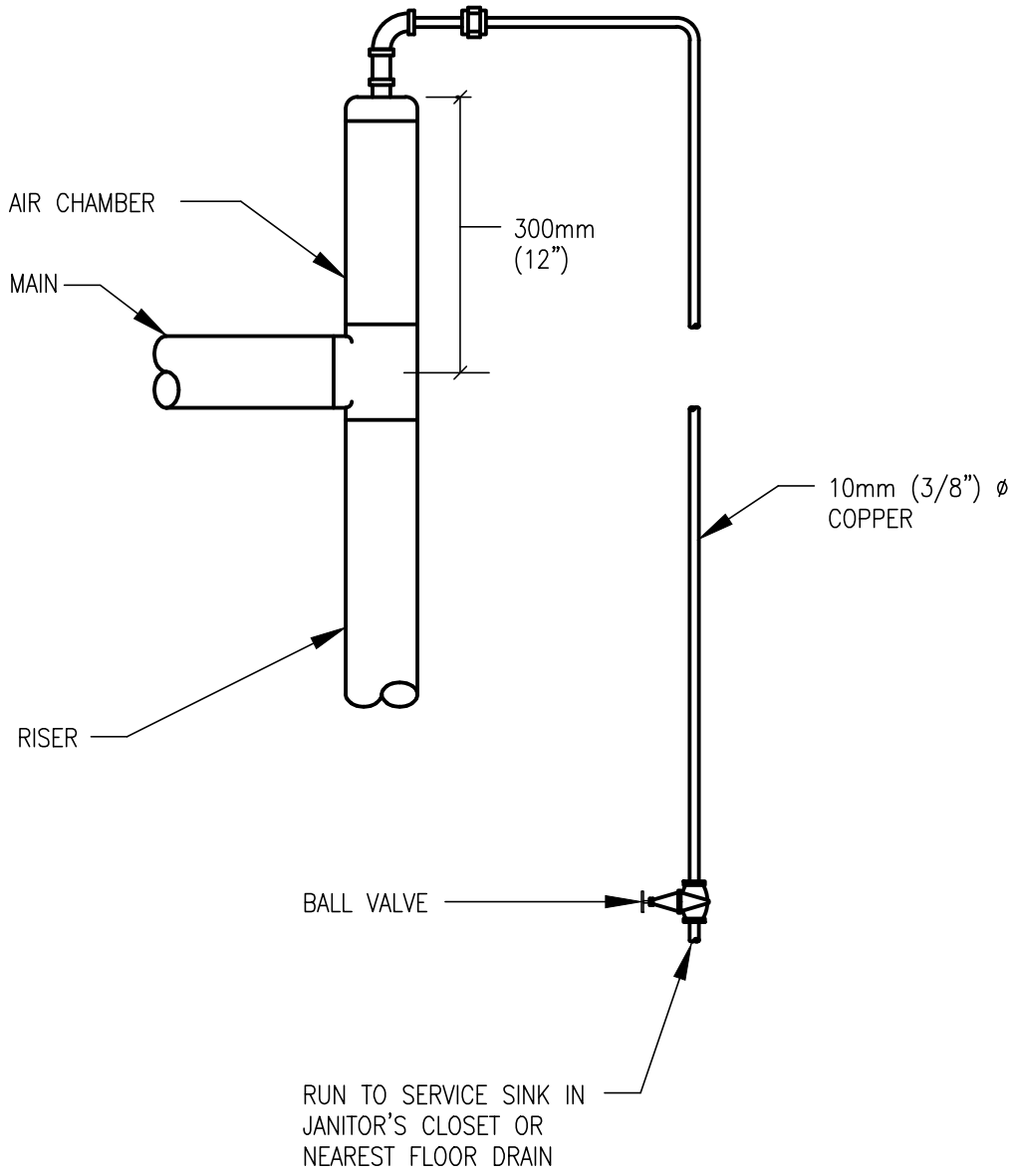


FOR AIR VENT ON LEVEL
PIPING USE AIR CHAMBER
AS ABOVE.

| | | |
|---|---|---|
| Chorley + Bisset<br>CONSULTING ENGINEERS | TITLE<br>TYPICAL DETAIL OF<br>AUTOMATIC AIR VENT | DETAIL NO.<br>**002** |

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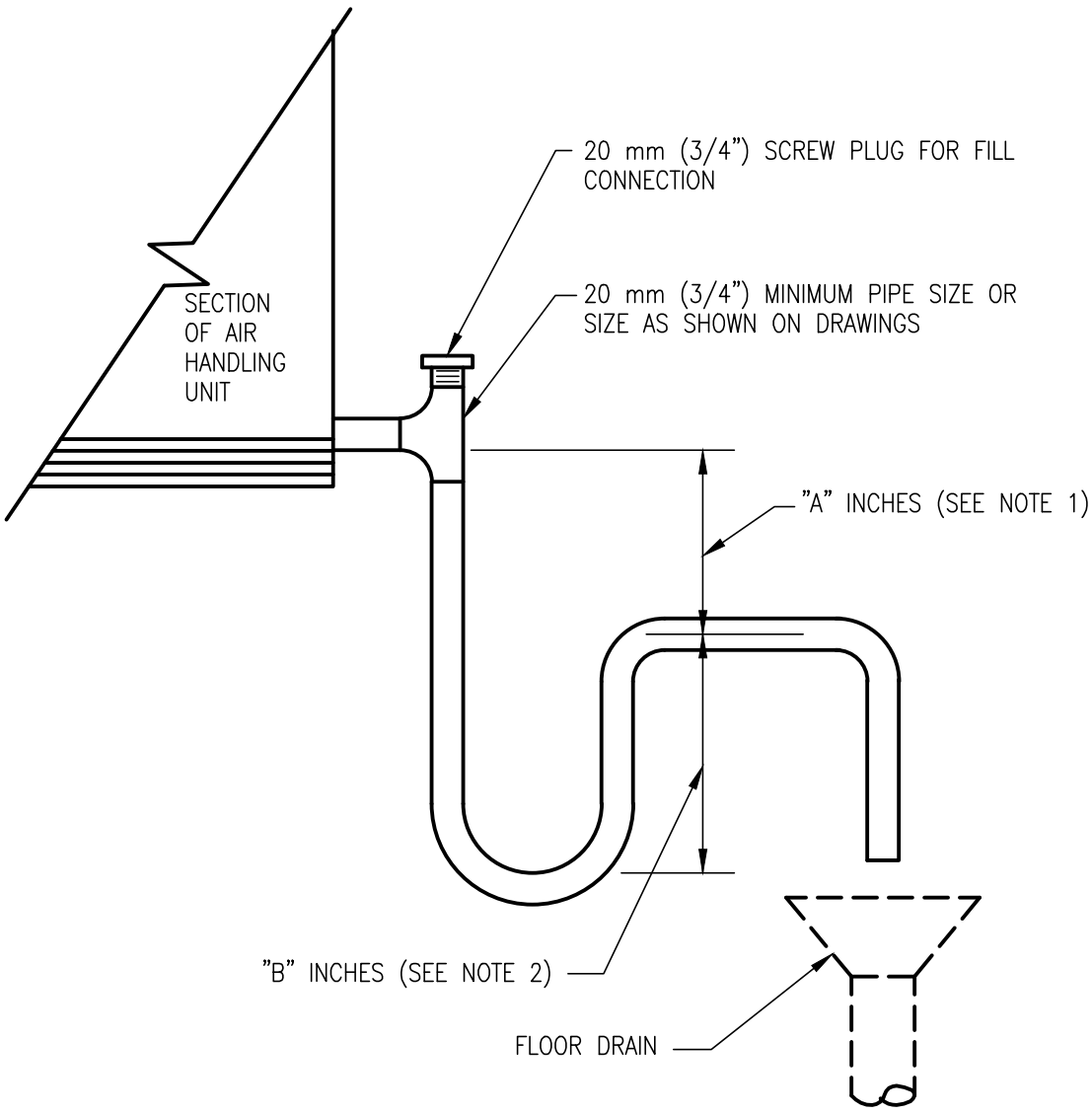
| Chorley + Bisset<br>CONSULTING ENGINEERS | TITLE<br>TYPICAL DETAIL OF<br>MANUAL AIR VENT | DETAIL NO.<br>**003** |

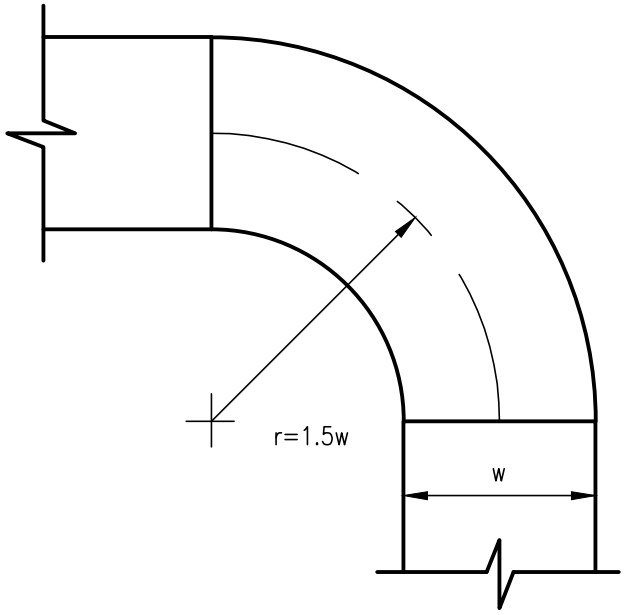


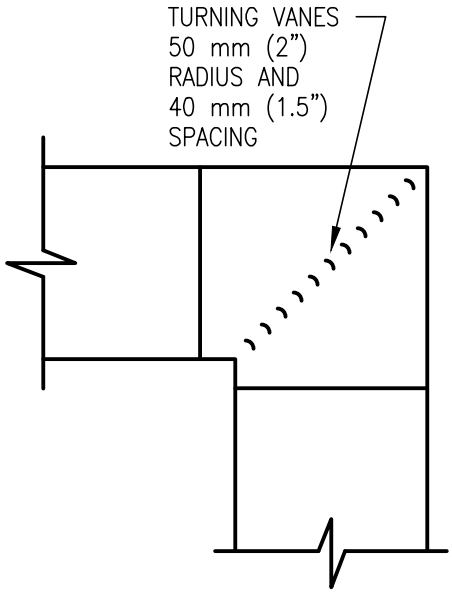

NOTES

1. "A" MUST BE EQUAL TO OR GREATER THAN THE NEGATIVE STATIC PRESSURE INSIDE THE SECTION REQUIRING DRAINAGE DURING NORMAL OPERATING CONDITIONS.(DRAW THROUGH COIL)

2. "B" MUST BE EQUAL TO OR GREATER THAN 1/2 OF THE NEGATIVE STATIC PRESSURE INSIDE THE SECTION REQUIRING DRAINAGE DURING NORMAL OPERATING CONDITIONS.(DRAW THROUGH COIL)
   OR
   "B" MUST BE EQUAL TO OR GREATER THAN THE POSITIVE STATIC PRESSURE INSIDE THE SECTION REQUIRING DRAINAGE DURING NORMAL OPERATING CONDITIONS.(BLOW THROUGH COIL)

| Chorley + Bisset CONSULTING ENGINEERS | TITLE: AIR SEAL FOR DRAINS FROM AIR HANDLING EQUIPMENT | DETAIL NO. 004 |
|---|---|---|



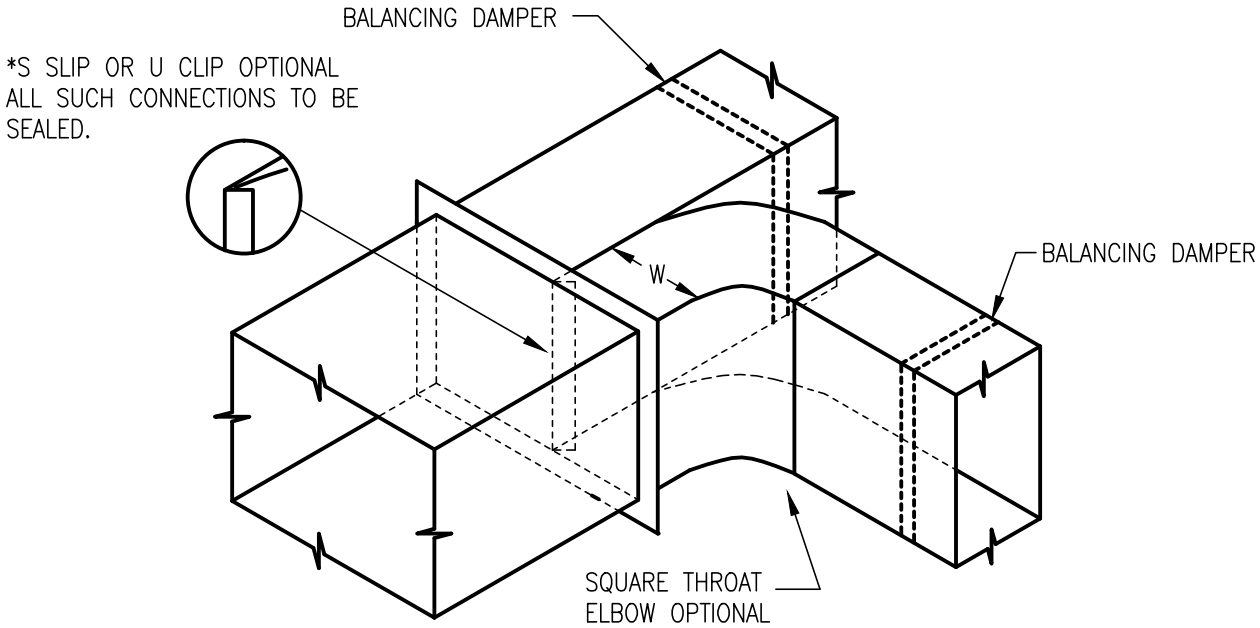

Chorley + Bisset
CONSULTING ENGINEERS

TITLE

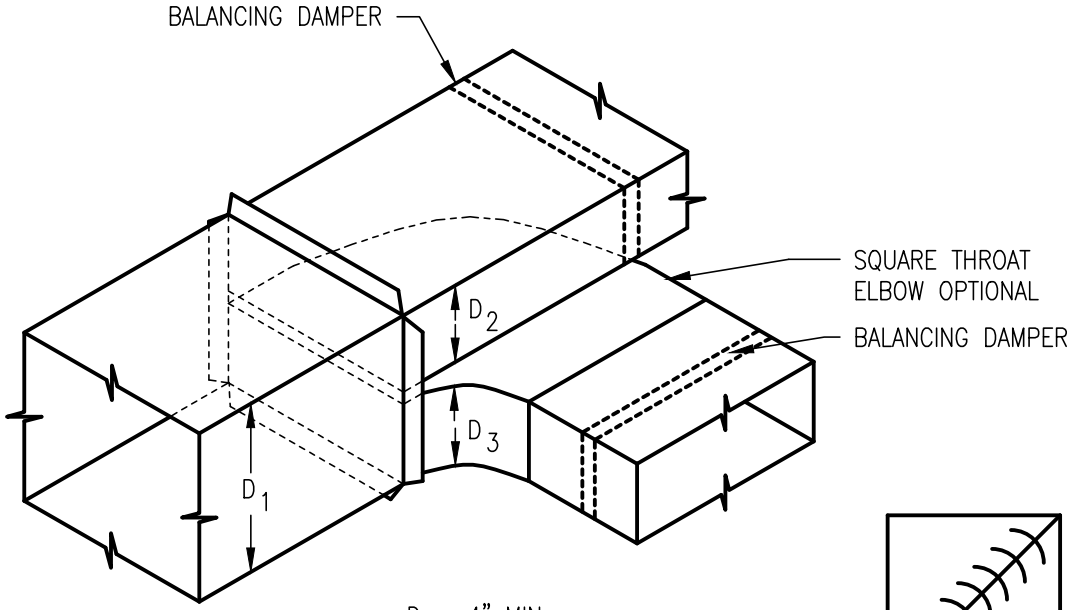
TYPICAL LOW VELOCITY
AIR DUCT TURNS

DETAIL NO.

**005**



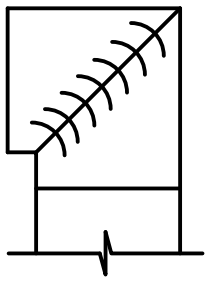

W =4" MIN.




$D_2$ =4" MIN.

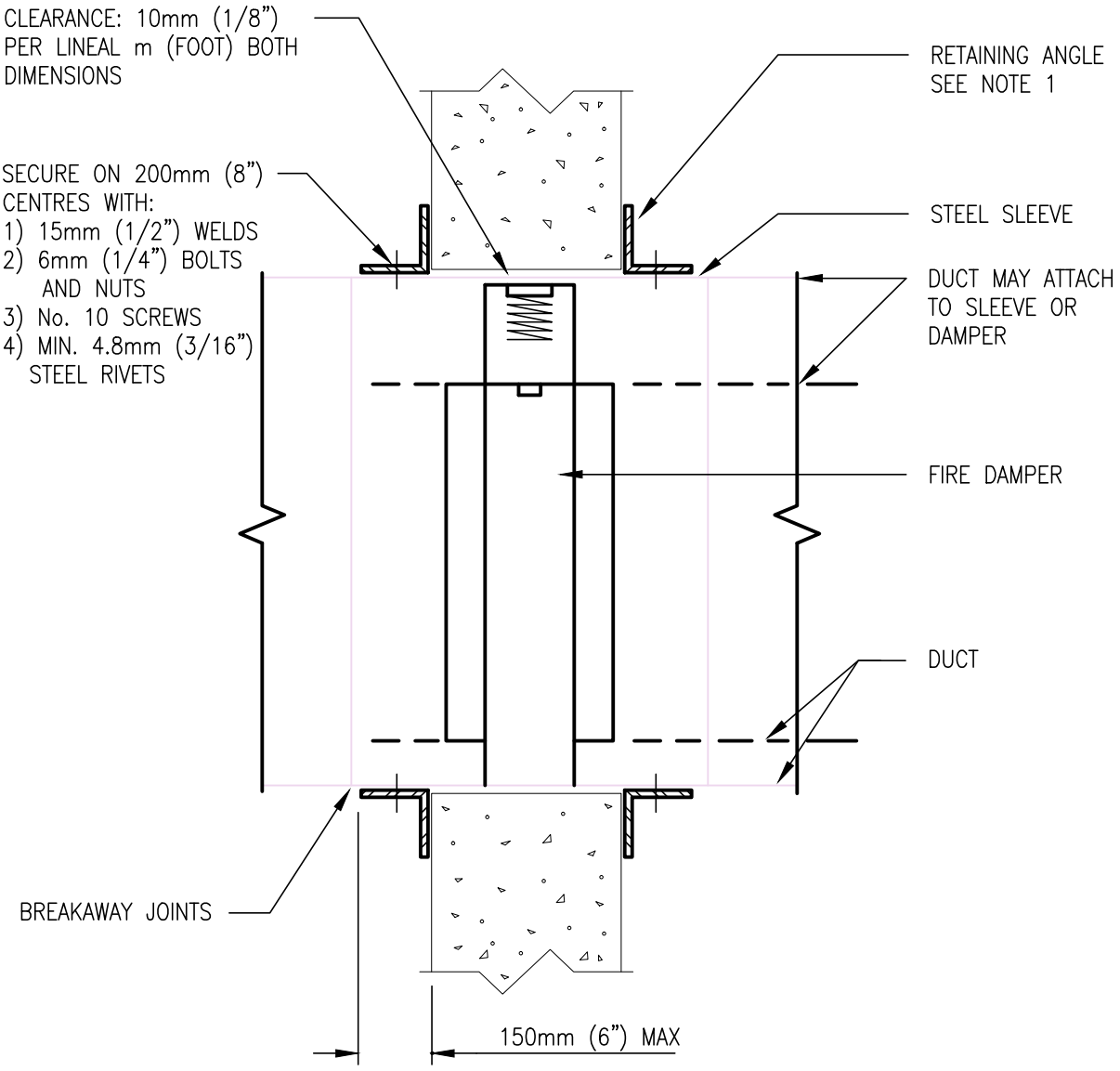
$D_3$ =4" MIN.

B.D.=BALANCING DAMPER



SQUARE THROAT

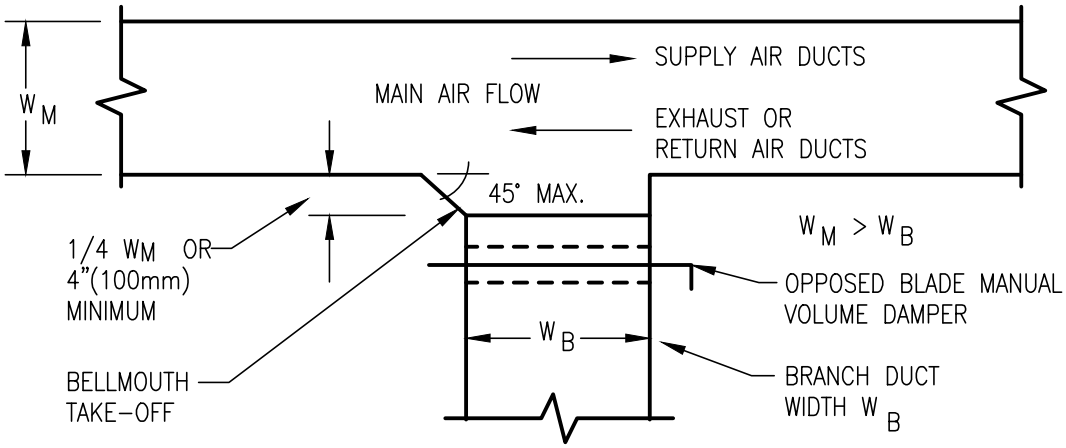
| Chorley+Bisset CONSULTING ENGINEERS | TITLE DUCT FITTINGS | DETAIL NO. 006 |
|---|---|---|



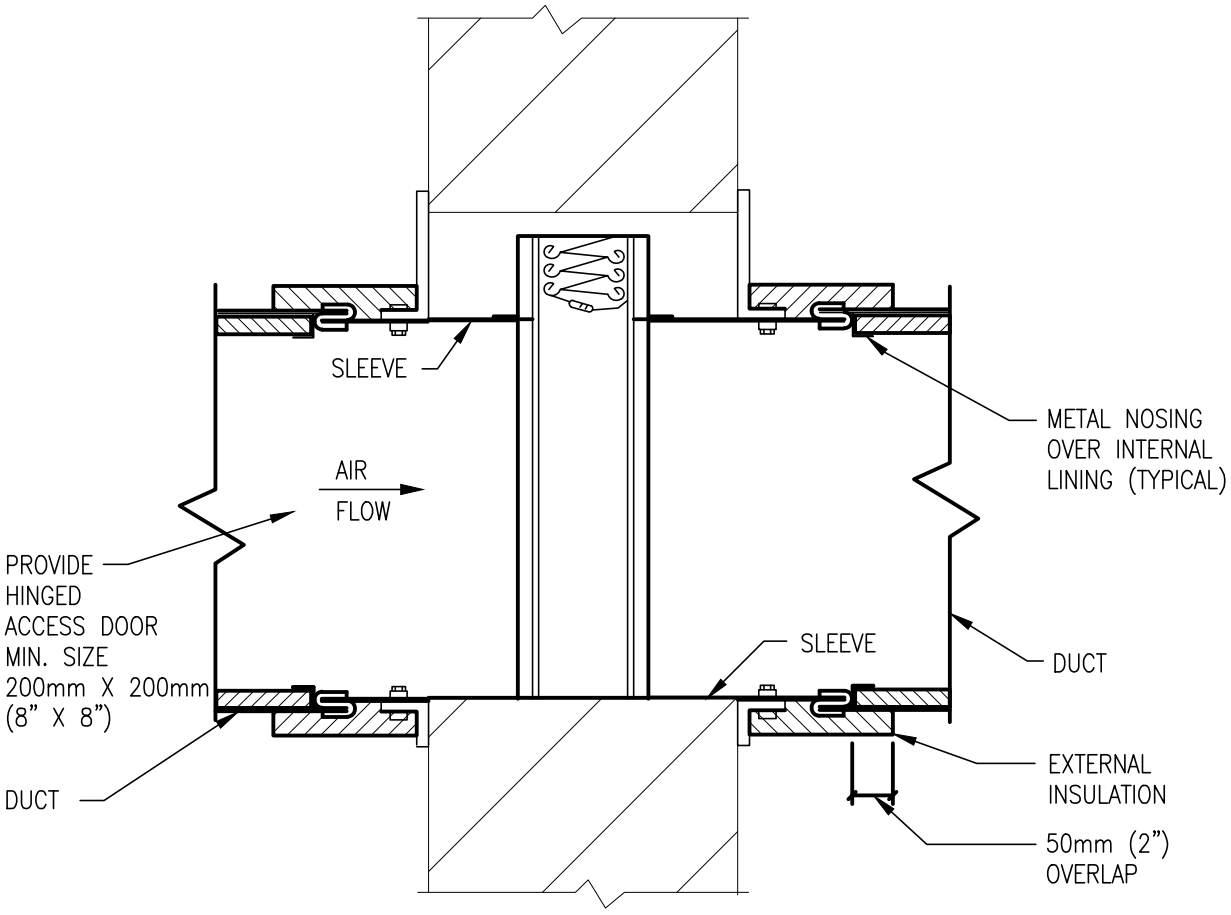

NOTES:

1. RETAINING ANGLES – MINIMUM 40 x 40 x 1.37mm (1 1/2" x 1 1/2" x 0.54" (16 GA)). ANGLES TO OVERLAP STRUCTURE A MINIMUM OF 25mm (1") ALL SIDES.
2. INSTALL ACCESS DOOR. LOCATE ON CORRIDOR SIDE IF POSSIBLE
3. MANUFACTURER U.L. APPROVED INSTALLATION PROCEDURES MUST BE USED IN LIEU OF THE ABOVE DETAILS WHERE APPLICABLE.

| | | |
|---|---|---|
| Chorley + Bisset CONSULTING ENGINEERS | TITLE VERTICAL FIRE DAMPER INSTALLATION | DETAIL NO. 007 |




| | | |
|---|---|---|
| Chorley+Bisset CONSULTING ENGINEERS | TITLE DUCT MAIN AND BRANCH TAKE OFFS | DETAIL NO. 008 |




| | | |
|---|---|---|
| Chorley + Bisset CONSULTING ENGINEERS | TITLE DUCT LINER INSTALLATION AT FIRE DAMPER | DETAIL NO. 009 |

INDEX - SECTION 15200

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 15001, “Mechanical General Provisions”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Heat Pump Water System**: The existing geothermal water source heat pump system will be modified to serve renovated areas.

2 Products

2.1 **GENERAL**

2.1.1 Furnish all test equipment. All equipment will remain the property of the testing and balancing company. Use recently calibrated instruments. Provide verification of calibration to the Consultant when requested.

2.1.2 Approved testing and balancing companies for this project are:

Air Audit Inc., Cambridge
C. J. Zettler & Associates Ltd., London

2.2 **MATERIALS**

2.2.1 Use materials specified herein or approved equal as defined in Section 15001, “Mechanical General Provisions”, Clause “Material and Equipment”.

2.3 **DUCT ACCESS HOLE PLUGS**

2.3.1 Use Duro-Dyne Type IP-4 duct access hole plugs.

3 Execution

3.1 **GENERAL**

3.1.1 Include all labour, engineering and test equipment required to adjust and balance all heating, ventilating, air conditioning and exhaust systems installed or altered under this Contract.

3.1.2 Check rotation of all fans. Advise appropriate trade if any corrections are needed. Ensure corrections are made before starting any testing or balancing.

3.1.3 Ensure that all control valves, devices and equipment interlocks are operating in the manner required for the correct performance of the systems.

3.1.4 Where existing systems are modified, balance the entire system, including terminals in non-renovated areas.

3.1.5 Carry out testing and balancing under both extreme summer and extreme winter conditions. If you wish to simulate these conditions, obtain approval from the Consultant before beginning work.

3.2 **JOB CONDITIONS**

3.2.1 Schedule this work in cooperation with other trades involved.

3.2.2 Do not begin testing and balancing until the systems have been completely installed, tested and put in running order. Correct operation of equipment and system components and cleanliness of piping and ductwork is the responsibility of the appropriate trade.

3.3 **SUBMITTALS**

3.3.1 Record all test data and submit four copies of completed reports to the Consultant. A copy of the final report to be included in each of the Operation and Maintenance Manuals.

3.3.2 Use data sheets which are approved by the Consultant to record measurements. Include schematic diagrams of all systems identifying branches, inlets, outlets and equipment. Submit sample sheets for review using same procedure as for Shop Drawings.

3.3.3 Provide a Deficiency List to the Contractor for all materials and installation methods which are found not to be complying with the Specifications and, where specified, quantities could not be achieved within the required tolerances. Submit copy of Deficiency List to the Consultant at the same time it is issued to the Contractor.

3.3.4 Submit report in hard cover 3-ring binder, complete with index page, indexing tabs and cover identification at front and side.

3.3.5 Record all test data in SI units.

3.4 **AIR SYSTEMS**

3.4.1 Test and adjust fan speeds and dampers to deliver the required air quantities. For belt-driven fans, determine size of sheaves required to properly balance systems and operate systems at minimum static pressures. Install selected sheaves. Sheaves for new equipment will be supplied by fan supplier. For existing equipment supply and install new sheaves, pulleys and belts as required.

3.4.2 **Constant Volume Systems**: Make pitot tube traverse of main supply and return air ducts to measure total air quantities.

3.4.3 Seal duct access holes with plugs. Do not use duct tape to seal access holes.

3.4.4 Test and adjust each diffuser, grille and register to within 10% of design requirements and also adjust so as to minimize drafts in all areas. After locking balancing dampers at desired position, mark “locked” position on damper for reference purposes.

3.4.5 Coordinate with Section 15600, “Liquid Heat Transfer”, to adjust wire taps on heat pump units to give required air quantities. **Where required air quantities fall between heat pump speeds, use higher speed setting rather than lower one.**

3.4.6 Record data as specified in Clause “Balancing Data”.

3.5 **WATER SYSTEMS**

3.5.1 Prior to mechanical contractor's removal of the existing geothermal heat pump main circulating pumps, visit the site and measure and record the flow rate and pressure drop to the existing borefield loop. Measure and record the existing circulating pump flow rate and pressure drop. Provide a written report to the Consultant. Use these values to reinstate geothermal borefield flow rates after the system changes are complete.

3.5.2 Prior to testing and balancing of these systems:

3.5.2.1 Verify that all new and existing strainers are clean.

3.5.2.2 Check new and existing expansion tanks and ensure that the systems are not air bound and are completely filled with water as required.

3.5.2.3 Check air vents at coils and high points of the systems to verify that all are installed and operating freely.

3.5.2.4 Position all automatic valves, hand valves, and balancing valves for full flow through coils, heat exchangers, heat pumps, individual room heating elements, etc.

3.5.3 Measure and adjust circulating water pump flow capacities to design quantities.

3.5.4 Balance all main branches and terminal equipment where balancing devices are installed. See Piping Schematics for locations. Lock all balancing valves. This includes heat pumps, force flow units and convectors, etc. Balance to within 5% of design requirements.

3.5.5 Mark and record flow readings of balancing devices. Where flow measuring devices are not installed, balance using design temperature differences.

3.5.6 Record data as specified in Clause "Balancing Data".

3.6 **BALANCING DATA**

3.6.1 Include the following information in the test report:

3.6.1.1 **Motors:**

Manufacturer
Model and/or Serial Number
Rated amperage and voltage
Rated kW (hp)
Rated rpm
Corrected full load amperage
Measured amperage and voltage
Calculated kW (hp)
Measured rpm
Sheave size, type and manufacturer

3.6.1.2 **Fans:**

Manufacturer
Model and/or Serial number
Rated L/s (cfm)
Rated rpm
Rated pressure rise
Measured L/s (cfm)
Measured rpm
Measured pressure rise
Pulley size, type and manufacturer
Belt size and quantity
Performance curve by manufacturer

3.6.1.3 **Air Systems (including inlets and outlets):**

Grille, register or diffuser reference number and manufacturer
Grille, register or diffuser location
Design air quantity
Effective area factor and size
Measured air quantity

3.6.1.4 **Heat Transfer Elements (Coils, Convertors etc.):**

Manufacturer and type
Design inlet and outlet temperatures (air and water side)
Design pressure drop (air and water side)
Measured inlet and outlet temperatures (air and water side)
Measured pressure drop (air and water side)
Measured flow rate (air and water side)

3.6.1.5 **Testing and Balancing Instruments:**

Types
Serial Numbers
Dates of calibration

3.7 **DUCT LEAK TESTING**

3.7.1 Perform leakage testing on representative sections, as selected by the Consultant, involving at least 25% of the duct distribution systems. Include all ductwork types (rectangular, round) and pressure classifications in the leak testing.

3.7.2 Test duct systems to the following SMACNA standards.

| Pressure Class | Seal Class | Leakage Class |
|---|---|---|
| All | A | 6 |

3.7.3 Refer to Section 15800, Clause “Duct Leak Testing”.

3.7.4 Test ductwork before ducts are insulated painted or concealed.

3.7.5 Immediately advise Contractor of any defects discovered during test. Retest systems after defects have been corrected.

3.8 **FINAL INSPECTION AND ACCEPTANCE**

3.8.1 After submission of balancing report, arrange a final inspection with the Consultant.

3.8.2 At final inspection recheck points or areas selected by the Consultant.

3.8.3 For each system, if more than 10% of the measurements at the selected recheck stations deviate by 10% or more from those in the Report, then the Report for that system will be rejected as unacceptable.

3.8.4 If Report is rejected, re-balance systems deemed to be unacceptable, submit new Reports, and make reinspection at no extra cost to the Owner.

3.8.5 After acceptance of Reports by Consultant, permanently mark settings of valves, splitters, dampers and other adjustment devices so that adjustment can be restored if disturbed. Type of marking and method of application to be approved by the Consultant.

**END OF SECTION**

INDEX - SECTION 15260

PART 1 - GENERAL



PART 2 - PRODUCTS



PART 3 - EXECUTION

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 15001, “Mechanical General Provisions”.

1.1.2 Under no circumstances may any insulation product containing asbestos fibre be used on this project.

1.1.3 All products used must have a flame spread rating less than 25 and a smoke developed classification not more than 50 when tested in accordance with CAN/ULC-S102-M88.

1.1.4 **Submittals:** Provide shop drawings which include product description, list of materials and thickness for each service and manufacturers' installation instructions.

1.1.5 **Environmental Requirements*:*** Maintain ambient temperature and conditions required by manufacturers of adhesives, mastics and insulation cements.

1.1.6 **Quality Assurance*:*** Insulation materials must be manufactured at facilities certified and registered to ISO 9000 Quality Standard.

1.1.7 **Storage of Materials*:*** Protect materials from dirt, water, chemical and mechanical damage before, during and after installation. Provide and install waterproof sheeting to protect insulation in unfinished areas as required. Remove any damaged materials from the site immediately. Remove and replace at no additional cost any installed materials which are damaged.

1.1.8 **Delivery**: Deliver insulation, coverings, cements, adhesive coatings, etc., to the site in Manufacturer’s original containers with the manufacturer's stamp or label affixed showing flame and smoke ratings of the products, name of manufacturer and brand.

1.2 **DEFINITIONS**

1.2.1 In this Specification, “exposed to view” means all surfaces of all services within Equipment Rooms, Service Corridors, plus all other areas of the building where the services are not enclosed within ceilings or shafts.

1.2.2 In this Specification, “exposed to weather” means all services located outdoors without an architectural enclosure.

1.3 **SHOP DRAWINGS**

1.3.1 Provide shop drawings which include product description, list of materials and thickness for each service and manufacturers' installation instructions.

1.3.2 Submit Shop Drawings in accordance with the Clause “Shop Drawings” in Section 15001 for the following equipment and materials:

- Canvas Covering
- Duct and Piping Insulation Types, noting application for each product
- Finishing Cement
- Lagging Adhesive

- Pipe and Duct Coverings
- Piping Insulation Inserts
- PVC Jackets

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 15001, “Mechanical General Provisions”, Clause “Material and Equipment”.

2.2 **PIPING INSULATION INSERTS**

2.2.1 Make rigid insulation inserts equal in thickness to the adjoining insulation. Use Johns Manville Thermo 12/Gold hydrous calcium rigid pipe insulation. Minimum width should be equal to 50% of pipe circumference. Use the following insert lengths:

| Nominal Pipe Size | | Insert Length | |
|---|---|---|---|
| mm | (inches) | mm | (inches) |
| 40 - 65 | (1-1/2 - 2-1/2) | 250 | (10) |
| 80 - 150 | (3 - 6) | 300 | (12) |
| 200 - 250 | (8 - 10) | 400 | (16) |

2.3 **PIPING INSULATION INSERT SHIELDS**

2.3.1 Use minimum 18 gauge galvanized metal shields. Form shields to fit insulation and extend up to the pipe centre line. Make length 100 mm (4″) less than length of associated insert.

2.4 **PIPE INSULATION**

2.4.1 **Piping**

2.4.1.1 Use Johns Manville Micro-Lok glass fibre insulation with factory applied AP-T Plus jacket. Jacket to consist of aluminum foil vapour barrier reinforced with fibreglass scrim and laminated to a fire resistant kraft facing.

2.4.1.2 In areas exposed to view, finish with Johns Manville Zeston 2000 PVC 0.51 mm (20 mil) thickness “Cut and Curled” jacketing. Use Zeston “Perma-Weld” solvent welding adhesive to permanently seal all PVC joints. Use white jackets.

2.4.2 **Valves and Fittings**: Insulate valves and fittings with factory precut Johns Manville Hi-Lo temp insulation inserts or Johns Manville Microlite 16 kg/m³ (1 lb/ft$^3$) density glass fibre insulation. Finish with Johns Manville Zeston 2000 PVC insulated fitting covers 0.51 mm (20 mil) thickness or finishing cement. Use white jackets.

2.4.3 **Pipe Thickness Schedule**

**Pipe Insulation Schedule**

| Fluid Design Operating Temperature Range (°C) | Insulation Conductivity | | Nominal Diameter (mm) | | | | |
|---|---|---|---|---|---|---|---|
| | Conductivity Range W/(m°C) | Mean Rating Temperature (°C) | less than 25 | 25 to 32 | 40 to 80 | 100 & 150 | 200 & up |
| Heat Pump Systems | | | | | | | |
| Below 4 | 0.033 - 0.039 | 24 | 25 | 40 | 40 | 40 | 40 |
| Domestic Hot Water | | | | | | | |
| 40 & greater | 0.035 - 0.040 | 38 | 25 | 25 | 40 | 40 | 40 |
| Domestic Cold Water (Sanitary and Condensate Drains) | | | | | | | |
| 4 - 24 | 0.033 - 0.039 | 24 | 25 | 25 | 25 | 25 | 25 |

2.4.4 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause “Material and Equipment”:

CertainTeed
Johns Manville
Knauf
Kooltherm
Manson
Ottawa Fibre
Owens Corning
Roxul

2.5 **AIR DUCTS**

2.5.1 On all round ducts, and on rectangular ducts not exposed to view with both dimensions 610 mm (24″) and smaller, use Johns Manville Microlite Type 75 flexible blanket fibreglass insulation with FSK facing. Product must meet the requirements of ASTM C 1290, and include aluminum foil vapour barrier reinforced with fibreglass scrim and laminated to a fire resistant kraft facing. Maximum thermal conductivity 0.042 W/m°C (0.29 Btu-in/hr$^2$ft2°F) in accordance with ASTM C 518. Use 40 mm (1-1/2″) thickness.

2.5.2 On rectangular ducts exposed to view, and on rectangular ducts not exposed to view with one dimension 660 mm (26″) or larger, use Johns Manville Spin-Glas Type 814 rigid fibreglass insulation board, 48 kg/m3 (3 lb/ft3) density, with FSK facing. Product must meet the requirements of ASTM C 612, and include aluminum foil vapour barrier reinforced with fibreglass scrim and laminated to a fire resistant kraft facing. Maximum thermal conductivity 0.033 W/m°C (0.23 Btu-in/hr$^2$ft2°F) at 24°C (75°F) mean temperature. Use 40 mm (1-1/2″) thickness.

2.5.3 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause “Material and Equipment”:

CertainTeed
Johns Manville
Knauf
Kooltherm
Manson
Ottawa Fibre
Roxul

2.6 **FINISHING CEMENT**

2.6.1 Use Ryder hydraulic setting finishing cement.

2.7 **LAGGING ADHESIVE**

2.7.1 Use white Childers CP-50A HV or Fosters 81-42W water based fire retardant lagging adhesive.

2.8 **CANVAS COVERING**

2.8.1 Use UL listed fabric 220 g/m² (6.5 oz/$y^2$) fire retardant canvas covering.

3 Execution

3.1 **GENERAL**

3.1.1 Install all insulation in strict accordance with manufacturer's published recommendations.

3.1.2 Install all insulation continuous through walls and sleeves.

3.1.3 Do not apply insulation until piping has been tested and approved.

3.1.4 Do not insulate unions or flanges at connections to equipment. In these locations, and in all other locations where insulation ends, finish with vapour resistant mastic.

3.1.5 Insulate ALL components of insulated systems unless specifically excluded.

3.1.6 Extend all surface finishes to protect all surfaces, ends and raw edges of insulation.

3.1.7 Patch and make good any existing insulation and covering which is damaged during the work of this Contract. Use material of the same quality as existing.

3.2 **FIRESTOPPING**

3.2.1 Where an insulated pipe passes through a fire separation, use only ULC labelled piping insulation in accordance with ULC Listed firestop system being used. See Section 15001, Clause “Firestopping”.

3.2.2 Extend ULC labelled pipe insulation through fire separation and 50 mm beyond fire separation on both sides. Tightly butt joints and wrap with approved joint tape.

3.3 **PIPING SYSTEMS**

3.3.1 **Sanitary Drainage Systems**: Insulate horizontal sections from funnel floor drains, floor drains, open hub drains, water closets, urinals and flushing rim sinks from fixture to point of connection with soil stacks.

3.3.2 **Other Systems**: Insulate the following piping systems in their entirety:

- Heat Pump Water and Geothermal Heat Pump Water
- Domestic Cold Water (potable, non potable)
- Domestic Hot Water
- Domestic Hot Water Recirculating
- Condensate Drains

3.3.2.1 Use the following Mean Rating Temperatures when selecting insulation thicknesses:

| | | | |
|---|---|---|---|
| Heat Pump Water | : | 4 - 40°C | ( 40 - 105°F) |
| Domestic Hot Water | : | 60 - 93°C | (141 - 200°F) |
| Domestic Cold Water | : | 4 - 13°C | ( 40 - 55°F) |
| Domestic Hot Water Recirculating | : | 60 - 93°C | (141 - 200°F) |

3.3.3 **Insulation Application**

3.3.3.1 **Hanger Points**: Provide an insulation insert and shield at each hanger point on all systems. On cold lines, vapour seal butt joints on each side of insert.

3.3.3.2 **Pipe**: Apply insulation over clean dry pipe. Butt all joints firmly together. Seal all jackets neatly in place. Wrap butt joints with a minimum 75 mm (3″) wide strip of the jacketing material. Use a vapour barrier adhesive on all "cold" lines. Finish with specified jackets in all areas where piping is exposed to view.

3.3.3.3 **Fittings and Valves**

3.3.3.3.1 For pipe sizes 40 mm (1-1/2″) and smaller, insulate with factory precut insulation inserts or with fibreglass blanket wrapped firmly under compression (minimum 2:1) to a thickness matching adjoining insulation. Finish with PVC fitting covers. In areas where insulation is not exposed to view, insulation ends may be mitred at elbows and sealed with tape.

3.3.3.3.2 For pipe sizes 50 mm (2″) and larger, insulate with factory precut insulation inserts. Finish with PVC fitting covers. In areas where insulation is not exposed to view, insulation ends may be mitred at elbows and sealed with tape.

3.3.3.3.3 **Cold Systems and Dual Temperature Systems**: Provide a continuous vapour barrier on the insulation for the following systems:

- heat pump water
- domestic cold water (potable, non potable)
- condensate drains

3.3.3.3.4 On components which require service, fabricate easily removable and reusable insulation sections e.g. suction guides for circulating pumps and pump casings. Test ports on balancing valves to be accessible outside of insulation.

3.3.4 **Pipe Insulation Covering**: In all locations where the insulation will be exposed to view, finish with PVC insulation covering. Use solvent welding adhesive to permanently seal all PVC joints. Taping or tacking of jackets will not be accepted. Follow strictly manufacturer's installation procedures for cold and hot systems. In Public spaces, use white covering.

3.4 **AIR DUCTS**

3.4.1 **General**

3.4.1.1 Seal all vapour retardant jacket seams and penetrations with UL Listed tape and adhesive.

3.4.1.2 See Section 15800, “Air Distribution”, for internal duct insulation. Where ducts are shown on the drawings to be internally lined, external duct insulation is not required.

3.4.1.3 Externally insulate all ductwork specifically identified on the Drawings.

3.4.1.4 Externally insulate all heat pump and other supply air ducts not located in return air plenums (i.e. located over washrooms, change rooms, etc.). External insulation is not required for sections of ductwork shown to have internal lining.

3.4.1.5 Externally insulate the first 1.5 m (5′) of all supply, return and exhaust ductwork adjacent to outside walls or roof.

3.4.1.6 Externally insulate fire damper sleeve assemblies where duct system is internally lined. See Detail Sheet in Section 15001.

3.4.2 **Application**

3.4.2.1 On round ducts adhere insulation to ducts with a flame resistant, quick tacking adhesive. Apply adhesive in 100 mm (4″) wide strips at 200 mm (8″) centres. Butt all circumferential joints and overlap all longitudinal joints a minimum 50 mm (2″). Staple all joints on 150 mm (6″) centres. Tape all joints with minimum 76 mm (3″) wide reinforced vapour barrier tape as recommended by insulation manufacturer.

3.4.2.2 On rectangular ducts, use adhesive and impale insulation over mechanical fasteners. Provide 100% coverage of adhesive on sheet metal, all exposed insulation edges, and all transverse joints. Provide mechanical fasteners per Insulation Manufacturer's published recommendations. Insulate behind duct balancing damper operators.

3.4.3 **Finish**

3.4.3.1 In locations where the insulation will be exposed to view, finish with canvas for rectangular ducts, and white PVC jackets for round ducts. Securely paste canvas on with a two coat application of lagging adhesive over the entire surface. Apply canvas between coats of adhesive, while first coat is still wet. Stretch canvas tight and smooth with overlapping seams located where least visible. Apply second coat of adhesive immediately following application of canvas. Do not use metal bands. For PVC jackets follow instructions for piping system jacketing.

3.4.3.2 Seal canvas with off-white sizing to leave a smooth non-porous surface ready to receive paint application.

3.4.3.3 Self adhesive aluminum covering will be acceptable in lieu of canvas. Follow manufacturer's installation recommendations.

**END OF SECTION**

INDEX - SECTION 15300

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 15001, “Mechanical General Provisions”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Fire Extinguishers**: Provide portable fire extinguishers meeting all requirements of the Ontario Building Code and the Ontario Fire Code.

1.2.2 **Sprinkler System:** Extend the existing sprinkler system to completely protect the renovated area of the Building, as shown on the Drawings. Design the system in accordance with the requirements of NFPA No.13, the Ontario Building Code and Factory Mutual. Follow Factory Mutual guidelines for Occupancy Hazard Classification and water flow rate requirements.

1.3 **SHOP DRAWINGS**

1.3.1 Submit Shop Drawings in accordance with the Clause “Shop Drawings” in Section 15001 for the following equipment and materials:

- Fire Extinguishers and Cabinets
- Sprinkler Heads

1.3.2 See requirements for Design Drawings in Part 3 of this Section.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 15001, “Mechanical General Provisions” Clause “Materials and Equipment”.

2.1.2 Use only material and equipment which is Underwriters' Laboratories of Canada Listed and Factory Mutual approved for the application intended.

2.2 **PIPE AND FITTINGS**

2.2.1 Unless specified otherwise, use standard black steel pipe with screwed or flanged cast iron sprinkler fittings suitable for 1200 kPa (175 psig) pressure, cold water, non-shock. Use screwed or flanged type joints between pipe and fittings or valves. Mechanical type Victaulic or Gruvlok couplings, Canadian Underwriter's Listed and Factory Mutual approved, may be used. Ensure wall thickness of pipe is in accordance with NFPA No. 13 for the type of connections used.

2.3 **FIRE EXTINGUISHERS AND CABINETS**

2.3.1 Use National Fire Equipment Ltd. Model No. ABC-5, 2.3 kg (5 lb) multi-purpose dry chemical extinguishers with a rating of 2A10BC. Provide complete with wall brackets.

2.3.2 In cooking areas and Kitchens without automatic fire suppression systems, use National Fire Equipment Ltd. Model No. PDC-050WWD 5 lb. dry chemical extinguisher with a rating of 10BC.

2.3.3 The following manufacturer of the above equipment will be considered equal subject to requirements of Clause “Material and Equipment”:

Wilson & Cousins

2.4 **SPRINKLER HEADS**

2.4.1 Use ULC listed Tyco quick response sprinkler heads as follows:

- Model RFII concealed sprinkler with white finish in all areas with suspended ceilings, unless shown or noted otherwise
- Upright sprinkler, chrome finish in all areas without suspended ceilings, unless shown or noted otherwise
- Pendant or upright sprinkler, rough bronze finish, guard, in mechanical and electrical rooms without suspended ceilings only (corrosion resistant where noted)

2.4.2 Use wire sprinkler guards with baked synthetic red enamel finish where shown on the Drawings.

2.4.3 Provide Tyco Sprinkler Cabinets with spare sprinklers and accessories. Use minimum 0.9 mm thick (20 gauge) steel cabinets finished in red lacquer and suitably labelled. Cabinets to contain:

- Spare sprinklers of each type per NFPA 13

2.4.4 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Grinnell Fire Protection Systems
Reliable Automatic Sprinkler Co.
Tyco Fire and Building Products
Viking Corp.

3 Execution

3.1 **INSTALLATION**

3.1.1 **Sprinkler System**: Provide complete system extension designed, constructed, installed and tested in accordance with NFPA 13, Factory Mutual and the Ontario Building Code.

3.2 **WATER SERVICE**

3.2.1 Existing shop drawings will be available from the Owner upon request.

## 3.3 DRAWINGS

3.3.1 The Fire Protection Drawings show sprinkler types and locations, main piping layouts and zoning. Use this information as a basis to produce a set of Fabrication Drawings for a sprinkler system which will completely protect all of the building areas. Coordinate the preparation of these Drawings with all other trades to avoid conflict with other services.

3.3.2 Sprinkler systems are to be designed by a Fire Protection Engineer using hydraulic calculations. Engage an Engineer registered with Professional Engineers Ontario who specializes in Fire Protection Engineering and is both qualified and insured in accordance with the requirements of Division C of the 2006 OBC. The Fire Protection Engineer will apply his or her seal to all Fire Protection Drawings prepared for construction. Submit Engineer's proof of liability insurance with Shop Drawings.

3.3.3 The Fire Protection Engineer is to size all piping and indicate sprinkler head and pipe locations on working Drawings. Sprinkler head locations and quantities shown in the Bid Documents are for general layout purposes only, to identify approximate locations and quantities and sprinkler head types to be used. The Contractor is responsible for determining exact locations and quantities of sprinkler heads. Piping locations are shown where critical only. The Contractor is responsible for determining exact locations for piping.

3.3.4 Piping is to be sized to suit available pressure from the city water main without use of a fire pump. Use low pressure requirement sprinkler heads where required.

3.3.5 Provide sufficient number of sprinkler heads, whether shown on the drawings or not, to achieve coverage as required by NFPA 13 and Factory Mutual.

3.3.6 Prepare the Drawings in AutoCAD 2010. Show sprinkler heads on Architectural Reflected Ceiling Plans. Architect will provide AutoCAD drawing files for overlays.

3.3.7 Before starting installation, submit six copies of Fabrication Drawings and Hydraulic Calculations to Factory Mutual for approval. Submit copies of Drawings, duly approved by the Owner's Insurance Underwriters, to the Consultant for final review prior to commencing work. Submit two copies to local Building Department for plan review.

3.3.8 Use sprinkler heads, piping and fittings suitable for the temperature of the environment (e.g. extremes of hot or cold, humidity). Use high temperature heads in Mechanical and Electrical Rooms.

## 3.4 DRAINS, AIR VENTS AND TEST CONNECTIONS

3.4.1 Provide drain cocks with hose thread at all low points of the system not drainable through the main drain valve at service entrance. Provide air vents, flushing and test connections as required to comply with Canadian Underwriters' regulations.

## 3.5 COOPERATION

3.5.1 Cooperate with other trades on the job and so arrange work that no delay is caused to any other trade. Examine all Drawings paying particular attention to lighting fixtures, structural steel, heating and plumbing piping, ductwork and electrical conduit, so that the installation of the sprinkler system will not interfere with other

work.

3.6 **IDENTIFICATION**

3.6.1 Provide every valve with a tag indicating its purpose (i.e. sprinkler drain valve, sprinkler test valve and sprinkler control valve. This is in addition to the tag required for the valve chart. Securely fasten tags to the valves so they are not easily removed.

3.7 **SPRINKLER GUARDS**

3.7.1 Provide guards where specifically identified on drawings.

3.8 **TESTING**

3.8.1 Test complete system in accordance with Underwriters' Laboratories of Canada and Factory Mutual requirements. Notify the Consultant 48 hours prior to testing of all fire protection systems so arrangements can be made to have these tests witnessed.

3.8.2 Test the operation of every valve supervisory device, flow alarm switch and pressure switch.

3.9 **SYSTEM FLUSHING**

3.9.1 Flush the complete sprinkler systems after installation.

3.10 **FIRE EXTINGUISHERS**

3.10.1 Install fire extinguishers in accordance with the manufacturer's recommendations.

3.11 **SPACING OF SPRINKLERS**

3.11.1 Sprinkler heads must be centred **both** ways in ceiling tiles.

3.12 **EXPOSED AREAS**

3.12.1 In all areas exposed to view, provide a decorative grade installation. Pay particular attention to neat pipe layout. Degrease all pipe and fittings, to be suitable for painting. Chrome plate all exposed piping serving window sprinklers.

**END OF SECTION**

INDEX - SECTION 15400

PART 1 - GENERAL



PART 2 - PRODUCTS



PART 3 - EXECUTION

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 15001, “Mechanical General Provisions”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Domestic Cold Water**: Extend system complete with connections to fixtures and equipment requiring cold water connections as shown and/or as specified.

1.2.2 **Domestic Hot Water**: Extend system complete with connections to fixtures and equipment requiring hot water connections as shown and/or as specified.

1.2.3 **Sanitary Drainage**: Extend soil and waste drainage system complete with connections to fixtures and equipment as shown and/or as specified.

1.2.4 **Condensate Drainage**: Provide indirect condensate drainage system complete with connections to fixtures and equipment as shown and/or as specified.

1.3 **SHOP DRAWINGS**

1.3.1 Submit Shop Drawings in accordance with Section 15001, “Shop Drawings” for the following equipment and materials:

- Cleanouts
- Floor Drains
- Plumbing Fixtures
- Shock Absorbers
- Trap Seal Valves
- Valves

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 15001, “Mechanical General Provisions” Clause “Material and Equipment”.

2.2 **PIPE AND FITTINGS**

2.2.1 Select the most economical use of the materials named below. Unless specified or shown otherwise, either material may be used or a combination of materials, whichever provides the greatest economy.

2.2.2 For all piping systems, use only solder and fluxes containing no lead.

2.2.3 **Sanitary Drainage Piping (Including Vent Piping)**: Use cast iron Class 4000 with cast iron fittings and mechanical joints, or copper type DWV to ASTM B306 with cast or wrought copper fittings and soldered joints. For below grade sanitary piping, use PVC pipe and fittings in accordance with ASTM Standard D3034 and CSA B182.1.

2.2.4 **Condensate Drainage Piping**: Use copper Type DWV to ASTM B306 with cast or wrought copper fittings and soldered joints.

2.2.5 **Domestic Water Piping (Hot, Cold, Recirc.)**: Copper, Type "L" with soldered joints and wrought copper fittings. For below grade piping only use Wirsbo Aquapex or Rehau or copper tubing in a PVC sleeve.

2.3 **CLEANOUTS**

2.3.1 Standard TY branch or Y branch and bend, Watts Bolted Cover Cleanout No. CO-450-50. For stack cleanouts, use Watts Ancon No. CO-460 Series complete with "S" Series satin bronze wall access cover and gasketed plug.

2.3.2 Use cleanouts of the same size as drainage pipe on piping up to 100 mm (4″) diameter, not less than 100 mm (4″) on size 150 mm (6″) and 200 mm (8″), and not less than 150 mm (6″) on larger size pipe. No aluminum components will be permitted.

2.3.3 In floor with vinyl or similar finish, use Watts CO-200-T-1-34 inlay type cleanout with round recessed nickel bronze hinged access cover and frame and secondary closure plug.

2.3.4 In concrete floors, use Watts CO-200-RX-50-34 floor level type cleanout with secondary closure plug and XH CI cover.

2.3.5 In carpeted floors, use Watts CO-100-RC-1-34 with secondary closure plug and round nickel bronze access cover, with carpet marker.

2.3.6 In quarry tile floors, use Watts CO-200-S-1-34 square nickel bronze access cover with clear epoxy coating.

2.3.7 In terrazzo floors use Watts CO-200-U-1-34 square nickel bronze access cover with closure plug and clear epoxy coating.

2.3.8 Provide CO-100 bodies and membrane clamps where cleanouts are installed in floors with membranes. Use Watts CO-100-C-RFC-7-1-34 in floors with surface membrane.

2.3.9 Use clear epoxy coating on all nickel bronze finishes.

2.3.10. The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Enpoco
Jay R. Smith
Mifab
Zurn

2.4 **FLOOR DRAINS**

2.4.1 **General**: Use floor drains equipped with trap primer tappings. No aluminum components will be permitted. Provide flashing clamps on all drains installed in floors with membranes.

2.4.2 **All Finished Areas Not Specifically Designated**: Watts Ancon FD-200-5-1 cast iron floor drain with XH, adjustable 140 mm (5-1/2″) diameter Type NB, heavy duty nickel bronze strainer with clear epoxy coating. Provide separate cast iron "P" trap.

2.4.3 **Funnel Floor Drains in Millwork (Drawing Reference FFD)**: Watts Ancon FD-200-EF-1 cast iron floor drain with adjustable heavy duty cast iron grate. Provide separate cast iron “P” trap and Type NB, 100 mm (4″) round funnel.

2.4.4 **Funnel Floor Drains in Unfinished Floor (Drawing Reference FFD)**: Watts Ancon FD-300-G-50 cast iron floor drain with adjustable heavy duty cast iron grate. Provide separate cast iron “P” trap and Type CI, 100 mm x 230 mm (4″ x 9″) oval funnel.

2.4.5 In floors with surface membrane, use Watts Ancon FD-100-C-FC7-1 with strainer and surface membrane clamp.

2.4.6 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Enpoco
Jay R. Smith
Mifab
Zurn

2.5 **VALVES**

2.5.1 Use valves of same manufacturer except where approved otherwise by the Consultant.

2.5.2 Use the following valves for all piping systems provided by this Section, unless specified otherwise. Use rising stem where space permits. Use flanged, screwed or solder ends to suit pipe lines, and non-heating malleable iron handles.

2.5.3 Use only industrial class valves complying with ANSI, ASTM, ASME and applicable MSS Standards.

2.5.4 Unless otherwise specified, use valves designed for 1380 kPa (200 psig) CWP (cold working pressure) minimum. Use rising stem where space permits. Use flanged, screwed, or soldered ends to suit pipe lines, and non-heating malleable iron handles. Use valves which are repackable under pressure. Use valves with extended valve stems where piping is to be insulated.

2.5.5 All valves must have a valid and current Canadian Registry Number (CRN).

2.5.6 All new valves and fittings to be lead free to meet California Standard AB1953 for Lead Free Plumbing Fixtures with lead content below 0.25%.

2.5.7 **Domestic Water Systems**

2.5.7.1 **Ball Valves**: For sizes 50 mm (2") and under, use 1034 kPa (150 psig) / 600 W.O.G., Brass Body to ASTM C49300 (Lead Free Brass), Full Port, PTFE Seats, Double "O" Ring or Teflon packing, TEA Plated Forged Brass C49300 Vented Solid Ball, Blowout Proof Stem, Lever Handle.

Screwed Ends - Kitz 858
Solder Ends - Kitz 859

2.5.7.2 **Check Valves**: Check Valves: For sizes 50 mm (2") and under, use 860 kPa (125 psig) / 200 W.O.G. bronze body to ASTM C89530 (Lead Free Bronze), Screwed Cap C49300 (Lead Free Brass), Integral Seat, PTFE Disk.

- Swing "Y" Pattern
- Screwed Ends - Kitz 822T
- Solder Ends - Kitz 823T

2.5.7.3 **Drain Hose Connections**: Use Kitz 68C bronze body ball valve, 4140 kPa (600 psig) CWP complete with brass threaded cap and chain.

2.5.8 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

| | |
|---|---|
| Jenkins | (Industrial Class) |
| Kitz | (Industrial Class) |
| Nibco | (Industrial Class) |

## 2.6 SHOCK ABSORBERS

2.6.1 Provide Ancon SG Series or P.P.P. SC Series shock absorbers ahead of all solenoid valves, flush valves, or other quick-closing valves. Provide in other locations where shown on Drawings.

2.6.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Jay R. Smith
P.P.P.
Mifab
Zurn

## 2.7 ESCUTCHEON PLATES

2.7.1 Provide one piece, brushed aluminum escutcheon plates at all points where pipes pass through walls, floors or ceilings into finished areas.

## 2.8 TRAP SEAL VALVES

2.8.1 PPP, P Series trap primer valves. Provide chrome plated finish In exposed locations.

2.8.2 Proset trap guard drain inserts may be used in lieu of trap seal valves.

2.8.3 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Jay R. Smith
Zurn

## 2.9 PLUMBING FIXTURES

### 2.9.1 General

2.9.1.1 Provide white fixtures unless specified otherwise. Use only first quality fixtures. Warped or distorted fixtures will not be accepted. Use fixtures of a single manufacturer only where possible. Likewise use a single manufacturer for faucets, supplies and drains.

2.9.1.2 All plumbing fixtures and faucets to meet California Standard AB1953 for Lead Free plumbing fixtures, with lead content below 0.25%.

2.9.1.3 Provide rigid spouts in all faucets except in kitchen and staff room.

2.9.1.4 Use only new plumbing fixtures, certified by CAN/CSA-B45.0 and closet seats, fittings and trim, certified by CAN/CSA B125, and free from cracks, scratches, wrench marks, or imperfections of any kind. Replace any permanently stained, chipped or marred fixtures or connections.

2.9.1.5 Use factory chrome plated items for all visible parts of the fixture trim including faucets, escutcheons, waste, strainers, traps, supplies, stops, etc.

2.9.1.6 Unless specified otherwise, the following manufacturers of the above equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

- Plumbing Fixtures - American Standard, Kohler, Eljer
- Plumbing Brass - Delta Commercial, Chicago Faucets, T&S
- Water Closet Seats - Beneke, Centoco, Viceroy
- Stainless Steel Sinks - Franke/Kindred Canada, Architectural Metal Industries

### 2.9.2 Fixture Carriers

2.9.2.1 **Lavatories**: Watts Ancon Series 400 heavy duty carriers to support all wall hung lavatories independent of the wall.

2.9.2.2 The following manufacturers of the above equipment will be considered equal, subject to the requirements of Clause “Material and Equipment”:

Jay R. Smith
Watts
Zurn

### 2.9.3 Water Closet (Drawing Reference WC1) (Floor Mount Tank Barrier Free)

2.9.3.1 **Bowl**: American Standard Cadet3 Model 2386.500 barrier free, floor-mounted, two piece vitreous china water closet with elongated bowl, 80 mm (3″) flush valve, lined tank. 1 kg MaP test performance. Use brass floor flange.

2.9.3.2 **Supply**: McGuire H166LKN3-BALL heavy duty ball valve supply, chrome plated, polished, rigid horizontal with vandalproof loose key angle stop, escutcheon and flexible riser.

2.9.3.3 **Seat**: Centoco No. 820STS Seat, elongated, heavy duty solid plastic white open front seat with cover, reinforced stainless steel check hinges, stainless steel posts, washers and nuts.

2.9.4 **Lavatory (Drawing Reference LA1) (Wall Hung Barrier Free)**

2.9.4.1 **Lavatory**: American Standard 0954.000 Murro, barrier free vitreous china wall-hung basin with overflow, for concealed wall hanger, 100 mm (4″) centres.

2.9.4.2 **Faucet:** Chicago Faucets Ecast 802-V317XKCP faucet, chrome plated, 100 mm (4″) centres, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, with vandal resistant 1.9 lpm (0.5 gpm) spray aerator outlet and cast brass 100 mm (4″) blade handles.

2.9.4.3 **Supply**: McGuire H170BVRB supply, heavy pattern, chrome plated, polished, short rigid horizontal integral sweat tubes with vandalproof loose key ball valve angle stop, escutcheon and braided flexible riser.

2.9.4.4 **Drain:** McGuire 155A drain, chrome plated with open grid strainer. McGuire 8872C P Trap, 32 mm (1-1/4″), chrome plated, polished cast brass with cleanout and escutcheon.

2.9.5 **Double Compartment Sink (Drawing Reference SS1) ( Double Sink)**

2.9.5.1 **Sink**: Franke Kindred Commercial LBD6408, 790 mm x 520 mm x 200 mm (31-1/4″ x 20-1/2″ x 8″) 18 gauge, Type 304 stainless steel double bowl countertop sink, with back ledge drilled for 200 mm (8″) centre faucet set. Sink complete with 90 mm (3-1/2″) crumb cup strainers and 40 mm (1-1/2″) tailpieces, self-rimming with gasket and hold down clamps.

2.9.5.2 **Faucet**: Delta Commercial 26C3233 deck mounted faucet, chrome plated, 200 mm (8″) centres, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, 200 mm (8″) cast brass tubular swing spout with 6 lpm (1.5 gpm) vandal resistant flow aerator outlet and cast brass 80 mm (3″) lever handles. Provide stops on supply piping and wall escutcheons.

2.9.5.3 **Waste**: Cast brass P trap 40 mm (1-1/2″) with unions, cleanout and escutcheon.

3 Execution

3.1 **SANITARY PIPING**

3.1.1 Where pipe sizes are not shown on the Drawings and are not specified, size in accordance with the requirements of the Ontario Plumbing Code.

3.1.2 Install piping and connect to, or rough-in for, all fixtures as shown or as specified. Conceal piping in walls or ceilings in finished areas. Where sewers pass under footings, backfill with lean concrete.

3.1.3 Use the following minimum slopes on horizontal drains, unless indicated otherwise on the Drawings:

| | |
|---|---|
| Fixture waste or drains | 2% |
| Drains up to and including 80 mm (3″) | 2% |
| Drains 100 mm (4″) and up to 150 mm (6″) | 1% |
| Drains over 150 mm (6″) | 0.5% |

## 3.2 UNIT DRAIN CONNECTIONS

3.2.1 Connect up all drains, condensate drains from heat pumps. Run drains to funnel floor drains or open hub drains without crossing or interfering with walkways.

## 3.3 VENTING

3.3.1 Vent all fixtures in accordance with local and provincial regulations. Run vents as directly as possible and grade properly to drain back to the fixture connection. Connect the bottom of all vent stacks into soil or waste stacks for drainage. Conceal vents in walls and ceilings in finished areas. Carry vent stacks through roof where shown or where required and project at least 600 mm (24″) above roof deck.

## 3.4 FLASHING

3.4.1 Carry vent, waste and soil stacks through roof where shown on Drawings or where required. Use materials specified in Section 15001 and make a watertight joint at roof. Supply all flashing materials.

## 3.5 CLEANOUTS

3.5.1 Install cleanouts behind walls so that the bolted cover on the cleanout will be within 25 mm (1″) of the finished wall. Wall cleanout access doors to be installed minimum 200 mm (8″) above finished floor.

3.5.2 Conceal cleanouts in finished walls with access doors. See Section 15001 “Mechanical General Provisions” for access doors.

3.5.3 Place cleanouts where shown, at end of all drainage lines, at all changes of direction greater than 45°, and at the base of all stacks.

3.5.4 Bring cleanouts up to floor level in all buried pipe and in all horizontal runs above grade where specifically shown. For all other cleanouts in horizontal runs above grade, leave with access from ceiling space. Bring cleanouts in concealed vertical pipes to a wall surface.

3.5.5 Locate floor cleanouts clear of fixed furniture and equipment. In corridors, locate cleanouts near walls but clear of wall base.

## 3.6 WATER PIPING

3.6.1 Connect required service to plumbing fixtures, hose bibbs, etc., as shown or as specified.

3.6.2 After installation, thoroughly flush out complete system of water piping and remove all scale, etc.

3.7 **VALVES**

3.7.1 Install a valve at takeoff point in each main branch which takes off from main and in all locations shown.

3.7.2 Install drain valves with hose connections at all low points and at all branch valves for upfeed risers.

3.7.3 Use line size ball valves unless noted otherwise.

3.8 **PLUMBING FIXTURES**

3.8.1 Provide compression type shutoff valves or ball valves at each fixture in addition to the faucets on each fixture. For countertop sinks, use ball valves.

3.8.2 Where fixture connections pass into walls, floors, or ceilings, provide proper escutcheons.

3.8.3 When installing accessories, take great care to avoid marring chrome plating. Wrench or other tool marks on the plating will be sufficient cause for rejection.

3.8.4 Unless shown otherwise, use the following sizes of hot and cold water and waste connections to fixtures:

| Fixture | Hot Water | Cold Water | Waste |
|---|---|---|---|
| mm (in) | mm (in) | mm (in) | mm (in) |
| Lavatory | 15 (1/2) | 15 (1/2) | 32 (1-1/4) |
| Water Closet (Flush Tank) | ---- | 20 (3/4) | 80 (3) |

3.8.5 Caulk all around bases of water closets, lavatories, wash fountains and other built-in equipment. Seal all edges which abut walls and floors.

3.8.6 Mount fixtures with finished floor to rim dimensions as follows:

| **Drawing Reference** | **Height mm (in)** |
|---|---|
| LA1 | 610 (24) |

3.8.7 Confirm all mounting heights with Architect prior to roughing in.

3.9 **VACUUM BREAKERS AND BACKFLOW PREVENTERS**

3.9.1 Provide vacuum breakers and backflow preventers on all plumbing fixtures and equipment where required by Ontario Plumbing Code.

3.9.2 Size vacuum breaker to suit maximum design flow rates of fixture or equipment served.

3.9.3 Install backflow preventers in accordance with CAN/CSA-B64.10, Manual for the Selection, Maintenance and Field Testing of Backflow Prevention Devices, including mounting height and clearance recommendations.

3.10 **ROUGHING-IN**

3.10.1 Where shown on Drawings, rough-in hot and cold water systems, drain and vent.

3.10.2 Cap off all piping and provide shutoff valves on hot and cold water branch piping.

3.11 **STERILIZATION OF POTABLE WATER SYSTEMS**

3.11.1 All chlorination and sampling must be completed and tested by a person holding a Water Distribution Licence Class 1 thru 4 and sampling submitted to an accredited laboratory. Provide certified reports.

3.11.2 Thoroughly flush the domestic hot and cold water piping systems using clean potable water to remove dirt and other contaminants. Remove all faucet screens prior to flushing and reinstall after completion of flushing.

3.11.3 Disinfect domestic hot and cold water piping systems using a liquid chlorine solution. Introduce the liquid chlorine to ensure the chlorine is distributed throughout the sections being tested. Apply chlorine to a achieve a minimum chlorine concentration of 10 mg/L throughout the sections being tested. Leave the 10 mg/L chlorine solution in place for 24 hours.

3.11.4 Test the chlorine residual after 24 hours. If tests show a minimum chlorine residual of 5 mg/L, flush the disinfected sections and recharge with potable water. If the chlorine residual is found to be less than 5 mg/L, repeat the disinfecting procedure until satisfactory results are obtained.

3.11.5 After the systems have been flushed and recharged with potable water, arrange and pay for bacteriological tests to be conducted by an independent testing agency. Provide certified reports. If there is evidence of contamination, repeat the disinfecting procedure until satisfactory results are obtained. Obtain the Building Inspector’s permission before placing the systems in normal operation.

**END OF SECTION**

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 15001, “Mechanical General Provisions”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Heat Pump Water System**: The existing geothermal water source heat pump system serves the building and will be extended to serve the renovation.

1.3 **SHOP DRAWINGS**

1.3.1 Submit Shop Drawings in accordance with Section 15001, Clause “Shop Drawings”, for the following equipment and materials:

- Automatic Air Vents
- Combination Shutoff and Balancing Valves
- Flexible Connectors
- Heat Pumps
- Strainers
- Valves

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 15001, “Mechanical General Provisions” Clause “Material and Equipment”.

2.2 **PIPING AND FITTINGS**

2.2.1 **General**

2.2.1.1 Use the following materials for all piping systems provided by this Section.

2.2.1.2 Use long radius elbows. Where the mains are 100 mm (4″) diameter or greater and where branches are smaller by two pipe sizes or more, cut-ins will be permitted. For all other branch connections, use manufactured tees.

2.2.1.3 For flanged connections use stainless steel spiral wound graphite gaskets and high tensile strength bolts, nuts and washers. Use welding neck, RF flanges.

2.2.2 **Water Piping for Sizes 50 mm (2″) and Smaller**. Use either copper or steel pipe as follows:

2.2.2.1 **Copper**

**Pipe** - Type L hard drawn copper
**Joints** - Solder
**Fittings** - Wrought copper or cast bronze
**Unions** - 1030 kPa (150 psig) octagon end, bronze

2.2.2.2 **Steel**

**Pipe** - Black steel, Schedule 40, ASTM A-53B
**Joints** - Screwed
**Fittings** - 860 kPa (125 psig) cast iron
**Unions** - 1030 kPa (150 psig) malleable iron, brass to iron ground joint seat

2.2.3 **Water Piping for Sizes 65 mm (2-1/2″) and Larger:**

**Pipe** - Black steel, Schedule 40, ASTM A-53B
**Joints** - Welded and flanged
**Fittings** - 1030 kPa (150 psig) Schedule 40 steel
**Unions** - 1030 kPa (150 psig) slip-on

2.3 **VALVES**

2.3.1 **General**

2.3.1.1 Use the following valves for all piping systems provided by this Section, unless specified otherwise.

2.3.1.2 Use only industrial class valves complying with MSS Specification SP-80.

2.3.1.3 All valves supplied for this project shall have a current and valid Canadian Registration Number for the Province of Ontario with TSSA. Upon request, suppliers shall provide a copy of statutory declaration for valves, stamped, signed and dated by TSSA as validation of the CRN registration.

2.3.1.4 All valves to have extended locking handles complying with MSS Specification SP-80.

2.3.2 **Ball Valves**

2.3.2.1 Kitz 68/69, bronze body, full port (CGA approved) with stainless steel ball and stem. Use valves with extension stems when installed in insulated piping. Use locking lever handle where “lockable valve” is noted on the Drawings.

2.3.2.2 The following manufacturers of the above two items of equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Jenkins
Kitz
Nibco

2.3.3 **Combination Balancing and Shutoff Valves**

2.3.3.1 Use T&A combination balancing and shutoff valves with ANSI flanges and locking adjustment.

2.3.3.2 Balancing Valves will all be designed for flow measurement, flow balancing and positive shutoff. Size valves in accordance with manufacturer's published guidelines. Provide extended differential ports to enable access without removing insulation.

2.3.3.3 Valves to be calibrated globe style with differential ports providing flow measurement, balancing and positive shutoff. Do not exceed 910 mm (3′) head at fully open position.

2.3.4 **Drain Hose Connections**

2.3.4.1 Full port, bronze body ball valves with stainless steel stems and ball – Kitz 68 with brass hose adaptor, cap and chain.

2.3.4.2 The following manufacturers of the above item of equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Jenkins
Kitz
Nibco

2.4 **STRAINERS**

2.4.1 Use Spirax Sarco Y-type removable stainless steel strainers, maximum P. D. 6 kPa (0.9 psig). Use line size strainers. Ahead of all circulating pumps, use 3.2 mm (1/8″) perforations. Use 1.6 mm (1/16″) perforations in all other locations.

2.4.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Armstrong
A. S. Leitch
Colton
Morrison Brass
Victaulic

2.5 **FLEXIBLE CONNECTORS**

2.5.1 For connections to large circulating pumps, where noted on the vibration isolation equipment schedule, use Kinflex Model FTC rubber spherical pump connectors with restraining tie rods.

2.5.2 Use Flexonics BSF and BSN flexible connectors with stainless steel flexible metal hose, stainless steel braid and carbon steel ends. On pipes 50 mm (2″) and smaller, use screwed connections. On pipes 65 mm (2-1/2″) and larger, use flanged connections. Minimum 1030 kPa (150 psi) working pressure at 120°C (250°F). Use line sized connectors. Minimum lengths as follows:

| Pipe Size mm (in) | | Minimum Connector Length mm | (in) |
|---|---|---|---|
| 20 | (3/4) | 300 | (12) |
| 25 | (1) | 300 | (12) |
| 40 | (1-1/2) | 450 | (18) |
| 50 | (2) | 450 | (18) |
| 80 | (3) | 450 | (18) |
| 100 | (4) and larger | 600 | (24) |

2.5.3 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Thorburn Equipment
Vibrant Power

2.6 **AUTOMATIC AIR VENTS**

2.6.1 Use Spirax Sarco Canada Type 13W, AWN-150, 1030 kPa (150 psig) float type air vents with semi-steel body and cap, stainless steel float, stainless steel valve seat and neoprene valve head.

2.6.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause “Material and Equipment”:

Hoffmann

2.7 **HEAT PUMPS**

2.7.1 The heat pumps will be purchased by the Owner and turned over to the Contractor. Contractor is responsible for receiving, installing and commissioning the heat pumps

2.7.2 Use McQuay SmartSource water source heat pumps, A.R.I. certified and CSA approved and fully charged with R-410A in all sizes. All units to meet the efficiency requirements of ASHRAE 90.1-2010. Units to consist of DX air coil, compressor, blower, water coil, condensate drain pan, capillary tube expansion device, filter, reversing valve and controls. See Equipment Schedule for sizes and capacities. See the Schedule to determine if the heat pumps are vertical or horizontal.

2.7.3 Casing and cabinet fabricated from powder coated, heavy gauge galvanized steel. Internally insulated with 10 mm thick (3/8″) thickness closed cell foam. Provide removable panel for access to fan, compressor and control box compartment. Units to have insulated stainless steel drain pan and solid state electronic condensate overflow protection switch.

2.7.4 Refrigerant circuit to include a rotary compressor (sizes to 018) or scroll compressor (sizes 024 and larger), capillary expansion tubes, finned tube heat exchanger, reversing valve, water to refrigerant coaxial heat exchanger, access valves and safety controls. Equip compressors with external vibration mounts and thermal overload protection. Heat exchangers rated for 2756 kPa (400 psig) on water side and 3450 kPa (500 psig) on refrigerant side.

2.7.5 Unit to include direct drive, forward curved centrifugal fan with a multi-speed, ECM type fan motor isolated from the fan housing with integral mounting brackets. Include on board controller with manual ECM motor speed adjustment dial. Fan wheels to be dynamically balanced. See Drawings for locations of fan outlets.

2.7.6 Provide control box which includes: controls for compressor, reversing valve, and fan motor; 50 VA control power transformer, and a terminal block for low voltage field wiring connections. Operating and safety controls to include: low suction temperature (freezestat) switch; high refrigerant pressure lock out switch; compressor overload protection; and supply fan overload protection.

2.7.7 Provide means to remotely resetting each individual heat pump from the future Building Control System. Use a unit mounted relay to interrupt power to the heat pump control board on signal from the building automation system. Signal from the control system can be 24 V, 120 V or 0-10 V.

2.7.8 Units to have microprocessor based control system. Unit control logic to provide heating and cooling operation as required by the thermostat / temperature sensor. Each standalone control system to provide the following:

- time delay compressor operation
- delayed de-energization of the reversing valve
- compressor short cycle protection
- random unit startup
- high refrigerant pressure alarm
- low suction pressure alarm
- brownout alarm
- service diagnosis

In addition the microprocessor to include the following functions based on remote signals (future):

- emergency shutdown
- night setback override
- pump restart on night setback

The microprocessor control board to include the following diagnostic functions:

- normal node
- high pressure fault
- low temperature fault
- condensate overflow
- brown-out
- load shed
- unoccupied mode (future)
- emergency shutdown

Provide “Fan”, “Cool”, “Heat” inputs and dry contacts for alarm output (future).

2.7.9 Provide neoprene vibration isolation pads for vertical heat pumps, as well as 860 kPa (125 psi) at 50°C (120°F) working pressure flexible connector hoses with stainless steel braid, bronze ends and one swivel end.

2.7.10 All horizontal units to include hanger bracket and rubber isolator kit for field installation, as well as 860 kPa (125 psi) at 50°C (120°F) working pressure flexible connector hoses with stainless steel braid, bronze ends and one swivel end.

2.7.11 Provide 50 mm (2″) thick pleated typ MERV 13 filters serviceable from either side with a duct collar for ducted return connections. Provide gasketed filter rack to reduce leakage and filter bypass. Provide one additional set of filters for each unit.

2.7.12 Heat pump units to have extra quiet construction including mass plate and additional sound insulation. Include optional sound package which features sound attenuating compressor blankets combined with sound attenuating material strategically applied within the air handling compartment to further reduce sound transmission. Sizes 007

to 019 will have sound attenuating material in the compressor compartment in lieu of compressor blankets.

2.7.13 In addition to the one year full warranty as specified in Section 15001 “Mechanical General Provisions”, provide an additional three year warranty on all parts, including the ECM fan motor, compressor, and the entire refrigeration circuit.

2.7.14 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Florida Heat Pump
Trane
Carrier

3 Execution

3.1 **PIPING**

3.1.1 **General**

3.1.1.1 Use flanges or unions on all piping connections to equipment.

3.1.1.2 Support all piping connected to isolated equipment with spring hanger supports for at least the first three support points.

3.1.1.3 See Section 15001 “Mechanical General Provisions” Clause “Piping”.

3.1.2 **Water Piping**

3.1.2.1 Provide drain valves with hose connections at base of all risers, at all low points in piping distribution, and at low points on all equipment connections. Drain valves to be ball valves.

3.1.2.2 For upfeed take off top of pipe. For downfeed take off bottom of pipe.

3.2 **VALVES**

3.2.1 Unless specifically noted, shown or specified otherwise, shutoff valves may be either butterfly valves or ball valves. Do not use ball valves for sizes greater than 50 mm (2″). Where butterfly valves are required to isolate a piece of equipment, provide an extra set of flanges if necessary to allow removal or repair of equipment without disturbing valves.

3.2.2 Use line sized valves unless shown or specified otherwise.

3.3 **AIR VENTS**

3.3.1 Provide automatic air vents at all high points in piping system and at all points where piping drops to form loops.

3.3.2 Use manual air vents only where shown or specified.

3.3.3 See Detail Sheet included with Section 15001 “Mechanical General Provisions” for installation requirements.

## 3.4 VIBRATION CONTROL EQUIPMENT

3.4.1 Install all vibration control equipment supplied by the manufacturer for equipment provided by this trade.

3.4.2 Use vibration isolators on all piping connected to vibrating equipment in mechanical rooms. Install all flexible pipe connectors and hangers as per manufacturer's instructions.

## 3.5 HEAT PUMP SYSTEM

3.5.1 Provide the services of a factory trained representative to be present at system startup and to instruct the Owner in system operation.

3.5.2 Install isolators and control valves which are supplied with individual heat pump units.

3.5.3 Install heat pumps so that they can easily be removed for servicing.

3.5.4 Connect supply and return piping together to allow for chemical cleaning of system. Do not connect heat pump units to piping system until after system is chemically cleaned.

3.5.5 Wire the standalone controller to the heat pump. All work to be in accordance with the manufacturer’s recommendations.

## 3.6 ACCESS DOORS

3.6.1 Provide access doors with quick fastening latches for access to all dampers, coils, thermostats, valves and any other concealed devices which require servicing.

## 3.7 COMBINATION SHUTOFF AND BALANCING VALVES

3.7.1 Provide water flow balancing valves and flow meters in all locations shown. Install in accordance with manufacturer's recommendations.

## 3.8 FLEXIBLE CONNECTORS

3.8.1 Install flexible connectors where shown. See Detail Sheet included with Section 15001, “Mechanical General Provisions” for pump isolation.

## 3.9 AIR AND WATER SYSTEM TESTING AND BALANCING

3.9.1 Cooperate with and assist the air and water testing and balancing company. See Section 15200, “Testing and Balancing”.

3.9.2 Change wire taps on individual heat pump units to allow for proper air balancing.

3.9.3 Be responsible for the initial alignment and tension of all fan pulleys and belts.

3.9.4 Provide any changes to fan drives, pulleys and belts as required to allow a proper air balance as recommended by the Testing and Balancing Company for equipment supplied under this Contract.

**END OF SECTION**

INDEX - SECTION 15800

PART 1 - GENERAL



PART 2 - PRODUCTS



PART 3 - EXECUTION

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 15001, “Mechanical General Provisions”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Heat Pump Water System**: A geothermal water source heat pump system serves the building and will be extended to suit the renovations.

1.3 **SHOP DRAWINGS**

1.3.1 Submit Shop Drawings in accordance with Section 15001, Clause “Shop Drawings” for the following equipment and materials:

- access doors
- backdraft dampers
- duct sealer
- ductwork gauges, material and methods of support for each pressure type, shape (i.e. round, rectangular) and size range.
- exhaust fans
- flexible ductwork
- fire dampers
- grilles, registers and diffusers
- range hood

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 15001 “Mechanical General Provisions”, Clause “Material and Equipment”.

2.2 **DUCTWORK**

2.2.1 **Standards**: Construct all ductwork in accordance with the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Manual “HVAC Duct Construction Standards - Metal and Flexible”.

2.2.2 **Materials**: Unless specified otherwise, fabricate all ductwork from galvanized steel. Use SMACNA recommended thicknesses except where specified otherwise. Where aluminum construction is shown or specified, use utility grade aluminum. For aluminum construction, use equivalent to galvanized steel to aluminum thickness adjustments as listed in current SMACNA Manual “HVAC Duct Construction Standards - Metal and Flexible”.

2.2.3 **Rectangular - Low Pressure**: Use SMACNA 2″ W.G. pressure class. Use SMACNA recommended sheet metal thicknesses.

2.2.4 **Rectangular - Medium Pressure**: Fabricate according to current SMACNA standards for static pressures in duct up to 1490 Pa (6″ W.G.).

2.2.4.1 Where round ductwork is exposed to view, a decorative grade installation is required. Arrange for special handling and shipping to avoid dents and minimize scratches.

2.2.5 **Flexible Type Round Ducts**

2.2.5.1 Where not exposed to view, use Thermaflex Type M-KC or FlexMaster equivalent insulated flexible duct with a woven fibreglass fabric core with a flame resistant coating permanently bonded to a coated wire helix. Minimum positive pressure rating of 4 kPa (16"w.g.) for sizes 100 to 250 mm (4 to 10 ″) and 2.5 kPa (10″ w.g.) for sizes 300 to 410 mm (12 to 16″). Insulate duct with minimum 40 mm (1-1/2″) thickness of 12 kg/m³ (0.75 lb/ft³) density fibreglass and bidirectional reinforced metallized film outer vapour barrier.

2.2.5.2 Flexible ductwork will not be permitted where exposed to view.

2.2.5.3 Flexible duct must bear ULC approval labels and conform to flame spread and smoke developed ratings as required by the Ontario Building Code.

2.3 **FIRE DAMPERS**

2.3.1 Use only dynamic type fire damper assemblies tested in accordance with CAN4-S112-M "Standard Method of Fire Test of Fire Damper Assemblies" and listed in most recent ULC "List of Equipment and Materials" or by another recognized independent testing and certification agency acceptance to the Consultant. Label each damper to indicate compliance with these requirements. Provide fusible links with a 70°C (158°F) rating unless noted otherwise on Drawings. Links shall comply with ULC-S505 "Standard for Fusible Links for Fire Protection Service". Fabricate all dampers from galvanized steel except in copper and aluminum duct systems. In these systems, use all stainless steel construction.

2.3.2 Provide damper assemblies whose fire protection ratings comply with Ontario Building Code requirements for the fire resistance ratings of the fire separations through which the protected openings pass. Provide an approval label, stating the fire rating, from a recognized independent testing laboratory acceptable to the Consultant, on each assembly.

2.3.3 For ducts with either face dimension of 300 mm (12″) or less, and for all medium pressure ducts, use low resistance type dampers with 100% free area.

2.3.4 Provide with each fire damper, detailed installation instructions. Include illustrations and adequate information to attain proper and safe installation of the fire damper assemblies.

2.3.5 The products of the following manufacturers will be considered equal, subject to the requirements of Clause "Material and Equipment":

Alumavent
Controlled Air Mfg. Limited.
Nailor Industries Inc.
Ruskin

## 2.4 EXHAUST AIR FANS

### 2.4.1 General

2.4.1.1 See Equipment Schedules on Drawings for types, details and capacities.

2.4.1.2 Provide felt edged backdraft dampers on all systems which are not provided with automatic control dampers.

2.4.1.3 Provide lifting lugs with all fans

2.4.1.4 Size V-belt drives for 150% of motor nominal horsepower. Provide belt guards.

2.4.1.5 Use fixed drive pulleys on fans greater than 0.75 kW (1 hp). Use adjustable drive pulleys on fans 0.75 kW (1 hp) or less. See Section 15001 for required motor efficiencies.

2.4.1.6 All steel fan components to be coated with electrostatically applied, baked polyester powder coating. Each component to be coated with minimum 2 mil thick baked powder finish. Paint must exceed 1,000 hour salt spray under ASTM B117 test method.

2.4.1.7 Use arrangement and motor location to suit fan location.

2.4.1.8 Use heavy duty ball or roller type bearings, regreasable, designed specifically for HVAC applications. L10-200,000 hours minimum. Provide extended grease fitting where required for easy access.

2.4.1.9 Use fan classification in accordance with A.M.C.A. Pressure Limitations. Use a minimum of Class I construction on all fans unless specified otherwise. Ensure all selections are will accommodate at least 10% speed increase before class change is required. Upgrade to higher construction class if this condition is not met. Submit certified Fan Performance Curves and fan sound level ratings based on A.M.C.A. Standards to the Consultant with Shop Drawings.

2.4.2 **Ceiling Exhaust Fans**: Use Panasonic exhaust fan, complete with backdraft damper, acoustically insulated housing and air inlet grille. Use centrifugal wheel with motor suitably grounded and mounted on rubber vibration isolators. Locate terminal box inside housing.

## 2.5 BACKDRAFT DAMPERS

2.5.1 Use Ruskin Model CBD-6 heavy duty, extruded aluminum backdraft dampers with counter balance. Use 3.2 mm (0.13″) aluminum frame, 1.8 mm (1/16″) aluminum blades with vinyl edge seals and nylon bushings.

2.5.2 The following manufacturer of the above equipment will be considered as equal, subject to requirements of Clause “Material and Equipment”:

NCA
Price

## 2.6 INTERNAL DUCT LINING

2.6.1 Use Schuller/Manville “Permacote Linacoustic” fibreglass duct liner with air stream surface protected with “Permacote”, acrylic coating. Coating to be treated with anti-microbial agent so as not to support growth of fungus or bacteria as determined by ASTM G21 and G22. Liner to meet or exceed Life Safety Standards as established by NFPA 90A and 90B, have a NRC not less than 0.7, and a thermal conductivity of 0.36 W/m.K (0.0208 Btuh x ft x °F) at 23.9°C (75°F).

2.6.2 The following manufacturers of the above equipment will be considered as equal, subject to requirements of Clause “Material and Equipment”:

Knauf
Manson
Fiberglas

## 2.7 DUCT ACCESS DOORS

2.7.1 Use Nailor Industries Inc. 0800 Series duct access doors. For duct dimension up to 300 mm (12″) use 250 mm x 150 mm (10″ x 6″) door. For duct dimension up to 600 mm (24″), use 380 mm x 250 mm (15″ x 10″) door. For all larger ducts, use 660 mm x 510 mm (26″ x 20″) door.

2.7.2 For insulated ducts, use doors factory insulated with 25 mm (1″) thick fibreglass insulation.

2.7.3 The following manufacturer will be considered equal, subject to the requirements of Clause “Material and Equipment”:

NCA
Price

## 2.8 FLEXIBLE DUCT CONNECTORS

2.8.1 Use Duro Dyne “Durolon” or Ventfabrics “Ventlon” pre-assembled flexible duct connectors with 150 mm (6″) fabric width.

2.8.2 The following manufacturer will be considered equal, subject to the requirements of Clause “Material and Equipment”:

Thorburn

## 2.9 GRILLES, REGISTERS AND DIFFUSERS

2.9.1 Use E. H. Price Limited grilles, registers and diffusers. Provide types, accessories and finishes as noted in the Equipment Schedules. See Drawings for sizes.

2.9.2 The following manufacturers of the above equipment will be considered as equal, subject to requirements of Clause “Material and Equipment”:

Kreuger
Nailor
Titus
Tuttle & Bailey

2.10 **BALANCING DAMPERS**

2.10.1 For ducts 930 cm² (144 in²) and less in cross sectional area, use single blade dampers with locking quadrant and pin on far side. For larger ducts use, multi-blade, opposed blade dampers with external operator and locking quadrant. Provide spacers to maintain clearance between duct and damper blades.

2.11 **DUCT SEALER**

2.11.1 Use Duro Dyne DSW water based high pressure duct sealer.

2.11.2 The following manufacturers of the above material will be considered as equal, subject to requirements of Clause “Material and Equipment”:

Childers
Multi-Purpose
3M Canada Inc.
United Sheet Metal

2.12 **TURNING VANES**

2.12.1 Use Rouane turning vanes as manufactured by S.E. Rozell and Sons Ltd. in all square elbows. Assemble vanes with Duro Vane Rail JVR-2 for 50 mm (2″) radius vanes spaced 38 mm (1-1/2″).

2.13 **HEAT PUMPS**

2.13.1 See Drawings and refer to Section 15600 “Liquid Heat Transfer”.

2.14 **RANGE HOOD (Drawing Reference RH-1)**

2.14.1 Use Broan Allure QS2 range hood, 760 mm (30″) wide, three speed setting, cUL listed, HVI certified 1.5 sones at 47 l/s (100 cfm), stainless steel finish, ducted. Provide halogen lamps with units.

3 Execution

3.1 **DUCTWORK**

3.1.1 **General**

3.1.1.1 Construct ALL ductwork located inside Mechanical Equipment Rooms to Medium Pressure duct standards. Construct all ducts designated on Drawings as round to Medium Pressure duct standards. Unless specified otherwise, construct ALL other ductwork to Low Pressure duct standards.

3.1.1.2 Fabricate and install ductwork in accordance with the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Manual "HVAC Duct Construction Standards - Metal and Flexible".

3.1.1.3 Pay particular attention to Section 15001 “Mechanical General Provisions”, Clause “Cutting and Patching”. This will be strictly enforced on this project. Coordinate work with trades responsible for floor and wall construction to reduce difficulty of making tight seals.

3.1.1.4 Fabricate all ductwork to the clear inside dimensions shown on the Drawings. Where internal lining is specified, dimensions shown are inside insulation.

3.1.1.5 Do not suspend ducts from metal roof deck.

3.1.1.6 Make duct connections to fans and heat pumps with flexible duct connectors.

3.1.1.7 Install access doors for easy access to each damper, thermostat, coil, valve, or other concealed device which requires servicing.

3.1.1.8 Provide backdraft dampers where shown or specified.

3.1.1.9 Install fire damper assemblies in strict accordance with manufacturer's instructions provided with each fire damper. See Detail Sheet in Section 15001 for installation requirements where ducts are internally lined.

3.1.1.10 Where ductwork has to be altered from dimensions shown due to construction conditions, use the same effective cross sectional areas, without exceeding a 4 to 1 aspect ratio. Carry out such changes at no additional cost to the Owner.

3.1.1.11 Install ductwork to maximize clear floor to ceiling heights.

3.1.1.12 Transitions are described in the direction of air flow. For converging transitions, use a maximum slope of 1 in 4 and, for diverging transitions, use a maximum slope of 1 in 7.

3.1.1.13 Paint interior of ductwork for at least 610 mm (24″) behind supply, return and exhaust grilles and registers with matte black paint so as to render ductwork invisible from occupied space. Do not paint ductwork which is internally lined.

3.1.1.14 Apply one coat zinc chromate primer over all welded surfaces.

3.1.1.15 If there is a conflict between the duct sizes shown on the floor plans and the duct sizes shown on sections, elevations or details, the floor plans will govern.

3.1.1.16 Install duct smoke detectors supplied by Division 16.

3.1.2 **Low Pressure - Rectangular Ductwork**

3.1.2.1 Fabricate and install according to current SMACNA standards. Use 2″ W.G. pressure class. Use SMACNA recommended sheet metal thicknesses. Fabricate with all flat surfaces wider than 450 mm (18″) either cross broken or transverse beaded, regardless of whether the duct is insulated, lined or bare.

3.1.2.2 Use elbows in the following order of preference:

3.1.2.2.1 Full radius elbows with inside radius equal to duct width.

3.1.2.2.2 Square elbows with turning vanes.

See Detail Sheets included with Section 15001 “Mechanical General Provisions”.

3.1.2.2.3 For duct takeoff to a single register, diffuser, grille or branch, use balancing dampers. Do **NOT** use splitter dampers. See Detail Drawing in Section 15001, “Mechanical General Provisions”.

3.1.2.2.4 Fabricate all duct fittings in accordance with Detail Drawings in Section 15001, “Mechanical General Provisions”. Provide all balancing dampers as shown on Details. These details apply to supply, return and exhaust air systems.

3.1.2.2.5 Seal all transverse joints, longitudinal seams and duct wall penetrations to SMACNA Seal Class A standards.

3.1.2.3 **Round Ductwork**

3.1.2.3.1 Provide a decorative grade installation where ductwork is exposed to view, outside of Mechanical Rooms. Use satin coat finish, degreased and suitable for field painting without etching duct surfaces.

3.1.2.3.2 Make all joints in ductwork exposed to view using “Spiralmate” round duct connector system or equivalent.

3.1.2.3.3 Rotate spiral seams on duct-to-duct joints so that the seam provides a continuous helical pattern across the joint.

3.1.2.3.4 Fasten diffuser collars to duct using pop rivets. Provide a finishing filet of elastomer seal at the collar-duct junction.

3.1.2.3.5 Space hangers at equal intervals. Fasten hangers to duct system using ring collars as shown on the Drawings.

## 3.2 FLEXIBLE DUCTS

3.2.1 In lieu of the solid duct connections shown, flexible ducts may be used to connect diffusers to duct runouts.

3.2.2 Length of flexible duct must not exceed 1.8 m (6′) and maximum one 90º elbow will be permitted. Use hangers and supports to ensure duct does not sag. Make all duct connections using Duro-Dyne FT-2 high fibreglass tape, sheet metal screws, and Duro-Dyne S-W high pressure duct sealer. Installation to be UL Listed treatment as published by the manufacturer.

## 3.3 INTERNAL DUCT LINING

3.3.1 Install lining in accordance with liner manufacturer's published recommendations and SMACNA "HVAC Duct Construction Standards - Metal and Flexible". Use both adhesive and mechanical fasteners. Select pin lengths to limit insulation compression to 3 mm (1/8″). Butter butt joints with a fire resistant coating and extend 50 mm (2″) on either side of joint to stop air from lifting insulation. Repair liner surface penetrations with adhesive meeting ASTM C919. Pins must be welded to duct.

3.3.2 Internally line ducts where shown on Drawings. Use 25 mm (1″) thickness, unless designated otherwise.

3.3.3 Where acoustic plenums are not specified, internally line outside air intake ducts and plenums with 37 mm (1-1/2″) thickness. Finish with two 3 mm (1/8″) thick coats of asphalt or vinyl mastic. Apply glass reinforcing fabric between coats. Lap joints by 100 mm (4″).

## 3.4 GRILLES, REGISTERS AND DIFFUSERS

3.4.1 Cooperate on the job with other trades so that grilles, registers and diffusers do not conflict with lights, etc. Bring any conflict between grilles, registers and diffusers and the work of other trades to the attention of the Consultant before any ductwork is installed. See Architect's reflected ceiling plan for location of grilles, registers and diffusers.

3.4.2 Install frame for each grille, register and diffuser to suit the type of building construction.

## 3.5 FLEXIBLE DUCT CONNECTORS

3.5.1 Make all duct connections to fans and heat pumps with preassembled duct connectors.

## 3.6 TESTING AND BALANCING

3.6.1 Cooperate with the Testing and Balancing trade. See Section 15200, “Testing and Balancing”. Make any changes deemed necessary by the Testing and Balancing trade to permit proper testing and balancing of the systems.

3.6.2 Provide additional balancing dampers where required by the Testing and Balancing Company.

3.6.3 Be responsible for the initial alignment and tension of all fan pulleys and belts.

3.6.4 Provide any changes to fan drives, pulleys and belts as required to allow a proper air balance as recommended by the Testing and Balancing Company for equipment supplied under this Contract.

## 3.7 DUCT LEAK TESTING

3.7.1 Duct leakage tests are specified in Section 15200, "Testing and Balancing".

3.7.2 Cap and seal ducts for the test sections as directed by the Testing and Balancing trade. Provide all necessary fittings and duct connections as required for the leak testing procedure.

3.7.3 Ensure all required duct access doors are installed before tests are started.

3.7.4 Immediately correct defects discovered during test and arrange for retesting until satisfactory results are obtained.

## 3.8 EQUIPMENT CONNECTIONS

3.8.1 Be responsible for all connections to Owner’s equipment, whether equipped with duct connections or not.

**END OF SECTION**

INDEX - SECTION 16001

PART 1 - GENERAL



PART 2 - PRODUCTS

INDEX - SECTION 16001

PART 3 - EXECUTION

1 General

1.1 **GENERAL PROVISIONS**

1.1.1 This Section and Division 1 - General Requirements apply to and govern the work of all Sections of Division 16.

1.2 **VISITING SITE**

1.2.1 Visit the site and be familiar with working conditions and work involved before submitting Bids. **NO EXTRAS WILL BE GRANTED DUE TO LACK OF A THOROUGH PRELIMINARY INVESTIGATION.**

1.2.2 Remove and replace existing ceiling tiles to inspect ceiling for existing Mechanical, Electrical and Structural obstructions. Include cost of all necessary changes in Bid Price. No extras will be granted due to lack of a thorough preliminary investigation of accessible ceiling spaces.

1.3 **CONTRACT DRAWINGS**

1.3.1 Electrical Drawings show Electrical work only and are not intended to show Structural details, Mechanical details or Architectural features. Take building dimensions and details from Architectural or Structural Drawings or from job measurements only.

1.3.2 Electrical Drawings indicate only the general locations of equipment and outlets. Wiring requirements are shown diagrammatically. Responsibility for the detailed layout of equipment, outlets, raceways and wiring is part of the work of this Division. Specific outlet locations are detailed on elevations.

1.3.3 If shown, only the general location and route of conduit, cable trays and communication hooks are shown. Install all services neatly to conserve headroom. All conduit, cable trays and communication hooks are to be accessible after work by other trades is complete. Install all services parallel to building lines unless shown otherwise.

1.3.4 The Consultant reserves the right to revise the locations of equipment and outlets within any given room without altering the Contract Price provided Notice of Change is given prior to roughing-in.

1.3.5 In case of conflict between work of other trades and work of this Division, clarify the location of these items with the Consultant before roughing-in.

1.3.6 In the event of any discrepancies or ambiguity of any symbol, note, abbreviation, etc., used in this Specification or on the Contract Drawings, obtain clarification, in writing, from the Consultant prior to submitting Bid. No allowance will be made for additional costs arising from failure to obtain proper clarification of conflicting information before Bid.

1.3.7 All dimensions and sizes are in SI units, Generally units are in millimetres. All exceptions to this are noted.

**CONDUIT SIZES**

| Imperial (Inches) | ½ | ¾ | 1 | 1-¼ | 1-½ | 2 | 2-½ | 3 | 3-½ | 4 | 4-½ | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.I. (metric) (mm) | 16 | 21 | 27 | 35 | 41 | 53 | 63 | 78 | 91 | 103 | 116 | 129 | 155 |

1.4 **SHOP DRAWINGS**

1.4.1 Submit Manufacturers' Shop Drawings, Electrical Wiring Diagrams and Control System Drawings to the Consultant. Provide title sheet for Shop Drawing submitted. Include project name, Shop Drawing item (including Specification paragraph reference) and approval stamps. The Consultant reserves the right to have samples submitted of any specified products.

1.4.2 Before submitting shop drawings, provide a complete list of shop drawings to be submitted in Microsoft Excel format. List all shop drawings and approximate date of submission.

1.4.3 Submit all shop drawings electronically in Adobe® Acrobat® PDF format. File attachments to an email must total no more than 5 MB and must be submitted unzipped. If multiple items are submitted in single PDF file, each individual piece of equipment must be “book marked” using equipment labels as per Design Drawings. All shop drawings submitted electronically must be checked and stamped by Contractor as specified below.

1.4.4 Catalogues, manuals or price lists will not be accepted as Shop Drawings. Before submission, check Shop Drawings, make necessary corrections, apply stamp “Checked and Certified Correct”, sign and date.

1.4.5 Submit one reviewed set of Shop Drawings with each set of Maintenance and Operating Instructions.

1.4.6 The review of Shop Drawings by Chorley + Bisset Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review does not mean that Chorley + Bisset Ltd. approves the detail design inherent in the Shop Drawings, responsibility for which remains with the Contractor. Such review does not relieve the Contractor of his responsibility for errors or omissions in the Shop Drawings or of his responsibility for meeting all requirements of the Construction and Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all subtrades.

1.4.7 The Contractor is to review each shop drawing and document the differences between the shop drawing submission and the description listed in the specification. If there are no differences listed, the Contractor implicitly declares the shop drawing meets all requirements of the Specification.

1.4.8 Ensure at least one copy of the reviewed Shop Drawings is kept on site at all times for reference.

1.4.9 Prepare all Drawings in SI units.

1.4.10 Shop Drawings to include the following:

1.4.10.1 Indicate details of construction, dimensions, capacities, weight and electrical performance characteristics of equipment or material.

1.4.10.2 Where applicable, include wiring, single line and schematic diagram including interconnect with work of other sections.

1.4.10.3 Include manufacturer's special installation instructions where applicable.

1.5 **FIELD DRAWINGS**

1.5.1 Submit, to the General Contractor, Drawings accurately showing all openings for busducts, conduits, etc. Drawings must include the size of openings and their locations by dimensions, including the location of the structural members framing these openings. Each trade will be responsible for detail layout of their own work.

1.5.2 Assume full responsibility for the detailed coordination of all Division 16 work. Prepare Field Drawings to determine the exact location of each service. On these drawings, include all mechanical and electrical services, architectural features, and structural details. If a conflict becomes apparent after the installation of services, pay all costs associated with removing and reinstalling these services.

1.5.3 If the General Contractor separates the Communication, Security or similar work from the other work of Division 16, the General Contractor assumes full responsibility for this coordination work including the preparation of the Field Drawings.

1.6 **AS-BUILT DRAWINGS**

1.6.1 The Contractor will be provided with the Electrical Drawings in AutoCAD Version 2010 compatible electronic format. The Contractor is to plot and print Drawings from the disc.

1.6.2 Revise and maintain the prints as work progresses. Show all revisions, relocations and changes, to scale. Use colour markings.

1.6.3 Contractor shall take as-built measurements, prior to backfill, of all buried ductbanks and conduits under floor slab. Show routing, depths and dimensions from fixed points on as-built drawings.

1.6.4 Transfer information from the marked prints to AutoCAD format on a monthly basis. Have the marked prints and updated AutoCAD prints on site for review by the Consultant at all times. Monthly draws will not be approved unless all changes have been shown.

1.6.5 Prior to testing and final commissioning, complete the transfer of all information to the AutoCAD Drawings. The Drawing format is to match exactly the layering system of the Consultant. Mark Drawings “As-Built Drawings” and insert name and logo of Contractor. Bind all xrefs. Submit one set of As-Built Drawing prints for review by the Consultant. Remove Engineers Stamp. Include Contractors Name and Logo.

1.6.6 Submit completed As-Built Drawings in AutoCAD Version 2010 format and one set of Reproducible Drawings with the Operating and Maintenance Manuals.

1.6.7 For the purposes of Contract payments, As-Built Drawings will be assumed to have **a value of $1,000.** This will not be released until As-Built Drawings have been accepted as complete and acceptable by the Consultant. This amount is in addition to the normal 10% holdback required by the Construction Lien Act, 1983.

1.7 **SIMULTANEOUS PROJECTS**

1.7.1 Other projects may be under construction simultaneously on this site during the course of this construction project. The Owner will not be the "constructor" as defined by The Ontario Health & Safety Act & Regulations. This Contractor is to maintain a separation between this project and all other Contractors, by time or space, as defined by The Ontario Health & Safety Act & Regulations.

1.8 **CONFLICTS AND PRECEDENCE**

1.8.1 Immediately upon discovery of any conflict, ambiguity, error or omission in the Contract Documents, request clarification in writing from Consultant prior to starting the work in questions.

1.8.2 Failure to give such written notice will constitute an irrevocable waiver and release of any claim for additional compensation or delays incurred.

1.8.3 Where work fails to conform to Contract Documents, as clarified by Consultant, promptly remove and replace such work as directed, without adjustment to Contract price.

1.9 **FIRESTOPPING**

1.9.1 Before starting any work on site, submit detailed Shop Drawings to the Consultant for review and comments. Include:

1.9.1.1 Manufacturer's technical product data and installation instructions for each specific type and location of penetration.

1.9.1.2 Certification that proposed firestopping materials and assemblies comply with CAN4-115-M.

1.9.1.3 For each specific type and location of penetration, provide installation instructions from a recognized independent testing agency.

1.9.2 Mark penetration types and locations on set of white prints. At completion of project, transfer this information to As Built Drawings.

1.9.3 Comply with all requirements of Ontario Building Code Clause 3.1.9, “Building Services in Fire Separations and Fire Rating Assemblies”.

## 1.10 MAINTENANCE AND OPERATING INSTRUCTIONS

1.10.1 For the Electrical Division 16 work only, assemble three sets of equipment literature (cuts), operating instructions, maintenance instructions, voltage test results, certificate, other pertinent data and Letter of Warranty. Place in three ring binders, complete with index pages, indexing tabs and cover identification at front and side. Submit to Consultant for approval.

1.10.2 Make changes or submit additional information as required to obtain approval. Final Certificate of Completion will not be issued until the Consultant possesses three approved sets. Include copies of reviewed Shop Drawings and name and address of Spare Parts' Suppliers with manuals.

1.10.3 Provide two electronic copies of the maintenance and operating manual in Adobe Acrobat PDF format on a compact disc or DVD and submit with the final version of manuals. Electronic copy of manual to be provided as one file formatted with bookmarks in accordance with the sections of the hard copy manuals. Do not include separate files in sub folders. Divide the maintenance manuals into sections which correspond with Specification Sections.

1.10.4 The following information is to be contained within the Sections:

1.10.4.1 **Section 1:** A list of names, addresses and telephone numbers of the Consultants, General Contractor and Electrical Contractor. Written warranty of the Electrical systems.

1.10.4.2 **Section 2:** Electrical Safety Authority Inspection Permit, Fire Alarm Verification Report and Certificate, Emergency Lighting Verification Letter.

1.10.4.3 **Remaining Sections - By Specification Section**

1.10.4.3.1 A list of names, addresses and telephone numbers of all suppliers. A copy of all reviewed Shop Drawings.

1.10.4.3.2 A complete and comprehensive maintenance and operating instructions details D (daily), W (weekly), M (monthly), SA (semi-annually), A (annually) for maintenance.

1.10.4.3.3 Copies of warranties.

1.10.4.3.4 Complete control diagrams, wiring diagrams and description of applicable control systems and the functioning of the system.

## 1.11 REGULATIONS AND PERMITS

1.11.1 Carry out the work in accordance with the latest editions of relevant codes, local bylaws, and requirements of local Authority Having Jurisdiction. Apply for and obtain permits and pay all fees. Consultant will submit Drawings to Electrical Safety Authority if required.

1.11.2 Enforce all prevailing Provincial and local safety regulations at all times. Abide by all Owner’s safety and security policies and procedures and conform to all regulations of the current Occupational Health & Safety Act.

1.11.3 After completion of the work, furnish to Consultant a Certificate of Unconditional Approval from Inspecting Authorities.

1.12 **MATERIAL AND EQUIPMENT**

1.12.1 Where an item of material or any equipment is specifically identified by a manufacturer's trade name and/or catalogue number, make no substitution except as provided for in paragraphs 3, 4 and 5 below.

1.12.2 In the case of some items of equipment, one or more additional names of acceptable equal manufacturers are listed in the Clause describing an item or a group of items. The design, layout, space allocation, connection details, etc., are based on the products named first in the description of each item. The products named first in the description of each item establish the quality of manufacture and design standards for all other manufacturers of that item. The general approval indicated by listing the names of other manufacturers is subject to final review of Shop Drawings, performance data, test reports, production samples (if required) by Consultant, and equipment shipped to site. Ensure that the products used meet the requirements specified and as shown on the Contract Drawings.

1.12.3 Suppliers wishing to submit other items of equipment for approval as an equal to those specified must apply to the Consultant at least 8 working days before Bid closing date. Requests must be accompanied by complete description and technical data on the items proposed. Approval for substitution of equipment will only be given on the understanding that all details, accessories, features and performance meet the Specifications unless otherwise stated. Deviations from the Specifications must be stated in writing at time of application for approval.

1.12.4 Include in the Bid, the equipment named in the Specifications or approved as an equal as in paragraph 3 above. This will form the Base Bid. Any number of alternative bids, as defined below, may be included in addition to the Base Bid.

1.12.5 Items of equipment by Manufacturers not named in the Specifications may be offered as alternatives to the manufacturers named in the Specifications. The alternative proposals must be accompanied by full descriptive and technical data, together with the statement of amount of addition or deduction from the Base Bid, if the alternative is accepted. Prior approval by the Consultant is not required on items submitted as alternative bids.

1.12.6 After execution of the Contract, substitution of equipment will be considered only if equipment accepted cannot be delivered in time to complete the work in proper sequence, or if the manufacturer has stopped production of the accepted item. In such cases, requests for substitution must be accompanied by proof of equality and difference in price and delivery, in the form of Certified Quotations from Suppliers of both specified and proposed equipment. Credit any decrease in price involved in substitution to the Owner by reduction of the Contract Price. The Contractor will not be reimbursed for any such increase in price.

1.12.7 Where equipment other than the equipment used as a basis for design, layout and space allocation is used, produce and submit revised layouts of equipment, pipes, ducts, etc., in the areas affected. Submit these Drawings with the Shop Drawings. Failure to produce these Drawings is indication by the Contractor that they are not required and the original space allocations are adequate for the substituted equipment.

1.12.8 Name the Subcontractors and Manufacturers in the Bid as indicated in Clause “List of Electrical Subcontractors and Manufacturers”.

## 1.13 INTERPRETATION OF CONTRACT DOCUMENTS

1.13.1 The decision as to which trade provides required labour or materials rests solely with the Contractor. Extra payments will not be considered based on a difference in interpretation of the Contract Documents as to which trade involved provides materials or labour for specific items of work. The Consultant will not enter into such discussions.

## 1.14 SITE VISITS

1.14.1 The Electrical Contractor shall have an office representative (not site personnel) at each site meeting and deficiency review. Attendance at these meetings is mandatory.

## 1.15 PROGRESS DRAWS

1.15.1 Electrical Contractor shall review all supplier and subcontractor draws submitted to their office to ensure they are fair and reasonable for the amount of work completed on site to date prior to submitting to the General Contractor. Electrical Contractor will be responsible for the validity of supplier and subcontractor draw claims.

## 1.16 WARRANTY

1.16.1 Warranty all workmanship, material and equipment supplied by Division 16 for one year after Substantial Completion except where specifically specified otherwise. Make good damage caused due to defects and workmanship.

1.16.2 Where equipment specified in Sections of Division 16 to have an extended warranty period, e.g. five years, the first year of the warranty period will be governed by the terms and conditions of the warranty in the Contract Documents, and the remaining years of the warranty will be direct from the manufacturer and/or supplier to the Owner. Submit signed and dated copies of the extended warranties to the Consultant before applying for a Certificate of Substantial Performance of the Work.

## 1.17 DIMENSIONS AND QUANTITIES

1.17.1 Dimensions shown on Drawings are approximate. Verify dimensions by reference to Shop Drawings and field measurement.

1.17.2 Verify equipment access and coordinate with equipment supplier to ensure equipment can be physically transported to installation location. Under no circumstances will any claim be allowed for extra cost to disassemble and/or assemble equipment at the final location which will be considered as part of equipment installation.

1.17.3 Quantities or lengths indicated in any of the Contract Documents are approximate only and will not be held to gauge or limit the work. No adjustment to the Contract Price will be allowed to complete the work.

1.17.4 Provide labour, products and services specified, but not shown on Drawings and vice versa, and all other labour, products and services necessary for completion of the work.

1.17.5 Make any necessary changes or additions to routing of conduit, cables, cable trays, and the like to accommodate structural, mechanical and architectural conditions, without adjustment to Contract price.

1.17.6 Provide work in accordance with the approved Schedule to meet completion date and specified interim Schedules.

1.18 **COOPERATION BETWEEN TRADES**

1.18.1 Cooperate and coordinate with other trades as required for satisfactory and expeditious completion of work. Take field dimensions relative to work. Fabricate and erect work to suit field dimensions and field conditions. Pay cost of extra work caused by and make up time lost as result of failure to provide necessary cooperation information or items to be fixed to or built-in, in adequate time.

1.19 **COOPERATE WITH OWNER'S STAFF**

1.19.1 Maintain close cooperation with Owner's staff. The Owner will determine the times during which work may be carried out in certain areas. If the work cannot be completed in the allowed time, the Contractor may be required to clean up the area and finish the work at some future time.

1.19.2 Shutdowns will be scheduled during unoccupied times. Include any overtime wages due to conditions stipulated above in the Bid Price.

1.19.3 Provide seven day's minimum notice, in writing, prior to any interruptions of service or restriction of use of any service.

1.19.4 Provide all phase testing, as required, prior to disconnecting existing and connecting new to avoid damage to equipment.

1.19.5 The Owner's operations must take precedence over Contractors' operations at all times. Interruptions due to noise, drilling, etc., will not be allowed without Owner's prior approval.

1.19.6 Include any overtime wages due to conditions stipulated above in the Bid Price.

1.20 **EXAMINATION OF DAMAGED DEVICES**

1.20.1 Report all damaged, defective and non-functioning devices and equipment shown for reinstallation or relocation to the Consultant prior to removal and storage. All devices and equipment will be assumed to be fully functional unless reported otherwise prior to removal.

1.20.2 Devices and equipment damaged during removal, storage or reinstallation will be replaced at no cost to the Owner.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Clause “Material and Equipment”.

2.2 **SLEEVES**

2.2.1 In general, sleeves are not required through walls or floors except in service room floors and foundation walls.

2.2.2 Use Schedule 40 steel pipe sleeves through concrete structural members, walls and floor slabs. Extend sleeves minimum 1″ AFF and seal pipe to sleeve.

2.2.3 For all conduits passing through foundation walls, use Link-Seal pre-engineered mechanical seals between sleeves and pipes.

2.2.4 For rated separation requiring a FT firestopping rating, use materials in conformance with manufacturer's recommendations.

2.3 **FIRESTOPPING**

2.3.1 Use only service penetration firestop components and assemblies tested in accordance with CAN.ULC S115 “Fire Tests of Firestop Systems” and listed in most recent ULC “List of Equipment and Materials” or by another recognized independent testing and certification agency acceptable to the Consultant.

2.3.2 Pipe sleeves through fire separations requiring a rating are to be installed as per firestopping manufacturer's recommendations, as some firestopping manufacturers do not allow pipe sleeves within their approved system. Confirm pipe sleeve compatibility prior to starting work on site.

2.3.3 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

Hilti
Tremco

2.4 **ACCESS DOORS**

2.4.1 Access doors to be flush to edge of frame, concealed continuous hinge with screwdriver operated cam latch. Non fire-rated door construction to be minimum 14 gauge, with 16 gauge frame. Fire-rated door construction to be a minimum 20 gauge insulated door with 16 gauge frame. Insulation thickness to provide required rating.

2.4.2 Size doors to allow adequate operating/maintenance clearance for devices. Doors to be a minimum 600 mm x 600 mm (24″ x 24″) for body entry, and 300 mm x 300 mm (12″ x 12″) for hand entry, unless noted otherwise. Use the following access doors:

| | |
|---|---|
| Masonry Walls | Acudor UF-5000 |
| Drywall Walls | Acudor DW-5040 |
| Drywall Ceilings | Acudor BP58, match ceiling thickness |
| Fire-Rated | Acudor FW-5050/FB-5060 to match fire separation |

2.4.3 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause “Material and Equipment”:

Adam
Ancon LeHage
E. H. Price

2.5 **SPRINKLER PROOF EQUIPMENT**

2.5.1 This building will be fully sprinklered. Use sprinkler proof electrical equipment to prevent the sprinkler system water from entering electrical equipment for all surface mounted equipment.

2.6 **IDENTIFICATION NAME LABELS**

2.6.1 Provide white lamacoid identification labels with black uppercase lettering, minimum 14 pt Arial or Helvetica typeface, for identification of all MCCs, switchboards, distribution panels, panelboards, transformers and transfer switches.

2.6.2 Provide black lamacoid identification labels with white uppercase lettering, minimum 14 pt Arial or Helvetica typeface, for identification of all MCCs, switchboards, distribution panels, panelboards, transformers and transfer switches.

2.6.3 Submit a complete list of nameplate wording for review by Consultant prior to installation.

2.6.4 Warning plates are to be red with white letters, minimum 14 pt Arial or Helvetica typeface, as indicated on drawings.

3 Execution

3.1 **GENERAL**

3.1.1 Instruct and supervise other Sections doing related work.

3.1.2 Supply the measurements of equipment to other Sections to allow for necessary openings to be left in the work of other Sections.

3.1.3 Install conduit, which is to be concealed, neatly and close to building structure so that the necessary furring can be kept as small as possible.

3.1.4 Carry out all work in accordance with the latest regulations of the Ontario Electrical Safety Code and all applicable Municipal, Provincial and Federal Codes and Regulations. In no instance, however, is the standard established by the Drawings and Specifications, to be reduced by any of the Codes referred to above.

3.1.5 Install all ceiling components in direct accordance with reflected ceiling plans.

3.1.6 Electrical Drawings show approximate locations for wall-mounted devices. Clarify exact location and mounting height with Consultant prior to roughing-in.

3.1.7 All serviceable equipment installed on the roof (including receptacles) to be installed minium 3 m (10'-0") from roof edge unless otherwise noted on Drawings.

## 3.2 STORAGE OF MATERIALS

3.2.1 Provide proper weatherproof storage for the protection of materials and equipment on site. Blank off openings in all equipment until required for use. Consultant may require materials which are not properly stored to be discarded and removed from the site.

## 3.3 SUPPORTS AND BASES

3.3.1 Provide all brackets and supports required in steel stud walls. All conduits and equipment must be supported on brackets or supports attached to steel studs. Do not support materials or equipment from wall sheathing.

3.3.2 Provide independent support; brackets and unistrut structures where required to install electrical equipment; disconnect switches, splitters, panels, etc:

- in areas where the equipment is located on walls/columns that are not suitable for direct installation.
- When installation away from structural building elements is called for.
- When it is necessary to elevate the electrical equipment to ensure code compliance or ergonomical operator access.

3.3.3 For all supports of suspended or wall hung electrical equipment, provide structural drawings stamped and signed by a structural engineer holding a P.Eng. designation and registered in the Province of Ontario. This engineer is to submit proof of professional liability insurance. Equipment to be supported from the bottom.

3.3.4 Do not mount starters, VFD's, etc. on building equipment.

3.3.5 Do not suspend luminaires greater than 11.3kg (25 lbs), cable tray, conduit racks, etc from metal roof deck. Provide supports as required to suspend from roof joists.

3.3.6 Provide lintels for double-width and adjacent tubs and multiple conduits running in parallel, where located in block and poured walls.

## 3.4 CONCRETE INSERTS

### 3.4.1 General

3.4.1.1 Anchors for the support of conduits and equipment from the underside of suspended structural concrete systems may be by cast-in-place inserts placed prior to the pouring of concrete or by the use of inserts placed in holes drilled after the forms are stripped.

3.4.1.2 The safe load capacity of concrete anchors is affected by a number of variables such as specific anchor type, embedment, spacing between individual anchors, edge distances, direction of loading, concrete strength and "prying action". Refer to the manufacturer's recommendations for each specific insert proposed, including any dynamic or vibratory loads.

3.4.1.3 Be responsible for the proper selection and installation of inserts, including number, type, spacing and accurate placement to provide the necessary safe load capacity and satisfactory long term performance.

3.4.2 **Installation of Inserts in Hardened Concrete:**

3.4.2.1 Use inserts placed in pre-drilled holes. Do not use powder driven inserts or self-drilling inserts. Before drilling holes, accurately locate all reinforcing bars in the affected areas using an electro-magnetic locator.

3.4.2.2 Do not drill through or otherwise damage reinforcing bars. If reinforcing is encountered, the inserts must be relocated. Ensure that hole diameter, depth of penetration, spacing, etc., are in strict accordance with the insert manufacturer's recommendations for the specific insert type and load condition.

3.4.2.3 Due to the relatively close spacing of reinforcing bars in the bottom of many of the beams and girders, the preferred location of drilled-in-place anchors in beams and girders is into the sides of these members, rather than upwards into the bottom.

3.4.2.4 Inserts to be zinc plated female concrete anchors. Nylon or plastic anchors are not acceptable.

3.4.3 Concrete screws without anchors are not acceptable.

3.5 **SLEEVES**

3.5.1 **Sleeves Embedded in Concrete**: Except as approved otherwise by the Consultant, install sleeves embedded in concrete in accordance with the following general guidelines:

3.5.1.1 Centre to centre spacing to be not less than 3 diameters of the maximum size adjacent sleeve.

3.5.1.2 Provide additional reinforcing at points of congestion as directed by the Consultant.

3.5.1.3 Sleeves through beams will be permitted only as directed by the Consultant.

3.5.1.4 The reinforcing in beams, slabs and columns must not be displaced from its intended position under any circumstances unless prior written approval is obtained from the Consultant.

3.5.2 Provide sleeves for all conduits which pass through service room floors and foundation walls. Sleeves to extend minimum 1" above finished floor.

## 3.6 FIRESTOPPING

3.6.1 Provide a listed firestop system in accordance with the Ontario Building Code to seal around all conduits, electrical wires and cables, and other similar electrical services which penetrate part of a building assembly required to have a fire resistance rating or a fire separation. Refer to Architectural Drawings and Specifications Section "Firestopping and Smoke Seals" for building assembly and fire separation types and locations.

3.6.2 For all penetrations through fire separations required to have a fire resistance rating, use firestop systems with an F rating not less than the fire resistance rating for the fire separation. This includes the sealing of any sleeves provided for future uses. Provide an FT rating where required by the Ontario Building Code. For all penetrations through a Service Room floor, provide a minimum W rating - Class 1 in addition to the fire resistance rating.

3.6.3 All firestopping must be thoroughly reviewed by the Technical Representative of the systems manufacturer on site before any firestopping is concealed and submit a report of compliance with the rating requirements. Technical Representative to complete 3 destructive tests to confirm compliance with ULC listing, minimum one floor test and one wall test, third test to be Contractor's choice. Contractor to replace fire stopping system after destructive test has been completed. Submit a copy of the report to the Consultant. Report to include as a minimum, confirmation fire stopping shop drawings were used during review, locations where destructive testing was completed, confirmation all fire stopping locations were reviewed and installed systems meet the manufacturer requirements.

3.6.4 Provide instruction wall labels on both sides of wall for all thru-wall penetrations using FlameStopper. Locate adjacent to penetration as required to be visible from standing position.

## 3.7 CUTTING AND PATCHING

3.7.1 Flash holes through walls and roof to make weatherproof.

3.7.2 Do not cut or drill holes through floors, roof or structural members before obtaining permission from the Consultant.

3.7.3 For penetrations through walls not required to have a fire rating, seal all spaces between pipe or pipe and surrounding wall construction with a fire-rated foam sealant. Use 3M Fire Barrier, Metacaulk, or Dow Fire Stop UL Classified fire rated foam sealants. Do this as the work progresses, to avoid leaving inaccessible holes at completion of the job. For penetrations through parts of the building assembly required to have a fire resistance rating or acting as a fire separation, see Clause "Firestopping" in this Section.

3.7.4 Before drilling holes through floors or roof slabs, accurately locate and note sizes for each required hole. Get approval of Consultant before any cutting is started.

3.7.5 Where conduits are required to pass through existing walls, floors, and roof, cut and patch the necessary openings.

3.7.6 Where recessed electrical equipment is removed or replaced with equipment of a smaller size, patch openings to match existing wall material.

3.7.7 Where wiring devices (switches, receptacles, etc) are removed from drywall walls, remove device box and patch opening to match existing wall.

3.7.8 Where wiring devices (switches, receptacles, etc) are removed from poured concrete or block walls, remove device and provide blank coverplate.

3.7.9 Include the cost of all cutting and patching in the Lump Sum Contract Price for the work of Division 16.

3.7.10 Remove and replace ceiling where necessary to complete the work of this Division unless this work is specifically included in another Division.

3.7.11 All cutting and patching to be done by the trade specializing in the materials to be cut.

## 3.8 PAINTING

3.8.1 Touch up minor damage to finish on equipment supplied with factory applied baked enamel finish. Completely refinish items suffering damage which, in the opinion of the Consultant, is too extensive to be remedied by touchup.

3.8.2 Paint both sides and edges of plywood backboards for electrical and communications equipment before installing equipment. Use one coat fire retardant primer and two coats fire retardant paint.

3.8.3 Paint disconnect switch or breaker for fire alarm and exit light systems in red enamel. Use one coat of primer and one finish coat.

3.8.4 Where walls are cut and patched for electrical work, paint walls to match existing. For walls less than 9.3$m^2$ (100 sq ft), paint entire wall. For walls larger than 9.3$m^2$ (100 sq ft), paint area of patch. Painting to be completed by painting contractor.

3.8.5 Include the cost of all painting in the Lump Sum Contract Price for the work of Divisions 16.

## 3.9 ACCESS DOORS

3.9.1 Supply access doors wherever equipment, junction boxes, life safety devices, etc., are concealed behind walls or inaccessible ceilings. All devices installed requiring periodic maintenance to be made accessible. Doors will be installed by the trade specializing in the materials receiving access doors.

## 3.10 IDENTIFICATION

3.10.1 Colour code control wiring consistently throughout the installation and generally match colour coding of internal wiring of pre-wired components. Match existing colour coding in use on site. Verify with Owner prior to installation.

3.10.2 All branch circuits shall be:

Phase A - red
Phase B - black
Phase C - blue

3.10.3 Identify all disconnects, starters, and other control equipment with lamacoid nameplates indicating the equipment controlled and all panels, transformers, etc identifying equipment name.

3.10.4 Lamacoid labels to be mechanically attached with self-tapping screws or rivets. Lamacoid labels attached using adhesive methods are not acceptable.

3.10.5 Identify the panel and circuit number for each wiring device with self-adhesive label on the coverplate. Use clear tape with black 14 pt Arial or Helvetica typeface. Locate labels for receptacles on front of coverplate and labels for switches on rear of coverplate.

3.10.6 Identify all pull boxes, junction boxes or octagon boxes located in the ceiling cavity with the exact use of the box, including circuits contained within. Felt pen is acceptable.

3.10.7 Where equipment is concealed above accessible ceilings, indicate location using coloured-coded marking devices, approved by Consultant, fastened to the ceiling components.

## 3.11 LOCKS AND KEYS

3.11.1 Where locked panelboards, control panels, terminal cabinets, etc., are specified, use a separate key pattern for each system with all locks in each system common to one key. Provide seven keys of each pattern to the Owner on a 25 mm (1″) key ring. Submit one set of keys with manuals.

## 3.12 TESTING

3.12.1 All systems must be thoroughly tested before arrangements are made for the final demonstration in the presence of the Owner's staff. Systems to be tested are:

1. Emergency Lighting
2. Lighting Control Systems

3.12.2 For the following systems, the manufacturer's Testing Representative must be present for the test period and submit a Certificate of Operation to the Consultant:

1. Fire Alarm

3.12.3 At the completion of the work, demonstrate operation of all systems to the Owner's representative and the Consultant. Promptly rectify any malfunction found.

## 3.13 TEMPORARY ELECTRICAL FACILITIES FOR CONSTRUCTION

3.13.1 Temporary electrical power is available at the site. Cooperate with owner for use of this power.

3.13.2 Tie in at one location only, as directed. Distribute temporary power from this location.

3.13.3 Arrange and pay for the cost of inspection of the temporary service.

3.13.4 Notify the monitoring company and Owner each and every time a part of the fire alarm system is shut down and reactivated.

3.13.5 Completely remove all temporary facilities when they are no longer required.

3.13.6 Provide fixed temporary lighting for open areas, stairwells and each enclosed room. In open areas and enclosed rooms use 150W A21 lamps, or equivalent, at spacings not exceeding 7.5m. In staiwells use one 100W A21 lamp, or equivalent, at each landing. Lighting to be on dedicated circuits.

3.13.7 Temporary lighting stipulated in this Section, do not include provisions for higher intensity lighting required for a specific operation (concrete finishing, plastering, etc.). This will be the responsibility of the specific trade requiring the higher intensity.

3.13.8 Provide minimum two 120V 20A GFCI receptacles, on dedicated circuits, per 150 m² construction area.

3.13.9 Temporary power requirements stipulated in this Section, do not include provisions for electric space heating, electric welders, or any other item of equipment which requires either a 3 phase supply or connection to a single phase circuit rated in excess of 20 amperes. Any trade using equipment which falls into above categories is to be responsible for providing additional facilities required for such equipment, including any increased sizing. This Division is responsible to see the connection to the temporary system is safe.

3.13.10 Use non-metallic sheathed cable, Type NMW-10, #12 AWG, manufactured in accordance with CSA Spec. C22.2 No. 38, for all temporary lighting branch circuit wiring.

3.13.11 **Temporary Fire Alarm Devices**

3.13.11.1 Notify the local Fire Department and Owner each and every time a part of the fire alarm system is shut down and reactivated.

3.13.11.2 Provide new temporary hard wired fire alarm detectors, pull stations and notification appliances within the construction area.

3.13.11.2.1 Provide one 135°F rate-of-rise heat detector for every 465 m² (5000 ft²) of floor area.

3.13.11.2.2 Provide smoke detectors in all temporary corridors spaced maximum 10m (30 ft).

3.13.11.2.3 Provide a manual pull station at every exit/entrance to the construction area.

3.13.11.2.4 Provide one surface mounted bell for every 560 m² (6000 ft²) of floor area.

3.13.11.3 Use #14 AWG, AC-90 cable for temporary wiring to devices.

3.13.11.4 Connect devices to dedicated fire alarm zones, grouped on a floor-by-floor basis. Provide zone cards as required to suit existing fire alarm panel.

3.13.11.5 Completely verify temporary fire alarm devices any time temporary devices are added, removed or relocated.

3.13.11.6 Once the permanent fire alarm system is operational completely remove all temporary devices and wiring. Turn devices over to the Owner.

## 3.14 EQUIPMENT SCHEDULE

3.14.1 Equipment Schedules are as shown on Drawings.

3.14.2 In general, the motor or item numbers shown in the Equipment Schedules coincide with those numbers shown for Mechanical Trades.

## 3.15 GROUNDING

3.15.1 Ground all components of the Electrical system in accordance with the requirements of Section 10 of the Ontario Electrical Safety Code latest edition and the Inspection Authority.

3.15.2 Provide a separate green ground conductor in all raceways.

3.15.3 Ground secondary neutrals of transformers to building ground conductor.

3.15.4 Where attached to equipment, conduits, cabinets, etc., use suitable approved solderless lugs, compression connectors. No soldered or split bolt type connections are to be used on grounding circuits at any point.

3.15.5 All compression connectors, lugs, etc., used in grounding circuits in any location are to have bolts, nuts, etc., of silicone bronze alloy equal to “Everdur” metal.

3.15.6 Clean all surfaces to which bus or cable are to be bolted, of all paint, rust, etc., and work to a bright, flat surface.

3.15.7 Conduit expansion joints and telescoping sections or metal raceways not thoroughly bonded otherwise, are to be provided with approved bonding jumpers or not less than #8 AWG stranded bare copper.

3.15.8 Provide a separate #14 green ground wire for all isolated ground receptacles.

## 3.16 START-UP SERVICES

3.16.1 Provide the services of a qualified person to be on call and available to the site within one hour, for 2 weeks after work of this Contract is taken over by the Owner. Assist Owner's staff to become familiar with the system operation.

## 3.17 MAINTENANCE OF EXISTING SERVICES

3.17.1 Take every precaution to locate and protect existing services so that no interruption occurs. If any existing service is damaged due to the work of this Division, arrange and pay for repair. Bear any costs due to interruption of existing services.

3.17.2 Be responsible for maintaining continuity of existing services, and for programming work so that the Owners can carry out their normal business uninterrupted, with the exception of scheduled shutdowns for connection to or rerouting of existing services, at a time agreed to by the Owners, on weekdays, over weekends or after normal working hours.

3.17.3 Permission from the Owner is required before making any connections to or rerouting of existing services. Give seven days prior notice to the Consultant and Owner.

## 3.18 PROTECTING AND MAKING GOOD

3.18.1 Be responsible for protection of Owner's property, as well as finished and unfinished work, from damage due to execution of work under this Contract. Repair damage resulting from failure to provide such protection to the satisfaction of the Consultant, at no expense to the Owner.

3.18.2 Attach and fasten fixture and fittings in place in safe, sturdy, secure manner so that they cannot work loose or fall or shift out of position during occupancy of building, as the result of vibrating or other causes in normal use of building.

3.18.3 Coordinate and cooperate with other trades, taking into account existing installations, to assure best arrangement of equipment in available space. For critical locations, prepare interference and installation drawing showing work of various sections as well as existing installations, for approval before commencing work.

3.18.4 All new equipment shall be delivered to site wrapped in plastic and removed only after room is thoroughly cleaned and painted, if applicable. Where existing or new equipment must be operational throughout construction in adjacent spaces, ensure door sweeps are installed and mechanical ventilation systems are fully operational. Provide filters with minimum filtration rate of 10 micron (MERV 5) on all make-up air and supply ducts. Ensure filters are regularly changed to maintain adequate airflow.

## 3.19 REMOVAL OF EXISTING MATERIAL AND EQUIPMENT

3.19.1 Remove existing material and equipment where shown or specified. Equipment such as Fire Alarm devices, and any other special devices are to be turned over to the Owner. Relocate these items to a designated storage site as directed by Owner. Other material and equipment which is removed becomes the property of the Contractor, and must be immediately removed from the site.

## 3.20 REBATES AND INCENTIVES

3.20.1 Provide all invoices and proof of purchase documentation to Owner as requested for application by Owner for rebates and incentives. All incentives will be paid to the Owner.

## 3.21 CASH ALLOWANCES

3.21.1 Refer to Section 01020 for cash allowances carried by the General Contractor.

3.21.2 Any amounts in excess of the cash allowances will be paid by the Owner. Return any unused portions of the cash allowances in full to the Owner.

## 3.22 DEFICIENCY REVIEW

3.22.1 The Electrical Contractor shall confirm in writing that the work is complete and ready for inspection. The Consultant will schedule a site visit to review the work and provide a written deficiency list. Once deficiencies have been corrected, the Electrical Contractor shall confirm in writing to the Consultant that all deficiencies have been

corrected. The Consultant will schedule a second site visit to review the correction of noted deficiencies. Should any noted deficiencies be found to be still outstanding, the Electrical Contractor shall correct them and again notify the Consultant in writing. Charges to the Electrical Contractor may result from repeat visits after the second visit.

3.22.2 The Electrical Contractor is required to complete all work above ceilings and allow time for deficiency reviews and correction of noted deficiencies in a timely manner in order to accommodate the current Construction Schedule. This includes time for reinspection as required prior to concealing (drywall enclosures, drywall ceilings and acoustic tile ceilings) of any service. The Electrical Contractor will be responsible for uncovering any concealed services for inspection.

## 3.23 LIST OF ELECTRICAL SUBCONTRACTORS AND MANUFACTURERS

3.23.1 In the Bid documents, name the Subcontractors and Manufacturers for the items listed below. Use only one name for each item. See Clause “Material and Equipment”. Where the name of a manufacturer is not entered on the Bid Form, the Contractor will be required to use the base specified manufacturer.

### 3.23.2 Subcontractors

Fire Alarm System
Data Wiring

### 3.23.3 Manufacturers

Disconnect Switches
Emergency Lighting / Exit Signs
Fire Alarm Devices
Luminaires (by Type)
Occupancy Sensors
Wiring Devices

**END OF SECTION**

INDEX - SECTION 16100

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 16001, “Electrical General Provisions”.

1.2 **DESCRIPTION OF SYSTEM**

1.2.1 Provide all new wiring and raceways. Where possible, conceal all wiring and raceways above ceilings, in walls and partitions. See Section 16001, “Electrical General Provisions”.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Clause “Material and Equipment”.

2.1.2 All outlet boxes, wiring devices, equipment and accessories must be C.S.A. approved and be designed for the application intended.

2.2 **RACEWAYS**

2.2.1 Use E.M.T. in concealed locations in concrete block walls, drywall partitions and for main and branch circuit wiring above corridor ceiling spaces.

2.2.2 Use minimum 1/2″ (16 mm) conduit for power wiring and 3/4″(21 mm) conduit for motor circuits.

2.2.3 Refer to Section 16700 for communication raceways.

2.2.4 Use set screw steel couplings and connectors. Use raintight steel couplings and connectors complete with “O” rings, where exposed to sprinklers.

2.2.5 Use red conduit for Fire Alarm wiring concealed above ceilings, in concrete walls and in mechanical and electrical rooms.

2.2.6 For new devices on existing block or poured concrete walls exposed in finished areas, provide metallic single compartment raceway and appropriate bases.

2.2.7 Use conduit expansion coupling for expansion joint crossing.

2.2.8 Use flexible metal conduit for all final connections to motors and other equipment subject to vibration or which has adjustable mountings. Minimum size 1/2″ (16 mm).

2.2.9 Use rigid PVC underground and in concrete floors, unless otherwise noted. Provide marking tape for underground installations in accordance with Ontario Electrical Safety Code.

2.2.10 For exterior above grade installations, use rigid aluminum conduits and fittings. All boxes and conduit bodies shall be die-cast, copper-free aluminum with aluminum covers and neoprene gaskets.

2.2.11 Fasten all raceways with approved supports. Use clamps and all mounting hardware of the same material as the conduit or compatible material to prevent galvanic corrosion.

## 2.3 CONDUCTORS

2.3.1 Aluminum conductors are NOT permitted on this project.

2.3.2 Use minimum copper #12 AWG RW-90XLPE **stranded** for branch circuiting and receptacle wiring.

2.3.3 Use RWU-90XLPE wire in all below grade locations.

2.3.4 Use minimum size of #14 AWG RW-90XLPE for control wiring.

2.3.5 Use RWU-90XLPE-1000 volt rated cables from Variable Frequency Drives to motors.

2.3.6 Type AC-90 cable may be used for final drops (maximum 2 m [6.5′]) to lighting fixtures and devices in accessible ceiling spaces. **DO NOT USE AS MAIN BRANCH WIRING FROM PANELBOARDS OR FOR BRANCH CIRCUIT WIRING (i.e. RECEPTACLES, ETC.).**

2.3.7 For wiring to heating equipment, recessed lighting fixtures or where body of fluorescent fixture is used as raceway, use conductors with high temperature insulation of type approved by Electrical Safety Authority.

2.3.8 Use all wire and cable insulation rated 600 volts minimum unless specified otherwise.

## 2.4 OUTLET BOXES

2.4.1 Use only masonry approved boxes in concrete and masonry construction.

2.4.2 Use 100 mm (4″) square or utility type boxes for surface-mounted boxes and 100 mm (4″) octagonal boxes for ceiling outlet boxes. Use multi-gang boxes for grouped devices. Use wrap-around covers for utility boxes. Use cast aluminium FS type boxes where surface mounted in finished areas.

2.4.3 Use flush-mounted boxes complete with adjustable ears, extension rings and plate rings as required. Do not use shallow or narrow boxes.

2.4.4 Provide FS type boxes c/w rain tight fittings where surface mounted in service rooms or where exposed to sprinklers.

## 2.5 WIRING DEVICES

2.5.1 Use specification grade wiring devices, types and ratings shown on the Drawings.

2.5.2 Switched receptacles to be black. Use red devices for receptacles\switches fed from emergency circuits.

2.5.3 Confirm colour of wiring devices and plates with Consultant prior to ordering.

2.5.4 **Receptacles**

2.5.4.1 125 volt 15 amp white self-testing GFCI Duplex Receptacle (CSA 5-15R)
Hubbell Catalogue No. GFR-5252-W-ST

2.5.4.2 125 volt 15 amp white U-ground Tamper Resistant Duplex Receptacle (CSA 5-15R)
Pass &Seymour Catalogue No. TR62W, or equivalent.
Alternative manufacturers to provide equivalent grade or better.

2.5.4.3 125 volt 20 amp white self-testing GFCI Duplex Receptacle (CSA 5-20R)
Hubbell Catalogue No. GFR-5352-W-ST

2.5.4.4 125 volt 20 amp white U-ground Tamper Resistant Duplex Receptacle (CSA 5-20R)
Pass &Seymour Catalogue No. TR63W, or equivalent.
Alternative manufacturers to provide equivalent grade or better.

2.5.4.5 125/250 volt 50 amp Range Receptacle (CSA 14-50R)
Hubbell Catalogue No. 9450A

2.5.5 **Switches**

2.5.5.1 125 volt 20 amp white single pole switch
Hubbell Catalogue No. HBL-1221-W

2.5.5.2 125 volt 20 amp white three way switch
Hubbell Catalogue No. HBL-1223-W

2.5.6 **Cover Plates**

2.5.6.1 In general, use 302 stainless steel face plates for all flush-mounted devices and die-cast face plates for all surface-mounted devices.

2.5.6.2 All receptacles exposed to weather to have die-cast aluminum duplex gasketted spring door in-use covers.

2.5.7 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause “Material and Equipment”:

Cooper
Hubbell
Leviton
Pass & Seymour

2.6 **DISCONNECT SWITCHES**

2.6.1 Fused or unfused disconnect switches to be conditionally hp rated, heavy duty type with visible break industrial safety switches in general purpose or weatherproof enclosures as required.

2.6.2 All three phase greater than 30A: Fused or unfused disconnect switches to be conditionally hp rated, heavy duty type with visible break industrial safety switches in general purpose or weatherproof enclosures as required.

2.6.3 For 120V mechanical equipment, provide Hubbell Cat. #B100 toggle switch complete with lockable cover.

2.6.4 All 208/600V single phase and three phase 30A and below: Hubbell Cat # HBL1372 disconnect switch with aluminum housing.

2.6.5 The door to be mechanically interlocked with the operating handle to prevent it from being opened when the switch is in the “ON” position. The handle is to be capable of being padlocked in the “OFF” or “ON” position.

2.6.6 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause “Material and Equipment”:

Eaton
Schneider
Siemens

3 Execution

3.1 **GENERAL**

3.1.1 Unless shown otherwise, the minimum size of all raceways and conductors to be in accordance with the Ontario Electrical Safety Code.

3.2 **CONDUIT INSTALLATION**

3.2.1 Conceal all conduits except in equipment rooms, unfinished area, and where specifically noted. Flush mount all devices, starters, etc., in finished areas. Install all exposed conduits parallel to building walls and partitions.

3.2.2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

3.2.3 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

3.2.4 Run parallel or perpendicular to building lines.

3.2.5 Run conduits in flanged portion of structural steel. Do not pass conduits through structural members except as indicated.

3.2.6 Group conduits wherever possible on suspended surface channels.

3.2.7 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers. Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

3.2.8 Horizontal runs of conduit will not be permitted in walls unless noted otherwise.

3.2.9 In any case, horizontal runs must be located above level of door or transom frames in area.

3.2.10 Vertical conduits must be supported at each floor slab and at the top and bottom of each riser.

3.2.11 Conduits must be supported from building structure. Provide independent unistrut under obstructions such as ductwork for support as required. Support unistrut from structural members. Do not secure to underside of metal pan roof deck.

3.2.12 Conduit placement should follow the following priority:

- Below grade
- In walls or partitions
- In ceiling cavity
- Exposed

3.2.13 Maintain continuity of ground through all connection points. Use sealer lubricant on all threaded connections embedded in concrete, buried in ground or exposed outdoors.

3.2.14 Leave all conduit systems finished complete with outlet boxes, coverplates, bushings, caps, nylon fish wire, etc. Provide bushings for all sleeves.

## 3.3 CONDUCTORS

3.3.1 Join #8 AWG and larger conductors with compression connectors properly sized. On #10 AWG and smaller, relaxed wing-nut type connectors may be used. Ideal Industries 451, 452 or 453.

3.3.2 Size conductors for a maximum of 2% voltage drop from the supplying panel to the furthest outlet in the circuit. In calculating voltage drop, use 80% of overcurrent rating or design load where known, whichever is less.

3.3.3 Draw wiring into raceways only after all other work that may cause injury to the wire is completed. Use only wiring lubricants that do not shorten insulation life. Use continuous lengths for feeders to panels and large equipment. Do not splice without permission from Consultant.

## 3.4 GROUNDING

3.4.1 Ground all components of the Electrical system in accordance with the requirements of Section 10 of the Electrical Safety Code latest edition and the Inspection Authority.

3.4.2 **Provide a separate ground conductor in all raceways.**

3.4.3 Ground secondary neutrals of transformers to building ground conductor.

3.4.4 Where attached to equipment, conduits, cabinets, etc., use suitable approved solderless lugs, compression connectors. No soldered or split bolt type connections are to be used on grounding circuits at any point.

3.4.5 All compression connectors, lugs, etc., used in grounding circuits in any location are to have bolts, nuts, etc., of silicone bronze alloy equal to “Everdur” metal.

3.4.6 Clean all surfaces to which bus or cable are to be bolted, of all paint, rust, etc., and work to a bright, flat surface.

3.4.7 Conduit expansion joints and telescoping sections or metal raceways not thoroughly bonded otherwise, are to be provided with approved bonding jumpers or not less than #8 AWG stranded bare copper.

3.4.8 Provide a separate #14 green ground wire for all outlets connected to a GFCI circuit breaker.

3.5 **OUTLET BOXES**

3.5.1 Support all boxes independently of the conduits running to them. Use flush boxes in areas where concealed conduit is used.

3.5.2 Check the Drawings to ensure that no outlets are roughed-in at inaccessible locations, where built-in furniture, counters, etc., are to be installed. In such locations, install the outlets above and clear of the trim by approximately 100 mm (4″) unless shown otherwise on the Drawings.

3.5.3 **DO NOT INSTALL OUTLET BOXES OF ANY SYSTEM BACK TO BACK**. Offset as necessary to prevent sound transmission between areas.

3.6 **WIRING DEVICES**

3.6.1 Install light switches on lock jamb side of the door as finally hung. Check door swing before roughing-in. Install switches with the “ON” position up. Locate switch as close as practical to door jamb but not closer than 1″. Coordinate location with built-in and Owner supplied equipment and furnishings.

3.6.2 When two or more devices are grouped together, mount under a common coverplate unless shown otherwise.

3.6.3 Mount light switches at height as indicated on Drawings.

3.6.4 Mount duplex receptacles 25 mm (1″) above a countertop backsplash to bottom of device coverplate.

**END OF SECTION**

INDEX - SECTION 16155

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 16001, “Electrical General Provisions”.

1.2 **RELATED WORK**

1.2.1 **Power supply wiring and raceways for motors of mechanically driven equipment:** Supply and installation of wiring and disconnect at motor by Division 16, unless otherwise noted on Drawings.

1.2.1.1 Wiring and raceways for control devices and instruments, such as automatic temperature and pressure control systems, electrical interlocks between starters, field devices and control panels, heat sensors, water temperature controls, thermostatic controls, “ON-OFF” multi-speed controller for cabinet unit heaters: Supply and installation by Division 15.

1.2.1.2 Control wiring and conduit for unit heaters and forced flow units for their associated thermostats and control by Division 15.

1.3 **REFERENCES**

| | | |
|---|---|---|
| CSA C22.2 No. 14-05 | - | Industrial Control Equipment |
| CSA C22.2 No. 100-04 | - | Motors and Generators |
| CSA C390-10 | - | Energy Efficiency Test Methods for 3-Phase Induction Motors |

1.4 **SYSTEM DESCRIPTION**

1.4.1 **Design Requirements**

1.4.1.1 Divisions supplying motor-driven equipment are to supply and install factory-wired package assembly, field instruments and control devices, including relevant raceway and wiring forming an integral part of automated control system of equipment.

1.4.1.2 Division 16 is to supply and install “power train” such as power supply equipment (switchgears, distribution boards, distribution panels, panelboards), disconnect switches, circuit breakers and splitter boxes, complete with wiring and raceways to termination point at motor or designated power terminals of assembled equipment (packaged unit).

1.4.1.3 Division 16 is to install separately mounted starters and other specified motor control devices handed over by other Division, necessary to complete “power train”.

1.4.1.4 Division 16 is to incorporate into motor control centre all starters, controls, terminals, equipment and wiring as specified herein and/or as indicated on Drawings.

1.5 **SUBMITTALS**

1.5.1 Submit Shop Drawings as defined in General Conditions of the Contract, to include but not limit following:

1.5.1.1 **Starters and Controllers**: Mounting method and dimensions, starter size and type, layout of identified internal and front panel components, enclosure types, wiring diagram for each type of starter and interconnection diagrams.

2 Products

2.1 **PILOT DEVICES, RELAYS AND CONTACTORS**

2.1.1 Selector switches are to be standard duty, oil tight type. When separately mounted, they are to be located in their own enclosures.

2.1.2 Unless noted otherwise, pilot lights to be oil tight, long-life LED type, with transformer.

2.1.3 Install double voltage relays and/or CSA approved segregated auxiliary contacts as required to perform interlocking or other functions. Contacts to suit application.

2.1.4 Relays, other than double voltage, to be electrically operated and electrically held and to have coils of the voltage and the number of contacts to suit the details of the control scheme. Relays to be Square D Class 8502 or equal.

3 Execution

3.1 **INSTALLATION**

3.1.1 **Motor**

3.1.1.1 Installation by Division supplying motor-driven equipment is to comply with governing regulatory authority requirements, applicable Sections of Division 16, and with motor manufacturer's recommended methods.

3.1.1.2 Terminate power supply cables to motor terminal box using flexible conduit connection.

3.1.1.3 Check for correct direction of rotation, with motor not coupled from driven equipment. Cooperate with other Sections supplying motor-driven equipment, to ensure initial start of each motor is correct.

3.2 **TESTS AND INSPECTION**

3.2.1 Operate switches and contactors to verify correct functioning.

3.2.2 Operate selector switch or pushbuttons for performance of starting and stopping sequences of contactors and relays. Confirm delays and Fire Alarm override function as specified.

3.2.3 Inspect and test starter operation as per starter manufacturer's instructions.

3.2.4 Full responsibility for proper performance of motors is to be assumed by Division installing such motors.

**END OF SECTION**

INDEX - SECTION 16400

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 16001, “Electrical General Provisions” and Section 16100, “Basic Materials and Methods”.

1.2 **DESCRIPTION OF WORK**

1.2.1 Provide breakers for existing panelboards.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal.

2.1.2 This building will be fully sprinklered. Use sprinkler proof electrical equipment to prevent the sprinkler system water from entering electrical equipment for all surface mounted equipment.

2.1.3 Unless noted otherwise on the Drawings or in Specifications, user operated devices, display and controls shall be located between 125mm (5") and 1830mm (72") from bottom of floor mounted equipment.

2.2 **DISTRIBUTION EQUIPMENT**

2.2.1 **Distribution and Panelboard Circuit Breakers**

2.2.1.1 Unless noted otherwise on Drawings or panel schedules, circuit breakers are to be moulded case as rated below. Series rated breakers are not acceptable unless stated otherwise on the Drawings (ground fault breakers excluded).

2.2.1.2 Breakers are to be suitable for the panelboards provided. All breakers are to be bolted in place. Plug-in only type are not acceptable.

2.2.1.3 For 250V panelboards, main and branch breakers to be rated minimum 22,000 amperes RMS symmetrical at 208 or 240 volt.

2.2.1.4 For 600V panelboards, main and branch breakers to be rated minimum 22,000 amperes RMS symmetrical at 600 volt.

2.2.1.5 All circuit breakers smaller than 400A to be moulded case thermal-magnetic type providing inverse time-current tripping curves. Multi-pole breakers to have common-trip device with single handle.

2.2.1.6 All circuit breakers 400A and larger to have adjustable Long-time Short-time Instantaneous (LSI) solid state trip unit.

2.2.1.7 All 600V circuit breakers 1000A and larger, and all 208V circuit breakers 2000A and larger to have adjustable Long-time Short-time Instantaneous Ground Fault (LSIG) solid state trip unit. Each circuit breaker shall provide trip indication showing reason for trip (overload, short circuit, ground fault).

2.2.1.8 Shunt trip breakers to be 120V AC solenoid type. Electrically held shunt trip breakers are not acceptable.

2.2.1.9 Provide ground fault circuit interrupters breakers as indicated on Panel Schedules. Provide separate neutral conductors for each circuit. Unless noted otherwise, ground fault circuit interrupter breakers are Class A, Group 5mA.

2.2.1.10 Provide positive locking devices on the handles of breakers serving loads below. Trip units to remain free to function while locked in the ON position.

- exit signs
- emergency lighting and night light circuits
- door hardware

2.2.1.11 Provide quantity of spare breakers as called for on the Panel Schedules or Drawings

2.2.2 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause “Material and Equipment”:

Eaton
Schneider
Siemens

3 Execution

3.1 **PANELBOARDS**

3.1.1 Provide new typewritten directories for all existing panelboards affected by work.

3.1.2 Contractor to provide updated schedules complete with room numbers. Trace out existing circuits as required.

3.1.3 Include room number and description of load for each breaker. For circuits serving mechanical equipment, indicate room number mechanical equipment serves. Coordinate on site with Division 15.

3.2 **ARC FLASH HAZARD WARNING LABELS**

3.2.1 Provide generic shock and arc flash warning labels on all new panelboards, MCC’s and disconnect switches and splitters in accordance with Ontario Electrical Safety Code 2-306.

3.2.2 Label shall be located so that it is clearly visible to persons before examination, adjustment, servicing, or maintenance of equipment. Locate label on the inside door of panelboards.

**END OF SECTION**

Chorley + Bisset
CONSULTING ENGINEERS

369 YORK ST., SUITE 2B, LONDON ON, CANADA N6B 3R4
P: 519-679-8660 F: 519-679-2145 chorley.com

**PROJ. NAME:** Gregory Hogan Catholic School
**PROJ. NO :** 8209

| | |
|---|---|
| **PANEL ID:** | **B** |
| **MAINS:** | 225A |
| **VOLTAGE:** | 208/120V,3Ø, 4W |
| **MOUNTING:** | FLUSH |
| **NO OF CKT:** | 72 |

| | |
|---|---|
| **LOCATION:** | CORRIDOR 004 |
| **FED FROM:** | DISTRIBUTION PANEL DP1 |
| **COMMENTS:** | Shaded Breakers are Existing |

| CKT | BRKR | DESCRIPTION | WATTS | CKT | BRKR | DESCRIPTION | WATTS |
|---|---|---|---|---|---|---|---|
| 1 | 20 | EXISTING LOAD | | 2 | 20 | EXISTING LOAD | |
| 3 | 20 | EXISTING LOAD | | 4 | 20 | EXISTING LOAD | |
| 5 | 20 | EXISTING LOAD | | 6 | 20 | EXISTING LOAD | |
| 7 | 20 | EXISTING LOAD | | 8 | 20 | EXISTING LOAD | |
| 9 | 20 | EXISTING LOAD | | 10 | 20 | EXISTING LOAD | |
| 11 | 20 | EXISTING LOAD | | 12 | 20 | EXISTING LOAD | |
| 13 | 20 | EXISTING LOAD | | 14 | 20 | EXISTING LOAD | |
| 15 | 20 | EXISTING LOAD | | 16 | 20 | EXISTING LOAD | |
| 17 | 20 | EXISTING LOAD | | 18 | 20 | EXISTING LOAD | |
| 19 | 20 | EXISTING LOAD | | 20 | 20 | EXISTING LOAD | |
| 21 | 20 | EXISTING LOAD | | 22 | 20 | EXISTING LOAD | |
| 23 | 20 | EXISTING LOAD | | 24 | 20 | EXISTING LOAD | |
| 25 | 20 | EXISTING LOAD | | 26 | 20 | EXISTING LOAD | |
| 27 | 20 | EXISTING LOAD | | 28 | 20 | STAFF ROOM | |
| 29 | 20 | EXISTING LOAD | | 30 | 20 | EXISTING LOAD | |
| 31 | 20 | EXISTING LOAD | | 32 | 20 | STAFF ROOM | |
| 33 | 20 | EXISTING LOAD | | 34 | 20 | EXISTING LOAD | |
| 35 | 20 | EXISTING LOAD | | 36 | 20 | EXISTING LOAD | |
| 37 | 20 | EXISTING LOAD | | 38 | 15 | EXISTING LOAD | |
| 39 | 20 | EXISTING LOAD | | 40 | 60 | EXISTING LOAD | |
| 41 | 15 | EXISTING LOAD | | 42 | 2P | | |
| 43 | 20 | STAFF ROOM 004 | | 44 | 15 | RANGE HOOD | |
| 45 | 20 | W/R 005 HAND DRYER | | 46 | 20 | EXISTING LOAD | |
| 47 | 20 | EXISTING LOAD | | 48 | 20 | EXISTING LOAD | |
| 49 | | | | 50 | 20 | W/R 006 HAND DRYER | |
| 51 | | | | 52 | 20 | EXISTING LOAD | |
| 53 | | | | 54 | 50 | EXISTING LOAD | |
| 55 | | | | 56 | 2P | | |
| 57 | | | | 58 | | | |
| 59 | 20 | EXISTING LOAD | | 60 | | | |
| 61 | 20 | EXISTING LOAD | | 62 | | | |
| 63 | 20 | EXISTING LOAD | | 64 | | | |
| 65 | 20 | EXISTING LOAD | | 66 | | | |
| 67 | 15 | EXISTING LOAD | | 68 | | | |
| 69 | 15 | EXISTING LOAD | | 70 | | | |
| 71 | 15 | EXISTING LOAD | | 72 | | | |

Chorley + Bisset
CONSULTING ENGINEERS

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**PROJ. NAME:** Gregory Hogan Catholic School
**PROJ. NO :** 8209

| | |
|---|---|
| **PANEL ID:** | **C** |
| **MAINS:** | 225A |
| **VOLTAGE:** | 208/120V,3Ø, 4W |
| **MOUNTING:** | FLUSH |
| **NO OF CKT:** | 72 |

| | |
|---|---|
| **LOCATION:** | CORRIDOR 004 |
| **FED FROM:** | DISTRIBUTION PANEL DP1 |

**COMMENTS:**
Shaded Breakers are Existing

| CKT | BRKR | DESCRIPTION | WATTS | CKT | BRKR | DESCRIPTION | WATTS |
|---|---|---|---|---|---|---|---|
| 1 | 20 | RM 121 LTG | | 2 | 20 | RM 100/100A LTG | |
| 3 | 20 | RM 123 LTG | | 4 | | | |
| 5 | 20 | RM 125/CORRIDOR LTG | | 6 | 20 | RM 136 LTG | |
| 7 | 20 | OFFICE 003 | | 8 | 20 | CORRIDOR LTG | |
| 9 | 20 | OFFICE 002 | | 10 | 20 | EXIT SIGNS | |
| 11 | 20 | RM 121 REC | | 12 | 20 | RM 100 REC | |
| 13 | 20 | RM 121 REC | | 14 | 20 | RM 100A REC | |
| 15 | 20 | RM 123 REC | | 16 | 20 | RM 134 REC | |
| 17 | 20 | RM 123 REC | | 18 | | | |
| 19 | 20 | RM 125 REC | | 20 | | | |
| 21 | 20 | RM 125 COPIER | | 22 | | | |
| 23 | 20 | RM 136 REC | | 24 | | | |
| 25 | 20 | RM 136 REC | | 26 | 20 | RECEPTION 001 | |
| 27 | 20 | RM 104 REC | | 28 | | | |
| 29 | 20 | RM 108 REC | | 30 | | | |
| 31 | 20 | RM 114 REC | | 32 | | | |
| 33 | 20 | EXISTING CIRCUIT | | 34 | | | |
| 35 | 20 | EXISTING CIRCUIT | | 36 | | | |
| 37 | 15 | EXISTING CIRCUIT | | 38 | | | |
| 39 | 15 | EXISTING CIRCUIT | | 40 | | | |
| 41 | 15 | EXISTING CIRCUIT | | 42 | | | |
| 43 | 15 | EXISTING CIRCUIT | | 44 | | | |
| 45 | 15 | EXISTING CIRCUIT | | 46 | | | |
| 47 | 20 | EXISTING CIRCUIT | | 48 | | | |
| 49 | 20 | EXISTING CIRCUIT | | 50 | | | |
| 51 | 20 | EXISTING CIRCUIT | | 52 | | | |
| 53 | 20 | EXISTING CIRCUIT | | 54 | | | |
| 55 | 20 | EXISTING CIRCUIT | | 56 | | | |
| 57 | 20 | EXISTING CIRCUIT | | 58 | | | |
| 59 | | | | 60 | | | |
| 61 | | | | 62 | 15 | SPARE | |
| 63 | | | | 64 | 15 | SPARE | |
| 65 | | | | 66 | 20 | SPARE | |
| 67 | | | | 68 | 20 | SPARE | |
| 69 | | | | 70 | 20 | SPARE | |
| 71 | | | | 72 | 20 | SPARE | |

Chorley + Bisset
CONSULTING ENGINEERS

369 YORK ST., SUITE 2B, LONDON ON, CANADA N6B 3R4
P: 519-679-8660 F: 519-679-2145 chorley.com

**PROJ. NAME:** Gregory Hogan Catholic School
**PROJ. NO :** 8209

| | |
|---|---|
| **PANEL ID:** | **HP1** |
| **MAINS:** | 225A |
| **VOLTAGE:** | 208/120V,3Ø, 4W |
| **MOUNTING:** | FLUSH |
| **NO OF CKT:** | 66 |

| | |
|---|---|
| **LOCATION:** | CORRIDOR 004 |
| **FED FROM:** | DISTRIBUTION PANEL DP1 |

**COMMENTS:**
Shaded Breakers are Existing

| CKT | BRKR | DESCRIPTION | WATTS | CKT | BRKR | DESCRIPTION | WATTS |
|---|---|---|---|---|---|---|---|
| 1 | 35 | EXISTING LOAD | | 2 | 35 | EXISTING LOAD | |
| 3 | 2P | | | 4 | 2P | | |
| 5 | 45 | EXISTING LOAD | | 6 | 15 | EXISTING LOAD | |
| 7 | 2P | | | 8 | 2P | | |
| 9 | 30 | EXISTING LOAD | | 10 | 15 | EXISTING LOAD | |
| 11 | 2P | | | 12 | 2P | | |
| 13 | 15 | EXISTING LOAD | | 14 | 20 | EXISTING LOAD | |
| 15 | 2P | | | 16 | 2P | | |
| 17 | 35 | EXISTING LOAD | | 18 | 35 | EXISTING LOAD | |
| 19 | 2P | | | 20 | 2P | | |
| 21 | 45 | EXISTING LOAD | | 22 | 45 | EXISTING LOAD | |
| 23 | 2P | | | 24 | 2P | | |
| 25 | 20 | EXISTING LOAD | | 26 | 15 | EXISTING LOAD | |
| 27 | 15 | EXISTING LOAD | | 28 | 2P | | |
| 29 | 15 | EXISTING LOAD | | 30 | 20 | | |
| 31 | 15 | EXISTING LOAD | | 32 | | EXISTING LOAD | |
| 33 | 15 | EXISTING LOAD | | 34 | 3P | | |
| 35 | 40 | | | 36 | 15 | HP-402 | |
| 37 | | EXISTING LOAD | | 38 | 2P | | |
| 39 | 3P | | | 40 | 20 | HP-404 | |
| 41 | | | | 42 | 2P | | |
| 43 | | | | 44 | | | |
| 45 | | | | 46 | | | |
| 47 | | | | 48 | | | |
| 49 | | | | 50 | | | |
| 51 | | | | 52 | | | |
| 53 | | | | 54 | | | |
| 55 | | | | 56 | | | |
| 57 | | | | 58 | 30 | | |
| 59 | 15 | SPARE | | 60 | | SPARE | |
| 61 | 15 | SPARE | | 62 | 3P | | |
| 63 | 20 | SPARE | | 64 | 15 | SPARE | |
| 65 | 20 | SPARE | | 66 | 2P | | |

INDEX - SECTION 16500

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 16001, “Electrical General Provisions” and Section 16100, “Basic Materials and Methods”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Lighting Systems**

1.2.1.1 Nominal 120 volt A.C.

1.2.1.2 Branch circuit wiring from 120/208 volt, 3 phase, 4 wire panelboards.

2 Products

2.1 **GENERAL**

2.1.1 Use materials specified herein or approved equal.

2.1.2 Use the product of only one manufacturer for each type of luminaire.

2.1.3 Refer to Luminaire Schedule on Drawings.

2.2 **FLUORESCENT LIGHTING**

2.2.1 **Fluorescent Lamps**

2.2.1.1 T8: Sylvania Octron FO32/841/XPS/ECO - life 36,000 hours at 12 hours/start, 3100/2945 initial/mean lumens.

2.2.1.2 T8 Reduced Wattage: Sylvania Octron Supersaver FO28/841/XP/SS/ECO3 - life 42,000 hours at 12 hours/start, 2725/2560 initial/mean lumens.

2.2.1.3 Fluorescent lamps shall use recycled mercury and be tested in accordance with EPA SW846 for low mercury content.

2.2.1.4 85 CRI or higher

2.2.1.5 Colour temperature to be 4100K unless shown otherwise.

2.2.1.6 The following manufacturers of lamps will be considered equal subject to the requirements of Clause “Materials and Equipment”:

General Electric
Osram Sylvania
Phillips
Standard

2.3 **LED LUMINAIRES**

2.3.1 All LED luminaires must bear an approved certification mark as per Ontario Electrical Safety Code Bulletin 2-7-29. A UL certification mark without the ‘c' is not an approved certification mark.

2.3.2 **Luminaires designed for LED lamps with integral driver** as specified below shall adhere to LED lamp manufacturer guidelines, certification programs, and test procedures for thermal management to guarantee the minimum lamp life and lumen maintenance as specified below.

2.3.3 **Luminaires designed with integrated custom LED’s.** shall be as specified on drawings or approved equal meeting the following requirements:

2.3.3.1 Only products from manufacturers that have been in the lighting manufacturing business for minimum of 10 years will be considered.

2.3.3.2 Modularity, shall be designed to allow for replacement of; driver, LED’s, without specialised tools and without removing luminaire from the ceiling.

2.3.3.3 Performance - LED luminaire with custom lamps must exceed LED lamp parameters specified below for efficacy and lumen maintenance by minimum 15%.

2.3.3.4 Lumen Maintenance - at least 70% of initial lumens for at least 50,000 hours.

2.3.3.5 Minimum luminous efficacy 50 lumens per watt (lm/W)

2.3.3.6 Warranty - Written warranty covering repair or replacement for a minimum of five (5) years from the date of purchase. Warranty must be included with maintenance manuals and have a toll-free (e.g., "800") number, or mailing address, or web site address for consumer complaint resolution and future LED replacement upgrade.

2.4 **EMERGENCY LIGHTING**

2.4.1 All floodlights to be 4 watt LED MR16 type, compatible with existing batteries.

2.4.2 The following manufacturers will be considered equal subject to requirements of Clause "Material and Equipment":

Beghelli Luxnet
Emergi-lite
Hubbell
Lithonia
Lumacell
Lumaid
Stanpro
Uniglo

2.5 **SPARE LUMINAIRES**

2.5.1 Provide a quantity of 1% spare luminaries (minimum 1) of each type used on project and turn over to Owner at Substantial Completion.

3 Execution

## 3.1 INDOOR LIGHTING

3.1.1 Install luminaires complete with the necessary accessories, conduit supports, ball aligners, hangers, mounting yokes, etc.

3.1.2 Check the type of ceilings before placing an order for luminaires.

3.1.3 Provide independent supports from slabs or steel above hung ceilings. Luminaires are not to be supported solely by the hung ceiling. Nylon inserts are not on approved fastening method for poured concrete. Do not secure to underside of metal pan roof deck.

3.1.4 Obtain revised locations from the Consultant when pipes or ductwork interfere with the proper mounting location of recessed luminaires before roughing-in conduit.

3.1.5 Take all necessary precautions to ensure that all luminaires, diffusers and lamps are left clean at the completion of the job.

3.1.6 Ensure that all luminaires including ballasts and lamps are in good working order at the completion of the job. Replace at no extra cost any defective or burned-out lamps.

## 3.2 LUMINAIRES IN SUSPENDED CEILINGS

3.2.1 Provide adequate additional chain hanger supports for all luminaires in suspended ceiling systems to approval of the Consultant, and in accordance with Ontario Electrical Safety Code Bulletin No. 30-4-4.1996.

3.2.2 All existing luminaires to be removed and reinstalled are to have new chain hangers provided.

3.2.3 Coordinate with the Architect and Ceiling Contractor to determine which ceilings have been designed and constructed to carry the weight of the luminaires, so the support chains can be eliminated.

3.2.4 Ensure all luminaires are mechanically secured to the ceiling system with manufacturer approved clips.

## 3.3 LUMINAIRE SCHEDULE

3.3.1 Refer to Drawings for luminaire type and description.

## 3.4 EMERGENCY LIGHTING

3.4.1 Test emergency for 1/2 hour and verify that the entire system is working properly. Contractor is to complete the Emergency Lighting Test Form and providing a line item for each and every device. A sample copy of the form is attached in Appendix `A'. Submit a letter and the completed form indicating each device has been tested, prior to occupancy. Letter to state the following: "The emergency lighting system has been tested for 1/2 hour and is working in accordance with the Drawings and Specifications".

## 3.5 REPLACEMENT LUMINAIRES

3.5.1 Prior to ordering new luminaires to replace existing, Contractor to verify voltage of existing luminaires.

**END OF SECTION**

# A P P E N D I X “A”

**Emergency Lighting Test Form**

| Emergency Lighting Test Form | | | |
|---|---|---|---|
| **Project Name** | XYZ Project, City | | |
| **C+B Project #** | #### | | |
| **Contractor Name** | Your Name Electric Ltd. | | |
| **Date of Test** | Day, Month, Year | | |
| **Device Type** | **Device Location** | **Source (Battery # or CCT#)** | **Test Duration (min.)** |
| | | | |
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INDEX - SECTION 16550

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 16001, “Electrical General Provisions” and Section 16100, “Basic Materials and Methods”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Stand Alone Lighting Control**

1.2.1.1 Provide stand alone lighting control devices as shown as shown on plans and specified herein.

1.3 **SUBMITTALS**

1.3.1 Submit a lighting control sequence of operation schedule with shop drawings outlining control sequence for each type of room. Group rooms with identical sequence of operation and indicate room numbers.

1.3.2 Schedule to identify number of lighting zones, zone type (switching or dimming), auto-on operation (to preset lighting level if applicable), auto-off operation, daylight harvesting, work plane height and illumination as specified herein.

2 Products

2.1 **GENERAL**

2.1.1 Use materials specified herein or approved equal.

2.1.2 In general, switches and automatic wall switches to match wiring device colour. Faceplates for low-voltage switches to match wiring device faceplates. Refer to Section 16100.

2.2 **LINE VOLTAGE OCCUPANCY SENSORS**

2.2.1 Provide a complete occupancy sensor control system in each room indicated completed with sensor, control wiring and mounting hardware as indicated and specified herein and in manufacturer installation manuals:

2.2.2 The following Sensors to be provided:

2.2.2.1 **DSW-100 Automatic Wall Switch**

- 100/230/277 VAC; 50/60 Hz operation
- Minor motion coverage of 15' x 15' major motion coverage of 35' x 30')
- Time delays: SmartSet (automatic), fixed (5,10,15,20,or 30 minutes), walk-through, test-mode
- Sensitivity adjustment: SmartSet (automatic) or reduced sensitivity
- Compatible with all electronic ballasts and PL lamp ballast systems
- Occupancy sensor to match wiring device colour

2.2.3 Unless otherwise indicated, provide the following models according to the symbol type:

| Type | Symbol | Wattstopper Cat. No. | Mounting |
|---|---|---|---|
| 3 |  | DSW-100/200 | wall at switch height |

2.2.4 Provide DT-355 dual technology line voltage ceiling sensors in storage and service rooms.

2.2.5 Provide wire guards over sensors where indicated, plated steel 5mm (1/4") wire suitable for flat wall or corner mounting.

2.2.6 All Occupancy Sensors to be from one manufacturer, UL and cUL listed and have five year warranty.

2.2.7 **Power Packs**

2.2.7.1 Power pack shall be self-contained transformer and relay module in a NEMA 1 plenum use acceptable enclosure.

2.2.7.2 Power pack shall have two isolated relays rated for 100,000 cycles capable of switching 20 amp load utilizing zero crossing circuitry to protect from effects of inrush current and increase life.

2.2.7.3 Power pack shall have a switch input for each relay output which accept three-wire momentary, two-wire momentary push-button, or maintained low voltage switches as well as 24 VDC voltage devices.

2.2.7.4 Power pack shall have 16mm thread nipple for mounting to junction boxes.

2.2.7.5 Power pack shall provide separate an independent inputs for occupancy sensor, photocell, time clock and load shed signal devices.

2.2.7.6 Power pack shall provide a 24 VDC 150 mA output, with the relay connected for powering other devices.

2.2.7.7 Power pack time input shall provide selectable control scenarios for: hold-ON, to keep lighting controlled by occupancy sensors ON during timed occupancy; ON-only, to allow switches to only turn lighting ON and not OFF during timed occupancy; auto-ON, to turn ON lighting loads at the beginning of timed occupancy; after hour shut-off, to provide local switch operation of lighting loads after hours and then shutting them off after a selectable override time period of 30 minutes, 1 hour, 2 hours, or 4 hours.

2.2.7.8 Power pack shall have a standard 5 year warranty and be UL and CUL listed.

2.2.7.9 To be Wattstopper BZ-150 or approved equal.

2.2.8 **Momentary Switches**

2.2.8.1 Provide momentary, low voltage switches as indicated on Drawings and specified here in. Switches to be multi-button or centre spring return toggle/decora type.

2.2.8.2 LVS-1-W Series Low Voltage Momentary toggle Switch

- 3 amp, 24 VAC/VDC rated
- Single-pole, double-throw centre off spring return.
- designed to fit conventional toggle switch openings
- Minimum 5 year warranty
- cUL listed

2.2.9 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Materials and Equipment":

Douglas
Sensor Switch
Wattstopper
Greengate

## 2.3 DIGITAL LIGHTING MANAGEMENT

2.3.1 Provide a 100% digital lighting control system as shown on the drawings to meet space control requirements of AHSRAE/IESNA 90.1-2010. Provide occupancy/vacancy modes of operation. In general, provide two control circuits per lighting zone with one circuit configured in occupancy mode and other in vacancy mode.

2.3.2 Provide automatic shut-off of receptacles as shown on the drawings. Receptacles to be powered whenever spaces are occupied, regardless of overhead lighting.

2.3.3 System to be capable of adjustment, including programming and photosensors and occupancy sensor parameters, using software residing on a PC. Use of a handheld configuration tool may not be substituted for this programming ability. Room controllers to operate independent of programming PC.

2.3.4 All components to be self-configuring, digitally addressable, capable of ladderless configuration and will not have dip switches or potentiometers.

2.3.5 Provide native BACnet integration via hardware. Use of a software gateway is not acceptable.

2.3.6 Provide contact closure to BAS for occupancy status.

### 2.3.7 Digital Room Controllers

2.3.7.1 Provide digitally addressable two relay controllers. Controllers to be self-configuring, automatically binding the room loads to the connected control devices without commissioning or the use of any tools.

2.3.7.2 Housing to be plenum rated and complete with nipple to mount to standard junction box.

2.3.7.3 Room controllers to have two integral on/off zero-crossing relays rated for 20A at 120V and three connections for digital lighting network connection.

2.3.7.4 Dimming room controllers to have three integral on/off zero-crossing relays rated for 20A at 120V with three 0-10V dimming outputs and three connections for digital lighting network connection.

2.3.7.5 Provide receptacle controllers for circuits as shown on the drawings.

2.3.7.6 WattStopper LMRC-102, LMPL-101 or LMRC-210 (dimming).

2.3.8 **Digital Switches**

2.3.8.1 Low voltage momentary pushbutton switches to be in 2 equal-sized button configuration, white and compatible with standard decorator wall plates. Buttons to be field replaceable without removing switch from wall. WattStopper LMSW-102.

2.3.8.2 Low voltage switches shown connected to dimming room controllers to be momentary pushbutton switches with one button configuration and LED bar graph showing relative light level of controlled load, white and compatible with standard decorator wall plates. WattStopper LMDM-101.

2.3.8.3 Buttons to be field replaceable without removing switch from wall.

2.3.8.4 Switches to have two connection ports for digital network through-wiring.

2.3.9 **Digital Occupancy Sensors**

2.3.9.1 Digital occupancy sensors to provide automatic switching for specified load connected to a room controller. Sensors shall be interchangeable without the need for rewiring.

2.3.9.2 Sensors to have two connection ports for digital lighting network.

2.3.9.3 Sensors to use dual technology (passive infrared and ultrasonic or microphonic) for occupancy detection. Sensors must be initially trigged by both detection technologies.

2.3.9.4 Digital occupancy sensors shall provide digital calibration for sensitivity (0-100%), time delay (1-30 minutes) and test mode.

2.3.9.5 Multiple occupancy sensors shall be able to be added to the digital lighting network without additional configuration.

2.3.9.6 Unless otherwise indicated, provide the following models according to the symbol type:

| Type | Symbol | Wattstopper Cat. No. | Mounting |
|---|---|---|---|
| 1 |  | LMDX-100 | wall at ceiling |
| 2 |  | LMDC-100 | ceiling |
| 3 |  | LMDW-102-W | wall at switch height |

2.3.10 **BACnet Network Bridge**

2.3.10.1 Provide hardware BACnet MS/TP-compliant digital communications between each room and the building automation system (BAS). System to allow occupancy sensor status and sensitivity adjustment through BAS.

2.3.10.2 The network bridge shall automatically create standard BACnet objects for selected room device parameters to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM room devices on each local network. Standard BACnet objects shall be provided as follows:

- Read the detection state of the occupancy sensor
- Read/write the On/Off state of loads
- Read the button states of switches
- Read total current in amps, and total power in watts through the room controller
- Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
- Read/write daylight sensor fade time and day and night setpoints
- Read the current light level, in footcandles, from interior and exterior photosensors and photocells
- Set daylight sensor operating mode

2.3.10.3 WattStopper LMBC-300.

2.3.11 **Handheld Configuration Tool**

2.3.11.1 Provide two handheld configuration tools with two-way communication to allow complete configuration and reconfiguration of devices. Unit to have LED or LCD display and be capable of uploading and downloading all configuration settings.

2.3.12 Other manufacturers must meet all of the above requirements and must submit shop drawings to Consultant for review minimum six working days prior to close for compliance review. Equal manufacturers will be added via addendum.

2.3.13 The following manufacturers will be considered as equal, subject to the requirements of Clause “Material and Equipment”:

Greengate
Sensor Switch
Wattstopper

3 Execution

3.1 **STAND ALONE LIGHTING CONTROL**

3.1.1 Program all occupancy sensors, where applicable, to SmartSet mode.

3.1.2 Program all occupancy sensors without SmartSet mode to a time delay of 20 minutes.

3.1.3 Demonstrate to consultant correct operation of occupancy and photo sensors.

3.1.4 Program all intelligent power packs for automatic ON operation of one circuit and manual ON operation of second circuit with automatic OFF operation for both circuits.

## 3.2 DIGITAL LIGHTING MANAGEMENT

3.2.1 Provide CMP rated Category 5e with RJ-45 connectors for all control wiring. Wiring in accessible ceiling space may be free run, supported by conduit for other systems. Do not attach cable to ceiling grid supports. In inaccessible ceilings and all walls, provide conduit and back boxes.

3.2.2 Digital lighting network cabling to be green throughout building. Contractor to ensure cabling colour is unique from other low voltage cabling (data, voice, BAS controls, etc).

3.2.3 Program all rooms for 50% automatic ON operation and 100% automatic OFF operation of all circuits. Programming to be in accordance with ASHRAE 90.1.

3.2.4 Adjust time delay so that controlled area remains lit for 5 minutes after occupant leaves area.

3.2.5 Provide assistance to BAS contractor as required to integrate, at minimum, occupancy status with BAS.

3.2.6 Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a fully functioning system. Provide Consultant and Owner ten working days written notice of system startup and adjustment date.

3.2.7 Adjust high trim level for luminaires to obtain the following maximum lighting levels at the work plane. Provide high trim percentage and measured illuminance at work plane for each room in maintenance manual.

| Space | Work Plane Height | Illuminance |
|---|---|---|
| Classrooms | 760 mm | 30 fc |
| Offices | 760 mm | 35 fc |

3.2.8 Provide room-by-room documentation on the commissioning of the system including sensor parameters, time delays, sensitivities, daylighting setpoints, sequence of operation, (e.g. manual ON, Auto OFF. etc.) and load parameters (e.g. blink warning, etc.)

3.2.9 Resubmit updated sequence of operation schedule to include high trim setting for each lighting zone and measured illumination at work plane.

3.2.10 Upon completion of commissioning, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

3.2.11 Thirty days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner's specific requirements. Provide a detailed report to the Consultant of re-commissioning activity.

3.2.12 Turn handheld configuration tools over to Owner's representative at end of construction. Provide signed letter from Owner confirming receipt, and include in electrical manuals.

**END OF SECTION**

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 The requirements of the Instructions to Bidders, the Contract Forms, the General Conditions as amended, and the Supplementary General Conditions as hereinbefore written will form a part of the following Specifications and the Contractor will consult them in detail for instructions governing the work.

1.1.2 Conform to the requirements of Section 16001, “Electrical General Provisions”.

1.2 **REFERENCES**

ANSI/EIA/TIA-569B -Commercial Building Standard for Telecommunications Pathways and Spaces

1.3 **DESCRIPTION OF SYSTEMS**

1.3.1 **Data Communication System**: Provide a system of empty conduits and boxes, outlets and wiring, as indicated on Drawings. All conduits are to be complete with nylon fishwire. Refer to Section 16710 for cabling details.

1.3.2 **Security System**: Provide a system of empty conduits and boxes, outlets and wiring, as indicated on Drawings. All conduits are to be complete with nylon fishwire. Refer to Section 16705 for cabling details.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal.

2.2 **COMMUNICATION/SECURITY/ACCESS CONTROL SYSTEM CONDUIT**

2.2.1 Cables shall generally be installed in communication trays or conduit. All new conduit shall be thin wall EMT, sized for the cables required plus an additional 50% for future cables. Minimum conduit size shall be 3/4″.

2.2.2 In general, the following table shall be used for communication conduit fill:

| **Conduit Size** | **3/4" 21mm** | **1" 27mm** | **1-1/4" 35mm** | **1-1/2" 41mm** | **2" 53mm** | **2-1/2" 63mm** | **3" 78mm** |
|---|---|---|---|---|---|---|---|
| **Max UTP** | 2 | 3 | 6 | 7 | 14 | 17 | 20 |
| **Max Coax** | 2 | 4 | 6 | 9 | 17 | 26 | 38 |

2.2.3 Cables shall NOT be attached to pipe or conduit or ductwork, etc.

2.2.4 Conduit ends shall be provided with non-metallic bushings to provide a round edge, which will not abrade the cable jacket.

2.2.5 **Telephone/Data:** Provide single gang device wall boxes, complete with 21 mm (3/4″) conduit **up to the cable tray or J hook system**. Provide pull boxes and splice boxes as indicated, for every 30 m (100') fo conduit, and more than two 90° bends or equivalent.

2.2.5.1 Stainless Steel faceplates specified in Section 16710 do not fit in all device boxes. Confirm compatibility with Data contractor prior to rough-in.

2.2.6 **Security/Access Control System:** Provide single gang device wall boxes, complete with 16 mm (3/4″) conduit **up to the cable tray or J hook system**. Provide pull boxes and splice boxes as indicated, for every 30 m (100') fo conduit, and more than two 90° bends or equivalent. All conduits to have pull strings from device wall boxes to cable tray.

2.2.7 PVC conduit is not allowed inside and will be removed at the contractor's expense.

3 Execution

3.1 **COMMUNICATION/SECURITY/ACCESS CONTROL SYSTEM CONDUIT**

3.1.1 Provide all conduits, outlet boxes and wiring for a complete system. Minimum size conduit to be 21 mm (3/4"), except where noted.

3.1.2 Where possible, run all conduit in the ceiling space and conceal all conduit within ceiling spaces, walls or partitions. Mount outlets at the same elevation above finished floor level as duplex receptacles or as noted on the floor plans.

3.1.3 Rigidly install all conduits, adequately supported and properly reamed at both ends. Join sections of conduits by approved couplings and conduit terminations at boxes, pull boxes, etc. using approved fittings.

3.1.4 The inside radius of bends not to be less than: Six times the internal diameter of conduits 50mm (2") and smaller.

3.1.5 Install conduits and boxes as per TIA/EIA-569-A.

3.1.6 Minimum size of pull boxes and splice boxes to be sized as per conduits and Tables 5, 2-2 and 5, 2-3 in TIA/EIA-569-A.

3.1.7 Conduits shall be grounded minimum at one end.

3.1.8 Conduit fill capacity shall not exceed 35%.

3.1.9 Cables and raceway shall maintain minimum 150mm (6″) separation from sources of heat such as steam or hot water pipes, vessels and fittings, which are insulated, and minimum 610mm (24″) from the same, which are uninsulated.

3.1.10 Pull wires must be provided in all conduits.

**END OF SECTION**

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1 General

1.1 **CERTIFIED SYSTEM VENDOR**

1.1.1 Data Communications work as specified will be the responsibility of the Contractor and equipment Vendor to:

1.1.1.1 Provide a minimum 15 year complete system performance warranty.

1.1.1.2 Provide a certified CAT 6 compliant wiring system compliant wiring system for based on contract documents.

1.1.1.3 Perform the pulling of all voice and data system cables.

1.1.1.4 **ONLY** qualified technicians directly employed by the Contractor and Vendor trained technicians will terminate all cables (at both ends), test and perform cross-connects.

1.1.1.5 After completion, provide testing as per ANSI/EIA/TIA-568A Addendum 5 on all cable runs, and documentation of test results.

1.1.1.6 Provide and install equipment as specified herein.

1.1.1.7 Provide documentation of the installation.

1.1.1.8 Provide System Vendor Letter of Certification/Warranty upon completion of job, which will include the notification of a CAT 6 compliant performance level, the Certification/Warranty Number, the identification of the installation by the location and installation date.

1.1.2 Approved Certified System Vendors are required to provide a complete voice/data system including all cables, fibre optic cables, patch cable, outlet jacks, patch panels, fibre patch panels which meet compliance requirements.

1.1.3 The Contractor's technicians are to have extensive training by the Certified System Vendor on the installation, terminations, testing and verification of the Vendors complete CAT6 system.

1.1.4 The following manufacturers are considered as equal, subject to the requirements of Clause "Material and Equipment":

CAT 6: Hubbell or AMP

1.2 **PREAPPROVED CONTRACTORS**

1.2.1 AMP or Hubbell Certified System Vendors

1.3 **SUBMITTALS**

1.3.1 **Shop Drawings**

1.3.1.1 Supply Shop Drawings in accordance with Section 16001 "Electrical General provisions". Do work in accordance with reviewed Shop Drawings.

1.3.1.2 Submit complete cabling system layout for voice and data, cable routing summary and cable outlet designations.

1.3.1.3 All cabling to be CMP rated.

1.3.1.4 Submit detailed layout drawings for termination racks.

1.3.1.5 Manufacturer's data on all devices, cables, patch panel, etc.

1.3.1.6 Detail exact location of equipment indicating wiring raceways, pull, junction and terminal boxes.

2 Products

2.1 **HORIZONTAL DISTRIBUTION SYSTEM**

2.1.1 The Horizontal Distribution System delivers connectivity from the Patch panel in the LAN Room to the work area. Four pair CAT6 UTP CMP rated cables will be used for this purpose.

2.1.2 Horizontal cabling will be terminated within the LAN Room and at the Telecommunications outlet, using the products specified herein. Quantities must be determined by the cable system installer after review of the Drawings.

2.1.3 Provide horizontal cabling for analog phone outlets as shown on the drawings. Terminate on 110 punchdown block located in LAN Rooms.

2.2 **RACEWAY**

2.2.1 Refer to Section 16700 for raceway details.

2.3 **SYSTEM COMPONENTS**

2.3.1 **Jacks**: Provide suitable Cat 6 components to form an installed system.

2.3.1.1 **Jack Colours**

**DATA:** White
**Smart Board Link:** Orange
**Phone:** Black

2.3.1.2 Provide stainless steel flush mounted plates with label designations. Semtron FM-0E-AMP-LAB Series.

2.3.2 **Voice and Data Cable**: Provide cable solution to meet certification.

2.3.3 **Patch Panels**

2.3.3.1 ALL Patch Panels used must be of the same brand as the Cable and Modular Jack used. Patch panels must be installed in a specified location in a wall mounted rack or a wall bracket as required.

2.3.3.2 Patch panels must provide 24 or 48 ports, according to need and be wired to T568A. Patch panels must be augmented with horizontal management panels (front) and rear cable support, to properly dress, terminate and manage the installed cables and provided patch cords**. All cabling is to be terminated in numerical order according to the School's room number system. (Example: 100, 101, 101A, 101B, 102-1, 102-2, 103...).** The front of each module must be capable of accepting 9 mm to 12 mm labels. Patch panels must be UL Listed and CSA certified.

2.3.4 Provide minimum 25% spare capacity on all new patch panels.

2.3.5 Provide dedicated patch panels for telephone outlets.

2.3.6 **Patch Cables**

2.3.6.1 All patch cables supplied must be of the same brand as the terminations and horizontal cable used. Patch Cords used at the telecommunication rack and at the workstation must be prefabricated stranded Cat 6, 24 AWG, 4 pair assemblies.

2.3.6.2 In the wiring closet, 6′ patch cords must be provided to cross-connect between the patch panels and network equipment. One patch cord per terminated outlet is to be provided. Six foot patch cords are to be labelled with Brady style numbers on both ends corresponding to the patch panel port number for which the cable is intended. As well, each workspace outlet to include one 10′ Cat 6 patch cord.

3 Execution

3.1 **INSTALLATION**

3.1.1 The Contractor will supply, install, test, document and certify the cable system according to this specification and must comply with able plant installation and termination procedures as specified in the CSA T529-95 Standard for horizontal and backbone copper and fibre-optic cabling systems as well as the manufacturer's CSV cable installation practices.

3.1.2 The Contractor will correct deficiencies at no cost to the Owner.

3.1.3 Base Wiring includes:

1. Cable
2. Jacks/Patch Panel
3. Distribution and Termination
4. Testing and Labelling
5. Patch Cables

3.2 **IMPLEMENTATION**

3.2.1 **Horizontal Cabling and Termination**

3.2.1.1 Within the LAN Room, horizontal cable terminations and rack installation will be as per Drawing Details and specifications.

3.2.1.2 **The horizontal data cabling** will be terminated on Patch panels, mounted in 19″ standard racks within the LAN Room. Provide one dedicated data cable per telecommunications outlet (or as specified on Drawings). Horizontal data cable length to the farthest outlet will not exceed 90 m (295′) as specified in CAN/CSA-T529. All Data cabling is to be Category 6 CMP. CMR cable will not be permitted.

3.2.1.3 Provide sufficient vertical and horizontal wire managers on the rack for Patch Cord management.

3.2.1.4 Unused ports on faceplates will be filled with the appropriate blank insert.

3.2.1.5 Each 4 pair cable to be terminated in an eight position module. Data pin/pair assignment must meet T568A Standard.

3.2.1.6 All cable runs will be completed without splices.

3.2.2 Support cables using cable clamps or wiring harnesses. Utilize cable trays and/or cable hanger to manage cable in orderly fashion.

3.2.3 Route all cable in such a way as to ensure maximum separations from sources of EMI as defined in CAN/CSA T529. Do not run cables above light fixtures, motors, speakers, air diffusers or similar locations.

3.2.4 Designate all data and voice outlets as per Drawings and Specifications.

3.2.5 Place all exposed cabling in a neat and professional manner and route as per Specifications and Drawings. Comb and/or route cabling in such manner as to ensure bundled cabling is neat and parallel to other cables in bundle. Tie-wrap all exposed cable bundles at maximum of every 200 mm (8″).

3.2.6 Securely mount data and voice outlets at all work area locations using screws as opposed to self adhesive strips.

## 3.3 LABELLING

3.3.1 Labelling must conform to these following Standards:

3.3.1.1 Brady type labelling within 6″ of each end of the horizontal cable to be used to indicate room number behind the patch panel. Brady type labelling within 6″ of end of the horizontal cable to be used to indicate patch port number inside the receptacle box.

3.3.1.2 Labelling on the front coverplate of the outlet must be as follows: the word “DATA” and “PHONE” in capital letters, patch panel port number and closet number if more than one closet exists in the building.

3.3.1.3 Labelling on the label area of the patch panel using manufacturer supplied labelling material must indicate the room number and number of the drop within that room, if there is more than one.

3.3.1.4 All other labelling is to be done using mechanically printed labels on permanent self adhesive white labels with minimum 3/16″ height.

3.4 **TESTING**

3.4.1 All cables will be tested as per ANSI/EIA/TIA-568B. All test records will be completed by the CSV. All test instrumentation, test records, and labour required for the testing will be supplied by the CSV/Contractor.

3.4.2 All cable faults will be corrected by the CSV/Contractor at no cost to the Owner. Splicing of cable pairs is not permitted for the repair of any cables. If a cable is found to be defective, it must be replaced.

3.4.3 Provide test result documentation within two weeks of completion of cable installation.

3.4.4 Inform Consultant 10 working days before testing is carried out so that the Consultant can witness all tests. Rectify wiring deficiencies immediately.

3.4.5 Carry out testing only after installation and termination/labelling of communications cabling at; floor tiles, surface-mounted telecommunications outlets, wall-mounted telecommunications outlets after substantial completion.

3.5 **DOCUMENTATION**

3.5.1 Provide complete documentation of the installation and testing.

3.5.2 Provide Vendor Certification upon completion of cable installation.

3.5.3 Provide records and AutoCAD Drawings complete with all jack locations and numbers (voice and data).

**END OF SECTION**

INDEX - SECTION 16721

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 16001, “Electrical General Provisions”.

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Fire Alarm System**

1.2.1.1 Supply and install all equipment and accessories to extend the existing conventional Edwards Quickstart system. Fire alarm devices are to be in accordance with the Ontario Building Code and associated standards.

2 Products

2.1 **NOTIFICATION APPLIANCES**

2.1.1 Provide suitable wire guards for all devices where indicated on the drawings.

2.1.2 **Horn:** Wall mounted horn devices are to have red housing with white “FIRE” lettering. Edwards G1RF-HD.

2.1.3 **Horn-strobes (Wall Mounted):** Wall mounted horn-strobe devices are to have red housing with white “FIRE” lettering with field selectable 15, 30, 75 or 110 candela, 1 Hz synchronized xenon high output strobe. Edwards G1RF-HDVM.

2.1.4 **Horn-strobes (Ceiling Mounted):** Ceiling horn-strobe devices are to have white housing with red “FIRE” lettering with field selectable 15, 30, 75 or 110 candela, 1 Hz synchronized xenon high output strobe. Edwards GCF-HDVM.

2.2 **PASSIVE GRAPHIC ANNUNCIATOR**

2.2.1 Provide updated passive graphic mounted adjacent to the main panel and annunciator panels. Graphic is to be minimum 410 mm x 410 mm (16″ x 16″) graphic outline of building, minimum five zone identification colour, mounted in a frame behind a acrylic faceplate with tamperproof screws of building identifying each zone.

2.2.2 The graphic is to be designed with each zone a different colour to the adjacent zone for easy identification. All zones are to be displayed and labelled same as annunciator. Location of fire alarm system panels to be shown on passive graphic.

2.2.3 In partially sprinklered buildings, identify areas that are sprinklered utilizing hatching.

2.2.4 Identify locations of supervised valves, flow switches and other fire suppression systems. Passive graphic, annunciator and field device identification tags must be displayed and labelled verbatim.

2.2.5 Floor plans to be shown in ‘track up’ orientation based upon location of passive graphic.

2.3 **WIRING**

2.3.1 Provide new wiring to conform with requirements of Ontario Electrical Safety Code Section 32, and applicable Codes and Standards. Size wiring in accordance with Class 2 requirements, but protected from mechanical injury or other injurious conditions such as moisture, excessive heat or corrosive action in accordance with Class 1 requirements.

2.3.2 General wiring with a floor area, conductors to be solid copper Securix II, Type 105°C PVC, 300 volt. Minimum size of any conductor: for alarm receiving circuits and remote annunciators, #16 AWG solid. Wire resistance in these circuits not to exceed 50 ohms. For audible signal circuits minimum #16 AWG solid. Voltage drop to any signal not to exceed 10%.

2.3.3 Conductors in multi-conductor cables to have allowable temperature rating of at least 105°C (200°F).

2.3.4 All conductors to be as per Ontario Electrical Safety Code and installed in metallic raceway.

2.3.5 Install conductors entirely independent of all other wiring and do not enter fixture, raceway, box or enclosure occupied by other wiring.

2.3.6 Splices will not be permitted unless otherwise indicated on the Drawings or specified. Where splices are necessary and approved by the Consultant, use approval metal contact electrical crimp type connectors.

2.3.7 All wiring must be clear of shorts, open and grounds on completion of work.

2.4 **MANUFACTURER**

2.4.1 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause “Materials and Equipment”:
Edwards

3 Execution

3.1 **FIRE ALARM SYSTEM INSTALLATION**

3.1.1 Fire alarm system installation to be in accordance with the latest edition of CAN/ULC S-524 “Standard for the Installation of Fire Alarm Systems”.

3.1.2 **Wiring**

3.1.2.1 Riser diagrams and drawings show general design intent. Obtain complete wiring diagrams from Fire Alarm manufacturer prior to rough-in.

3.1.2.2 Provide all wiring in conduit and in accordance with Fire Alarm equipment manufacturer's requirements.

3.1.2.3 Identify signal circuit, 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.

3.1.2.4 All conventional initiating wiring to be Class B.

3.1.2.5 All initiating and D.C. signal circuits extending from the fire alarm control to be current limited and protected, in accordance with Ontario Electrical Safety Code requirements.

3.1.2.6 The extended circuit wiring to each alarm receiving circuit or signal circuit is to be individually supervised with no common wiring.

3.1.2.7 Install all wiring in EMT metal conduit above ceilings, and surface in mechanical spaces, and in maintenance/storage spaces with exposed ceilings.

3.1.3 **Control Panels, Transponders and Annunciators**

3.1.4 Passive graphic, annunciator and field device identification tags provided by Fire Suppression Contractor must be displayed and labelled verbatim.

3.1.4.1 Review zone identification with Fire Inspection Department prior to programming, labelling and manufacturing passive graphics.

3.1.5 **Devices**

3.1.5.1 Install detectors in accordance with CAN/ULC Standard S524 latest edition “Installation of Fire Alarm Systems”.

3.1.5.2 Location of devices shown on Drawings are approximate and must be adjusted to site conditions. If location of existing device to be replaced is not properly centred in individual rooms, adjust to suit.

3.1.6 Mount detectors on ceiling as per CAN/ULC Standard S524 standard unless otherwise specified herein, with the minimum and maximum distances as required for the respective type of detector, at the highest point where variations in ceiling height exist. Do not mount detectors on sides, on undersides, or less than 600 mm (20″) from walls, beams, joints, ducts, open web steel joists, bulkheads or any structure projecting below actual ceiling height and less than 450 mm (18″) from air handling or heating outlets.

3.1.7 Should interference from obstruction, lamp positions, air outlet or heat radiating surfaces be encountered in locating any detector where shown, locate the detector as near as possible to the indicated position, clear of obstacles, to the satisfaction of the Consultant, but maintain a clear space of 600 mm (24″) on the ceiling, below and around.

3.1.7.1 Duct detectors to be mounted in supply air ducts unless otherwise indicated on the Drawings.

3.1.7.2 Mount end of line resistors beside last device. Document location of end of line resistors and place inside fire alarm control panel and in maintenance manuals. Provide PTouch labels on end of line faceplates indicating circuits contained within.

3.1.8 Locate all addressable monitor modules adjacent to equipment being monitored.

3.1.9 Locate all addressable control modules for motors adjacent to starters/motor control centres or building automation control panels as site directed.

3.1.10 Locate all addressable control modules not controlling motors within 3' of device being controlled, where practicable.

3.2 **VERIFICATION AND CERTIFICATION OF FIRE ALARM EQUIPMENT**

3.2.1 The Contractor is to provide a full set of Electrical Drawings and Specifications to the fire alarm system representative prior to starting the verification of the fire alarm system. Failure to do so may require the entire fire alarm system to be reverified. Fire alarm system representative to review drawings and provide comments to Consultant prior to commencing verification.

3.2.2 All construction work must be complete before verification of fire alarm system is started. Any modifications to the fire alarm installation after the verification has been commenced will require the entire system to be reverified. Where partial occupancies occur, the fire alarm system for the area to be occupied (including control units) shall meet the requirements of this Standard. Upon system completion, those parts of the fire alarm system tested to this Standard shall be retested in accordance with the requirements of CAN/ULC-S536, Standard for the Inspection and Testing of Fire Alarm Systems, prior to the release of the Verification Report.

3.2.3 Fire alarm technician to review existing building prior to date of verification and review any existing conditions requiring repair. Submit report minimum one week before commencing verification. Consultant will review and issue appropriate instruction.

3.2.4 Where a field device is replaced, the device shall be verified in accordance with CAN/ULC-S537-04.

3.2.5 Testing of all flow switches is to be with actual water flow activation. Supervised valve switches and other supervisory zones to be tested by closing valves or replicating the abnormal condition.

3.2.6 The Contractor is to engage the services of the Fire Alarm manufacturer's representative to verify the fire alarm system in accordance with CAN/ULC-S537-04.

3.2.7 The manufacturer's representative is to supply to the Electrical Contractor a reasonable amount of technical assistance with respect to any changes necessary.

3.2.8 During the period of inspection by the manufacturer's representative, make available to the manufacturer's representative as many electricians as designated by the manufacturer's representative to complete the verification within the specified time frame.

3.2.9 Contractor is to supply Consultant with a list of deficiencies indicating areas where installation deviates from ULC Standards or Ontario Building Code. This list will be reviewed and authorized or rejected by Consultant prior to acceptance of certificate.

3.2.10 **Inspection Certification:** On completion of the inspection and when all the above conditions have been complied with, the Contractor is to provide to the Consultant:

3.2.10.1 A verification report identical to Appendix C of CAN/ULC-S537 completed by the fire alarm manufacturer's technician. Document C1 from CAN/ULC-S537 must be signed and dated by the technician upon completion of the verification.

3.2.10.2 A certificate of verification confirming that the inspection has been completed showing the conditions upon which such inspection and certification have been rendered. Certificate must be free of conditions noted. No additional exceptions or conditions are acceptable.

3.2.10.3 Proof of liability insurance for the inspection.

3.2.10.4 A letter separate from the Verification Report stating “All door hold open devices, including latch retraction/release have been tested by the fire alarm verifier and are installed and working, in accordance with Ontario Building Code 3.1.8.12".

3.2.10.5 Provide ESA Inspection Certificate.

3.2.11 **Description of Fire Alarm System**

3.2.11.1 Upon completion of the project, provide to the Owner a copy of CAN/ULC-S536-13 Appendix E "Description of Fire Alarm System for Inspection and Test Procedures". Provide type written copy of this form and provide soft copy with maintenance manuals.

3.3 **FIRE WATCH - ALTERNATIVE MEASURES FOR OCCUPANT FIRE SAFETY**

3.3.1 In the event of any shutdown of fire protection equipment or part thereof, the Fire Department and building occupants/owner should be notified. Instructions should be posted as to alternate provisions or actions to be taken in case of an emergency. These provisions and actions should be acceptable to the Chief Fire Official and be in accordance with the accepted Fire Safety Plan.

3.3.2 An attempt to minimize the impact of inoperative equipment should be made (i.e. where portions of a sprinkler, fire alarm system and standpipe system are taken out of service, the remaining portions will be maintained). Assistance and direction for specific situations should be sought from the Fire Department and be in accordance with the accepted Fire Safety Plan.

3.3.3 Procedures to be followed in the event of shutdown of any part of a fire protection system are as follows:

3.3.3.1 Notify the Fire Department and the monitoring station. Give your name, address and a description of the work and when you expect it to be corrected. The Fire Department should be notified in writing of shutdowns longer than 24 h;

3.3.3.2 Post notices on all floors by elevators and at entrances, stating the work and when it is expected to be completed;

3.3.3.3 Unless noted otherwise in the Fire Safety Plan, have staff or other reliable person(s) patrol the affected area(s) at least once every hour; and

3.3.3.4 Notify the Fire Department, the fire signal receiving centre, and building occupants/owner when work has been completed and systems are operational.

3.4 **INSPECTION COSTS**

3.4.1 Include all costs involved with this inspection in the total Bid Price.

3.5 **TESTING**

3.5.1 Tests of the complete system in the presence of the Owner and the Consultant are to include:

3.5.1.1 Spot check of devices to ensure proper connections and supervision.

3.5.1.2 Operation of an alarm initiating device on each detection circuit is to verify the required operation of alarm devices, annunciators, etc.

3.5.1.3 Operation of all other alarm initiating devices in a convenient, silent method (buzzer, light, meter, etc.) are to ensure connection to the proper circuit and function of the device.

3.5.1.4 Live smoke or open flame are not to be used for testing.

3.5.1.5 Test each area in stages to match the Work Schedule.

3.5.1.6 Demonstrate to Consultant and Owner the operation of ancillary functions (ie maglock and door hardware release, elevator recall, etc).

3.5.2 Provide assistance to the Fire Inspection Department for testing a minimum of 25% of the installed field devices and up to 100% of sprinkler/ standpipe devices (supervised valves, flow switches, etc). Correct deficiencies and retest any devices or zones operating incorrectly as directed by the Fire Inspection Department.

3.5.3 **Integrated Systems Testing**

3.5.3.1 Provide Integrated Systems Testing as indicated in CAN/ULC-S1001-11 "Integrated Systems Testing of Fire Protection And Life Safety Systems.

3.5.3.2 Contractor to engage with Fire Alarm manufacturer at testing phase or a 3rd party commissioning type contractor to arrange for this work. In general, systems to be tested for proper integration with the fire alarm system are noted in CAN/ULC-S1001-11 and include but are not limited to elevators, cooking equipment fire suppression systems, hold-open devices, electromagnetic locks, smoke control systems, emergency generators, audio/visual and/or lighting controls, notification systems, sprinkler systems, standpipe systems, fire pumps, water supplies, water supply control valves, freeze protection systems, fixed fire suppression systems.

3.5.3.3 Contractor to provide to consultant for approval, all proposed testing procedures and proposed reports prior to commencing test.

3.5.3.4 Provide completed reports upon completion of fire alarm verification and submission of verification reports and certificate.

3.6 **TRAINING**

3.6.1 The Contractor shall provide 2 hours training for the complete operation of fire alarm system.

**END OF SECTION**

INDEX - SECTION 16820

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1 General

1.1 **GENERAL PROVISIONS**

1.1.1 Conform to the requirements of Section 16001, “Electrical General Provisions” and Section 16100, “Basic Materials and Methods”.

1.2 **DESCRIPTION OF WORK**

1.2.1 Provide electric hand dryers, as indicated.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal and must be CSA approved, ULC tested and listed.

2.2 **ELECTRIC HAND DRYERS**

2.2.1 Electric hand dryers to be no-touch type control, 120/208 volt single phase auto sensing, maximum 1500 watts, surface-mounted, stamped steel housing with white epoxy finish. Provide 5 year limited warranty.

2.2.2 Automatic, activated by infrared optical sensor. Operates while hands are under blower. Shut-off within 2 seconds when hands removed, or in 35 seconds if hands or other obstruction is not removed.

2.2.3 Combination Motor and Blower: vacuum type with automatic resetting thermal protector. 5/8hp, 14,000 - 28,000 RPM adjustable. Air velocity: 10,000 - 19,000 LFM adjustable.

2.2.4 Heater: resistance coil to provide an air temperature of 58°C (135°F) measured at average hand position of 102 mm (4″) below air outlet.

2.2.5 Complete with HEPA filter and 4 spare filters, or cold plasma clean technology to sanitize hands and purify surrounding air, killing up to 99.6% of pathogens on hands.

2.2.6 Sound level not to exceed 83 dB at high air velocity, 69 dB at low air velocity.

2.2.7 The following manufacturers will be considered as equal subject to the requirements of Clause “Material and Equipment”:

American Dryer Extreme Air CPC Series
XCELERATOR Hand Dryer c/w noise reduction nozzle
World Dryer VERDEdri

3 Execution

3.1 **ELECTRIC HAND DRYERS**

3.1.1 Mount electric dryers securely to wall, as indicated, to prevent easy removal.

3.1.2 Dryer units are not to be installed until all wall, ceiling and floor finishes are applied, and all work within the room space is completed. Any units installed and damaged will be replaced at the expense of this Contractor.

3.1.3 Mounting height and location of dryers:

3.1.3.1 In washrooms with one dryer, mount at barrier free level. In washrooms with two or more dryers, mount one at barrier free level.

3.1.3.2 Mounting heights: (from bottom edge of dryer):

| | |
|---|---|
| Washroom | 1041 mm (41") |

3.1.3.3 Ensure a minimum clear floor space of 760mm by 1220mm (30" by 48") is provided in front of or parallel to hand dryers mounted at barrier free level.

3.1.3.4 Ensure hand dryers mounted at barrier free height are located within 610mm (24") horizontally from edge of barrier free lavatories or wash fountains. Notify Consultant prior to rough-in where hand dryer cannot be installed in this location.

3.1.3.5 Ensure a minimum of 510mm (20") is provided between adjacent hand dryers.

3.2 **TESTING AND CLEANING**

3.2.1 Inspect installation to verify secure and proper mounting. Test each dryer to verify operation, control functions, and performance. Correct deficiencies.

3.2.2 Clean surfaces and wash with mild soap.

**END OF SECTION**

# ST. CLAIR CATHOLIC DISTRICT SCHOOL BOARD
# GREGORY HOGAN CATHOLIC SCHOOL

## 1825 HOGAN DRIVE, SARNIA, ONTARIO N7S 6S9

## SCCDSB PROJECT #: 615-CP-1724


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KEY PLAN

NOTES

LEGEND

| DATE MM/DD/YYYY | DESCRIPTION | No. |
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| 05/16/2017 | ISSUED FOR TENDER | 1 |

ONTARIO ASSOCIATION OF ARCHITECTS
RANDY R. WILSON
LICENCE
4000

PROJECT TITLE:
GREGORY HOGAN
CATHOLIC SCHOOL
OFFICE RENOVATION

DRAWING TITLE:
COVER PAGE

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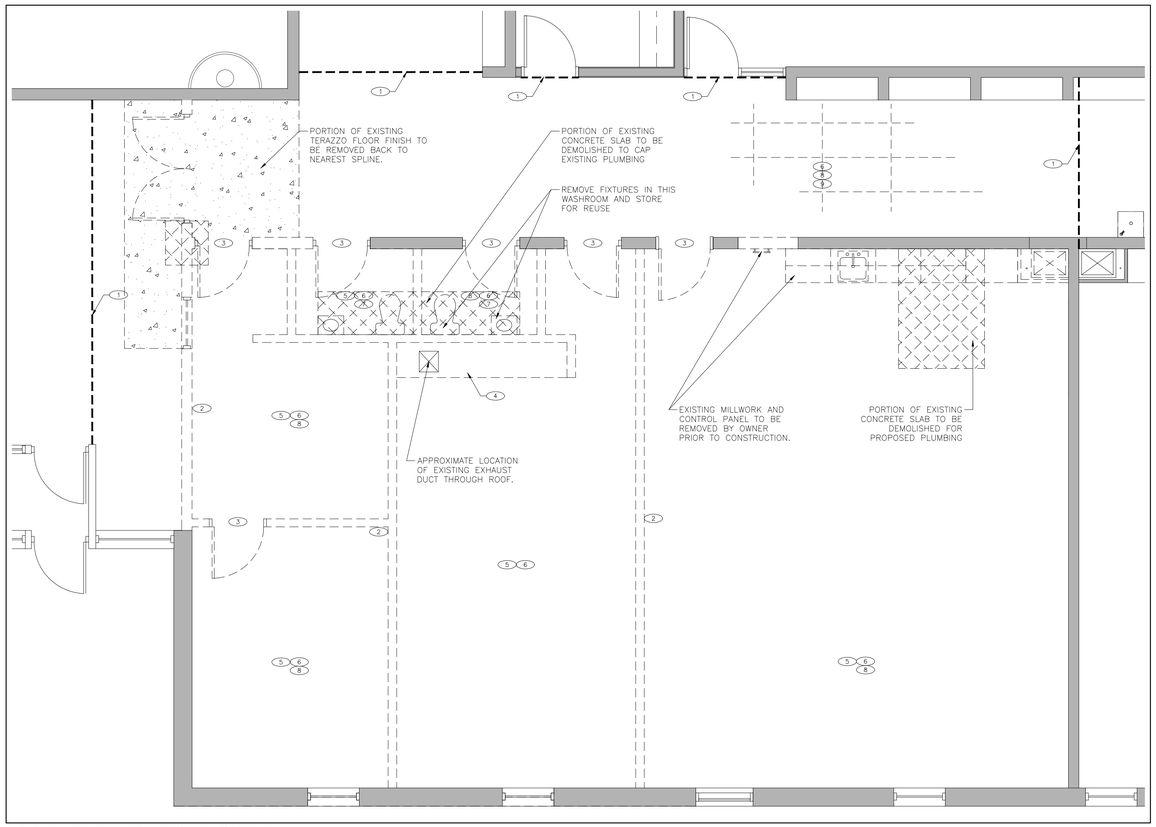


3 PART DEMOLITION FLOOR PLAN
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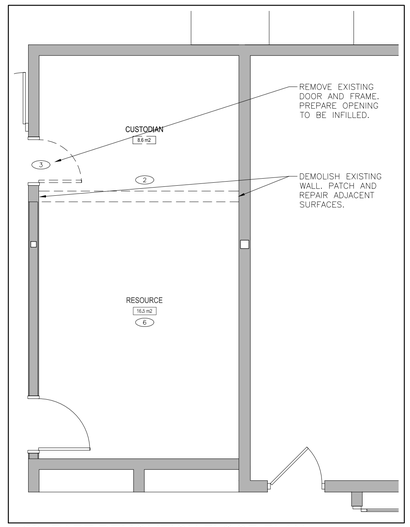


2 PART DEMOLITION FLOOR PLAN
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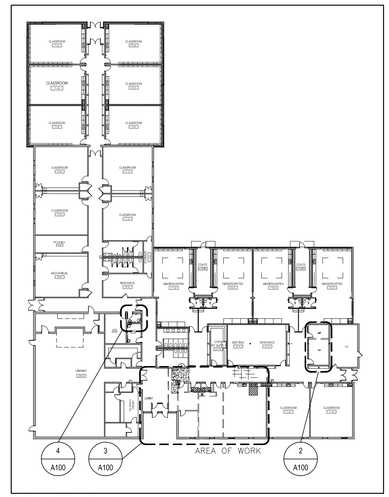


1 KEY PLAN
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## GENERAL NOTES:

A. REMOVE ALL WIRING FROM ELECTRICAL ITEMS THAT WILL BE REMOVED AND ALL REDUNDANT CONDUIT BACK TO NEAREST JUNCTION BOX THAT WILL REMAIN, AND MAKE SAFE. INSTALL METAL COVER PLATES OVER EXPOSED OPENINGS AND ELECTRICAL BOXES. REFER TO ELECTRICAL FOR ADDITIONAL REQUIREMENTS.

B. MAKE GOOD ALL AREAS AFFECTED BY REMOVALS – FLUSH TO ADJACENT SURFACE AND MATCH EXISTING FINISH.

C. DISPOSE OF ALL DESIGNATED SUBSTANCES TO THE REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION

D. ALL PIPING THAT IS TO BE REMOVED OR ABANDONED IS TO BE REMOVED BACK TO THE NEAREST JUNCTION AND CAPPED. REFER TO MECHANICAL FOR ADDITIONAL REQUIREMENTS.

E. NOTE ALL EXISTING ITEMS MAY NOT BE SHOWN ON THESE DRAWINGS. A CAREFUL REVIEW OF THE SITE IS REQUIRED TO DETERMINE THE FULL EXTENT OF THE WORK SHOWN,

F. THE ARCHITECTURAL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL PROJECT MANUALS, STRUCTURAL, CIVIL, MECHANICAL AND ELECTRICAL DRAWINGS. IN CASE OF DIFFERENCES BETWEEN CONSULTANTS' DOCUMENTS WITH RESPECT TO QUANTITY, SIZES OR SCOPE, THE GREATER SHALL APPLY.

G. PROVIDE PROTECTION FOR ALL FINISHES OR SERVICES TO REMAIN.

H. ALL WINDOWS FALLING WITHIN THE DEMOLITION AREA ARE TO HAVE COVERINGS, THEIR FITTINGS, MOUNTING HARDWARE REMOVED & RETURNED TO THE OWNER.

I. DEMOLITION NOTE REFERENCE NUMBERS, WHERE LOCATED ADJACENT TO A ROOM NAME/NUMBER APPLY TO THE ENTIRETY OF THE ROOM.

J. GENERAL CONTRACTOR IS TO ALLOW FOR THE SUPPLY AND INSTALLATION OF LOOSE LINTELS AS REQUIRED WHERE NEW OPENINGS ARE BEING CREATED OR WIDENED. REFER TO THE LOOSE LINTEL SCHEDULE PROVIDED ON THE DRAWINGS, OR PROVIDE ENGINEERING WHERE THERE ARE NO STRUCTURAL DRAWINGS / SCHEDULE.

K. GC IS REQUIRED TO REMOVE ALL REMAINING ADHESIVES ON WALLS WHERE COMMUNICATION BOARDS WERE REMOVED UNLESS BEING COVERED WITH NEW BOARDS. TYPICAL FOR ALL ROOMS AFFECTED BY WORK.

## DEMOLITION NOTES:

(1) INSTALL CONTINUOUS HOARDING, WHERE INDICATED, MADE OF 92 MTL. STUD FRAME & 6MIL POLY SHEET, CUT TO FIT AROUND EXISTING SERVICES, AND COVERED IN 13 PLYWOOD (ON THE OCCUPIED OR TRAFFIC SIDE). TAPE AND SEAL ALL EDGES TO CONTAIN DUST AND DEBRIS WITHIN THE CONSTRUCTION ZONE. TAPE AND SEAL ALL EXISTING DOORS TO CONTAIN DUST AND DEBRIS WITHIN THE CONSTRUCTION ZONE MAINTAIN AND REPAIR AS REQUIRED FOR THE DURATION OF THE CONSTRUCTION PROJECT. CONTRACTOR TO ALLOW FOR THE RELOCATION OF THE HOARDING SYSTEM AS REQUIRED TO SUIT THE PHASING OF THE PROJECT.

(2) REMOVE EXISTING WALLS AS INDICATED ON THE DRAWINGS. CONSTRUCTION TYPE MAY VARY FROM EXTERIOR MASONRY ON CONCRETE BLOCK BACKUP TO INTERIOR CONCRETE BLOCK AND/OR DRYWALL PARTITIONS. WALL REMOVAL TO INCLUDE DOORS AND FRAMES INDICATED ON DRAWINGS. REMOVE MECHANICAL AND ELECTRICAL COMPONENTS / DEVICES (BACK TO SOURCE) ANCHORED TO OR CONCEAL WITHIN WALLS. PROVIDE ALL SHORING AND TEMPORARY SUPPORT REQUIRED TO MAKE EXISTING STRUCTURE SAFE. REFER TO DRAWINGS FOR ADDITIONAL REQUIREMENTS.

(3) EXISTING DOOR, AND FRAME IF INDICATED, TO BE REMOVED AND DISPOSED BY GC. HARDWARE TO BE REMOVED BY OWNER PRIOR TO CONSTRUCTION. WHERE FRAME IS REMOVED PREPARE OPENING TO RECEIVE NEW INFILL OR DOOR AND FRAME. REFER TO NEW CONSTRUCTION PLANS AND ELEVATIONS.

(4) EXISTING MILLWORK TO BE REMOVED. REMOVE ALL EQUIPMENT, SINK, DRAINS, GAS AND WATER LINES AS REQUIRED. AS INDICATED. ONLY RETAIN MILLWORK FOR OWNERS' USE OR REUSE IN NEW CONSTRUCTION WHERE SPECIFICALLY NOTED.

(5) EXISTING FLOOR FINISHES AND WALL BASE TO BE REMOVED BY OWNER, INCLUDING ALL ADHESIVES AND MORTAR DOWN TO EXISTING CONCRETE SLAB AND WALL BACKING BY MEANS OF GRINDING. G.C. TO PREPARE FLOOR SURFACE LEVEL TO WITHIN 10MM OVER 3000MM AND MAKE READY FOR NEW FINISHES. PROVIDE ANY AND ALL REMEDIAL WORK TO WALL BACKING WHERE BASE HAS BEEN REMOVED. REFER TO NEW CONSTRUCTION PLANS AND ELEVATIONS.

(6) EXISTING CEILING TREATMENTS FIXTURES AND FINISHES TO BE REMOVED AND DISCARDED (OR SALVAGED AS REQUIRED, REFER TO NOTE 10), INCLUDING ALL TILES, GYPSUM BOARD, SUPPORT HANGERS, AND FRAMING.

(7) REMOVE ALL PLUMBING FIXTURES, SUPPLY AND WASTE LINES AS NOTED. FLUSH CAP ALL SERVICES AT FLOOR, WALL AND ABOVE CEILING LEVEL. PATCH, REPAIR AND MAKE GOOD ALL EXPOSED SURFACES.

(8) PATCH AND REPAIR ALL CRACKS, HOLES AND DEFECTS IN EXISTING WALLS TO PREPARE FOR FINAL FINISH.

(9) EXISTING LIGHT FIXTURES TO BE CAREFULLY REMOVED AND SALVAGED FOR REINSTALLATION. EXTRA MATERIAL MAY BE SALVAGED FROM AREAS UNDER NOTE 6

## LEGEND:

- (1) DEMOLITION NOTE REFERENCE NUMBER
- LOCATION OF HOARDING
- PORTION OF EXISTING MASONRY/DRYWALL PARTITION TO BE REMOVED.
- APPROXIMATE EXTENT OF EXISTING WALLS AND STRUCTURE TO REMAIN.
- APPROXIMATE EXTENT OF AREAS WHERE EXISTING SLAB IS TO BE DEMOLISHED.
- EXISTING DOOR & FRAME TO REMAIN
- EXISTING DOOR & FRAME TO BE REMOVED & RETURNED TO OWNER

P1 — 16 G.W.B.
92 METAL STUDS AT 400 O.C.
SOUND ATTENUATION BLANKETS, SIZED TO FIT.
16 G.W.B.
HEIGHT - FINISH FLOOR TO UNDERSIDE OF STRUCTURE

P2 — EXISTING WALL
63 METAL STUDS AT 400 O.C.
16 G.W.B. - IMPACT RESISTANT
HEIGHT - FINISH FLOOR TO UNDERSIDE OF STRUCTURE

B1 — 190 CONCRETE BLOCK Refer to Specifications for CMU Type
HEIGHT - From Finish Floor to Structural Support
F.R.R. = 1.5 HOUR. STC = 50

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KEY PLAN

NOTES

LEGEND

| DATE MM/DD/YYYY | DESCRIPTION | No. |
|---|---|---|
| 05/16/2017 | ISSUED FOR TENDER | 1 |

ONTARIO ASSOCIATION OF ARCHITECTS
RANDY R. WILSON
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4000

PROJECT TITLE:
GREGORY HOGAN CATHOLIC SCHOOL OFFICE RENOVATION

DRAWING TITLE:
DEMOLITION PLAN

| DATE PLOTTED: | DRAWN: | DRAWING No. |
|---|---|---|
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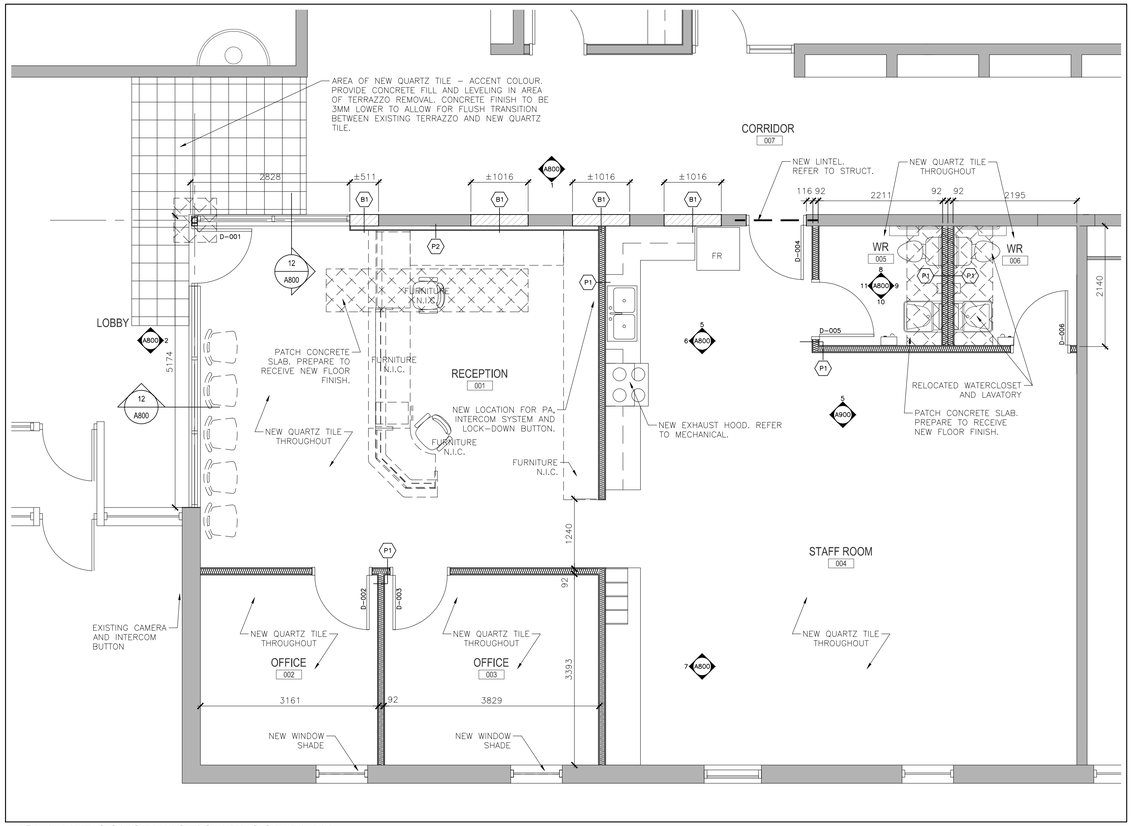
| PROJECT No. 1717 | | |




3 PART CONSTRUCTION FLOOR PLAN
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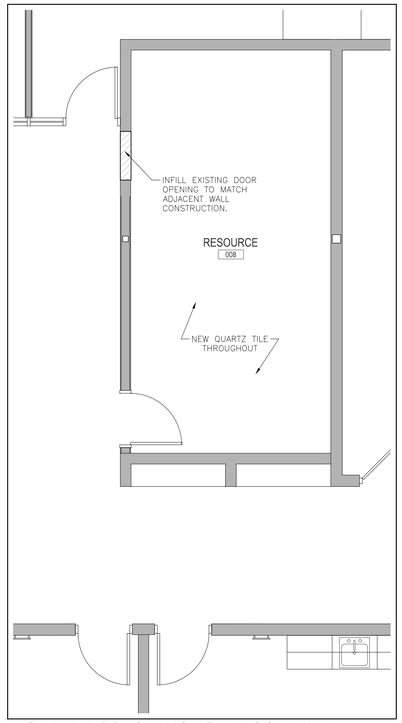


2 PART CONSTRUCTION FLOOR PLAN
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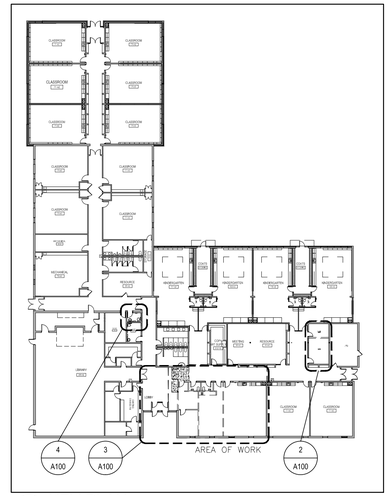


1 KEY PLAN
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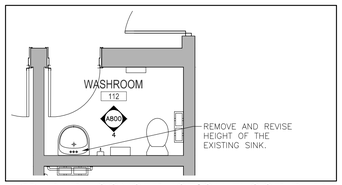


3 PART CONSTRUCTION FLOOR PLAN
SCALE = 1:50

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KEY PLAN

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|---|---|---|
| 05/16/2017 | ISSUED FOR TENDER | 1 |

ONTARIO ASSOCIATION OF ARCHITECTS
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PROJECT TITLE:
GREGORY HOGAN CATHOLIC SCHOOL OFFICE RENOVATION

DRAWING TITLE:
CONSTRUCTION FLOOR PLAN

| DATE PLOTTED: | DRAWN: | DRAWING No. |
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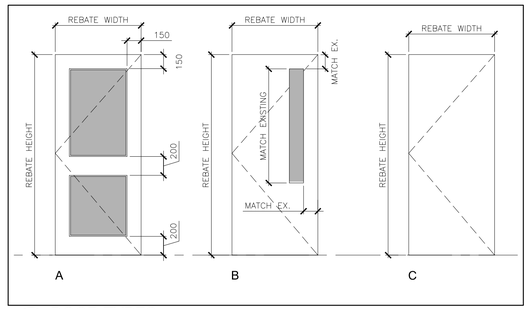
| PROJECT No. 1717 | | |




4 DOOR TYPES
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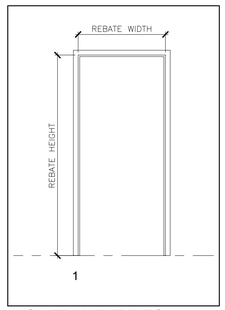


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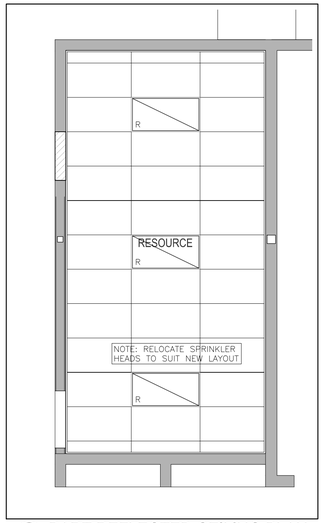


2 PART REFLECTED CEILING PLAN
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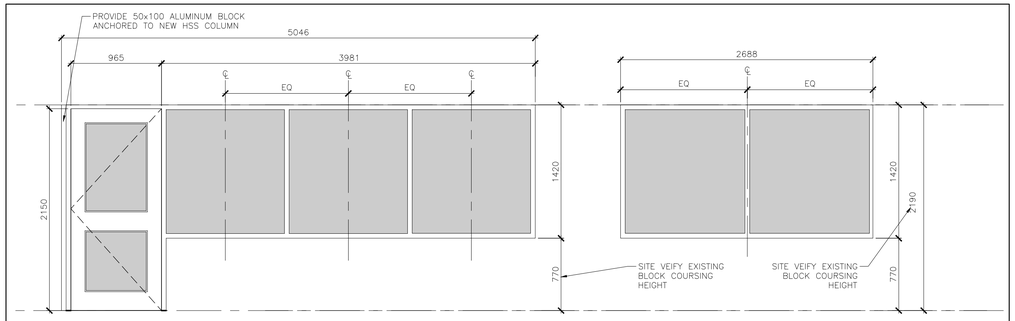
1 PART REFLECTED CEILING PLAN
SCALE = 1:50




5 SCREEN TYPES
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**DOOR SCHEDULE - REV00** 3/21/2016 **RWAI - 1717**

**Gregory Hogan Catholic School**
St. Clair Catholic District School Board

**Randy Wilson Architect Incorporated**

***CHANGES ARE HIGHLIGHTED, BOLD & ITALICIZED***

## Abbreviations

Refer to Floor Plans for Door Swings

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ALUM** | Aluminum | **GL** | Glass | **PT** | Paint | **EX** | Existing | **STL** | Steel |
| **HM** | Hollow Metal | **TEMP** | 1/4" Tempered | **STN** | Stain | **PL** | Lead Lined | **CRL** | C.R. Laurence |
| **SS** | Stainless Steel | **PGW** | Polished Georgian Wired | **ANOD** | Clear Anodized | **COMP** | Composite Assembly | **BES** | Besam |
| **WD** | Wood | **PHEN** | Phenolic | **N/A** | Not Applicable | **BP** | Bent Steel Plate | **WD** | Wood |

| Door No. | Room From | Room To | Rebate Width | Rebate Height | Door Type | Door System | Door Material | Door Finish | Door Glass | Door Film | Door Grille | Frame Type | Frame Material | Frame Finish | Frame Profile | Frame Glass | Rating | Hardware Groups | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-001 | Lobby | Reception | 965 | 2150 | A | - | ALUM | ANOD | GL | - | - | - | ALUM | ANOD | - | GL | | Admin Office Lock | Refer to screen type SC1 |
| D-002 | Reception | Office | 965 | 2150 | B | - | HM | PT | GL | - | - | 1 | HM | PT | 1 | - | | Office Lock | |
| D-003 | Reception | Office | 965 | 2150 | B | - | HM | PT | GL | - | - | 1 | HM | PT | 1 | - | | Office Lock | |
| D-004 | Corridor | Staff Room | 965 | 2150 | B | - | HM | PT | GL | - | - | 1 | HM | PT | 1 | - | | Classroom Func. | |
| D-005 | Staff Room | Washroom | 965 | 2150 | C | - | HM | PT | - | - | - | 1 | HM | PT | 1 | - | | WR lock | |
| D-006 | Classroom | Washroom | 965 | 2150 | C | - | HM | PT | - | - | - | 1 | HM | PT | 1 | - | | WR lock | |

**FINISH SCHEDULE**
**Gregory Hogan Catholic School**
St. Clair Catholic District School Board

Randy Wilson Architect Incorporated - 1717

| | TAG | MANUFACTURER | MATERIAL CODE | COLOUR | REMARKS |
|---|---|---|---|---|---|
| 1 | QUARTZ | PRCEDO | | | |
| 2 | PT 1 | BENJAMIN MOORE | N/A | Match Existing | Field colour, including bulkheads. Eggshell finish. |
| 3 | PT 2 | BENJAMIN MOORE | N/A | Match Existing | Door and window frames. Eggshell finish. |
| 4 | RB | ROPPE | PINNACLE | 193-BLACK BROWN | 100mm high |
| 5 | WS | SOLARFECTIVE PRODUCTS LTD. | Solar Shade fabric: 300 Series, 3% | Grey / Beige | 3% Openness / weave |
| 6 | ACT 1 | ARMSTRONG | 770 Cortega | White | 24x48 |
| 7 | PLAM 1 | WILSONART | 7949K-18 | Asian Night | Countertops |
| 8 | PLAM 2 | WILSONART | 10776 | Hardrock Maple | Cubbies and Cabinets |

**ROOM FINISH SCHEDULE** **RWAI - 1717**

**Gregory Hogan Catholic School**
St. Clair Catholic District School Board

**Randy Wilson Architect Incorporated**

***CHANGES ARE HIGHLIGHTED, BOLD & ITALICIZED***

## Abbreviations

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ACT** | Acoustic Ceiling Tile | **EP.PT.** | Epoxy Paint | **GLZ** | Glazing | **OPEN** | Open to adjacent room | **SRTC** | Service Room Traffic Coating |
| **Anod** | Anodized Aluminum Frames | **EPF** | Epoxy Flooring | **GSW** | Glass System Wall | **PCT** | Porcelain Tile | **STO** | Stone |
| **CF** | Clear Finish Strain | **EPW** | Epoxy Wall Coating | **GYP.** | Gypsum Board | **PT** | Paint | **TER** | Terrazzo |
| **CMU** | Concrete Masonry Unit | **EX** | Existing | **HW** | Hardwood | **RES** | Resilient Sht. Flooring/Base | **NVCT** | Non Vinyl Composite Tile |
| **CONC** | Architectural Concrete | **EXP** | Exposed Structure | **IP** | Intumescent Paint | **RUB** | Rubber Flooring/Base | **WB** | Wood base finish to match floor |
| **CPT** | Carpet Tile | **GB** | Gypsum Board | **LIN** | Linoleum | **SB** | Stone Base | **WC** | Wallcovering (# indicates wallcovering type) |
| **CT** | Ceramic Tile | **GLB & S** | Glass Block & Stained Glass | **N/A** | Not Applicable | **SEAL** | Concrete Sealer | **WD** | Woodwork |

| Room No. | Room Name | Floor Material | Floor Finish | Floor Base | North Mat'l | North Finish | East Mat'l | East Finish | South Mat'l | South Finish | West Mat'l | West Finish | Ceiling Mat'l | Ceiling Finish | Ceiling Height | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 001 | RECEPTION | EX | QUARTZ | RUB | EX & NEW CMU | PT | GB | PT | GB | PT | NEW GB & EX CMU | PT | ACT | - | MATCH EX | |
| 002 | OFFICE | EX | QUARTZ | RUB | GB | PT | GB | PT | EX | PT | EX | PT | ACT | - | MATCH EX | |
| 003 | OFFICE | EX | QUARTZ | RUB | GB | PT | GB | PT | EX | PT | GB | PT | ACT | - | MATCH EX | |
| 004 | STAFF ROOM | EX | QUARTZ | RUB | GB | PT | GB | PT | EX | PT | GB | PT | ACT | - | MATCH EX | |
| 005 | WASHROOM | EX | QUARTZ | RUB | EX CMU | PT | GB | PT | GB | PT | GB | PT | ACT | - | MATCH EX | |
| 006 | WASHROOM | EX | QUARTZ | RUB | EX CMU | PT | GB | PT | GB | PT | GB | PT | ACT | - | MATCH EX | |
| 007 | CORRIDOR | EX | QUARTZ | RUB | EX CMU | PT | OPEN | N/A | EX & NEW CMU | PT | OPEN | N/A | EX | - | MATCH EX | Patch floor, wall and ceiling at area where existing cmu was removed. Patch area of terrazzo removed with new quartz tile |
| | LOBBY | EX | QUARTZ | RUB | OPEN | N/A | EX & NEW CMU, NEW GB | PT | EX | N/A | EX | N/A | EX | - | - | Patch area of terrazzo removed with new quartz tile |


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KEY PLAN

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| DATE MM/DD/YYYY | DESCRIPTION | No. |
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| 05/16/2017 | ISSUED FOR TENDER | 1 |

ONTARIO ASSOCIATION OF ARCHITECTS
RANDY R. WILSON
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4000

PROJECT TITLE:
GREGORY HOGAN CATHOLIC SCHOOL OFFICE RENOVATION

DRAWING TITLE:
REFLECTED CEILING PLAN SCHEDULES DOOR AND SCREEN TYPES

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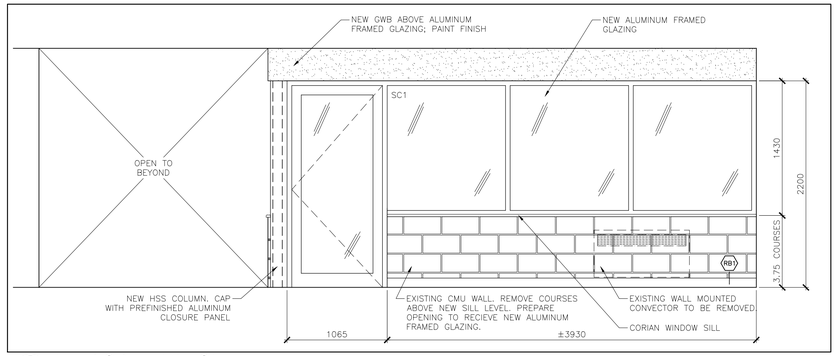
| PROJECT No. 1717 | | |

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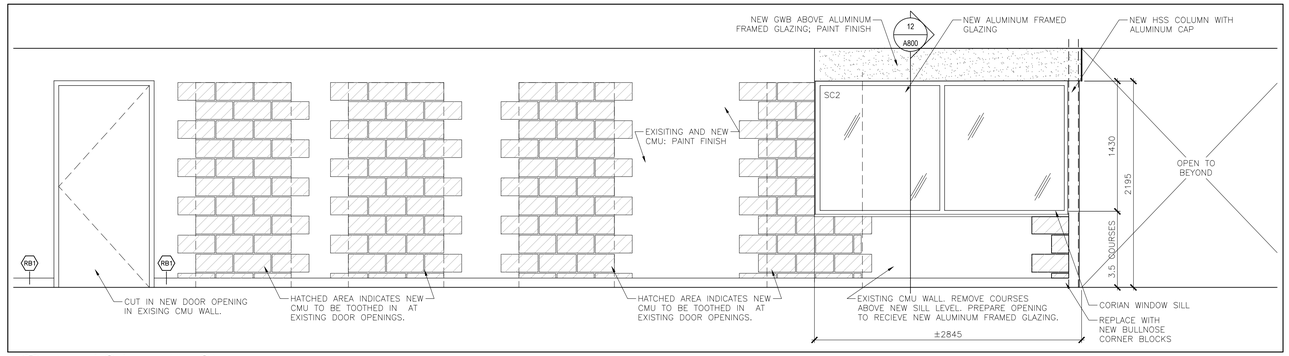


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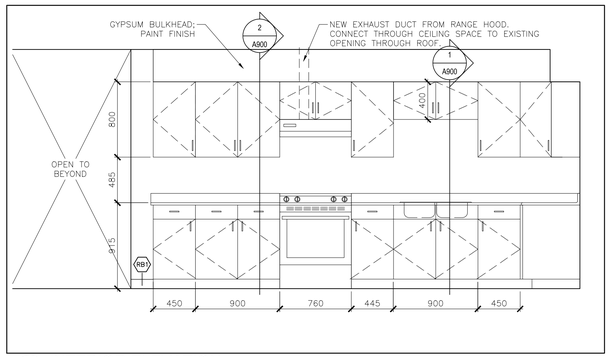


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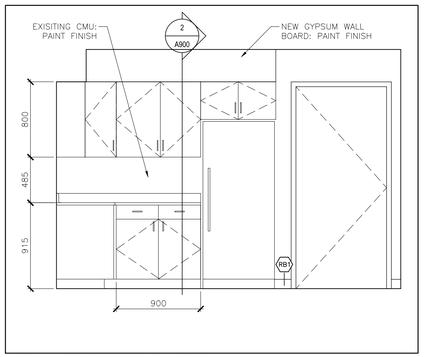


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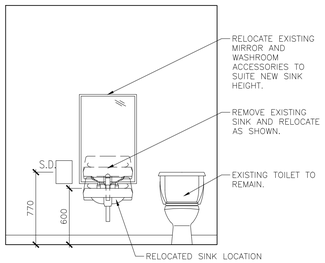


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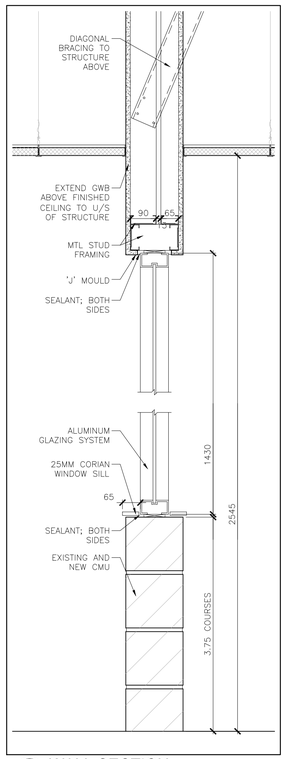
3 RESERVED

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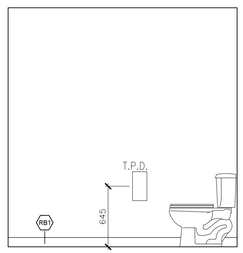


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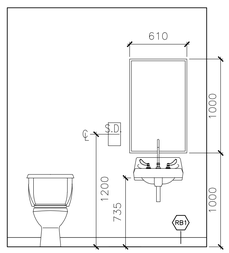


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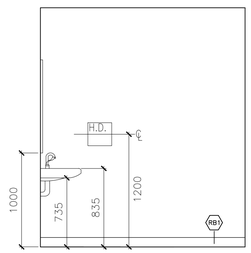


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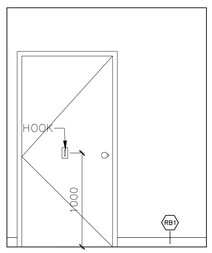


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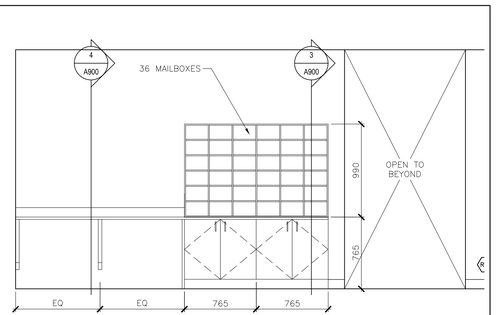


7 INTERIOR ELEVATION
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KEY PLAN

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| 05/16/2017 | ISSUED FOR TENDER | 1 |

ONTARIO ASSOCIATION OF ARCHITECTS
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LICENCE
4000

PROJECT TITLE:
GREGORY HOGAN CATHOLIC SCHOOL OFFICE RENOVATION

DRAWING TITLE:
INTERIOR ELEVATIONS

| DATE PLOTTED: | DRAWN: | DRAWING No. |
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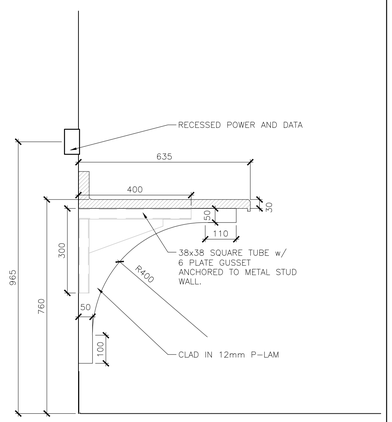


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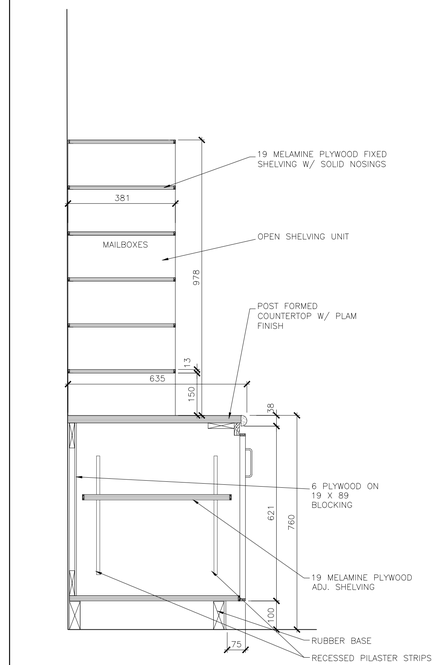


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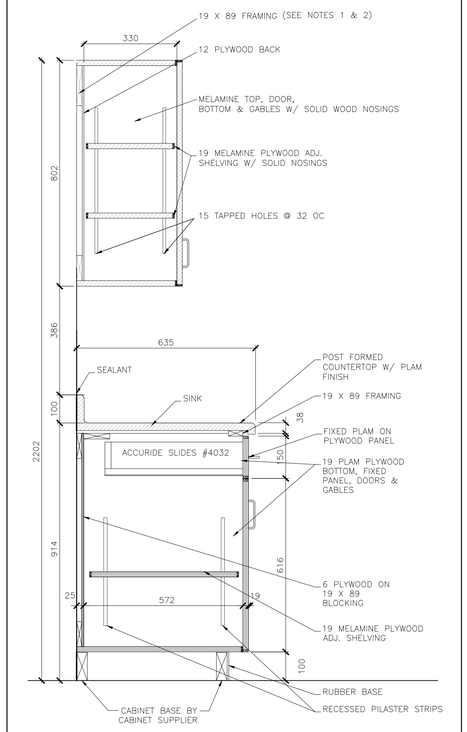


2 MILLWORK SECTION
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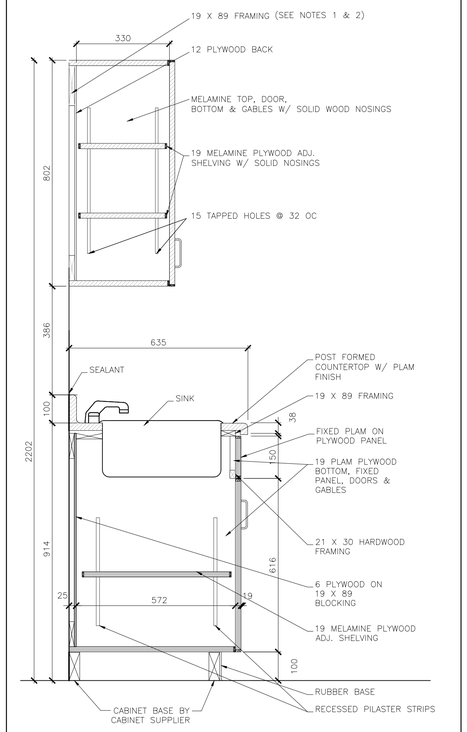


1 MILLWORK SECTION
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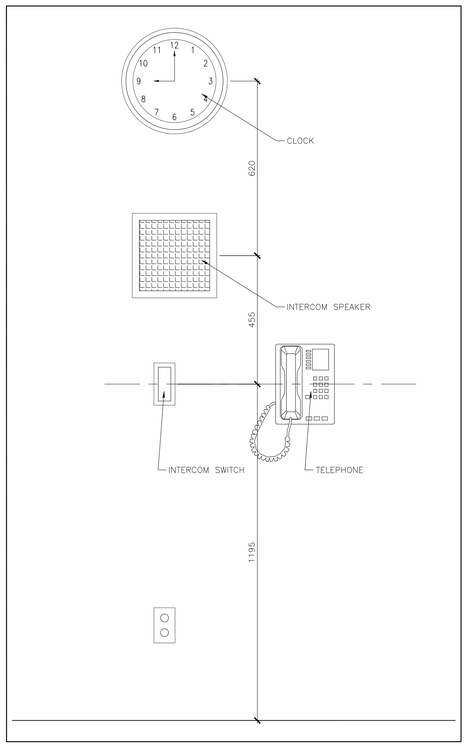



5 MILLWORK SECTION
SCALE = 1:10

RANDY WILSON ARCHITECT INCORPORATED
280 QUEENS AVENUE, SUITE 1Q
LONDON, ONTARIO N6B1X3
t. 519.439.0611
f. 519.438.5962
e. randy@rwarchitect.ca
www.rwarchitect.ca

KEY PLAN

NOTES

LEGEND

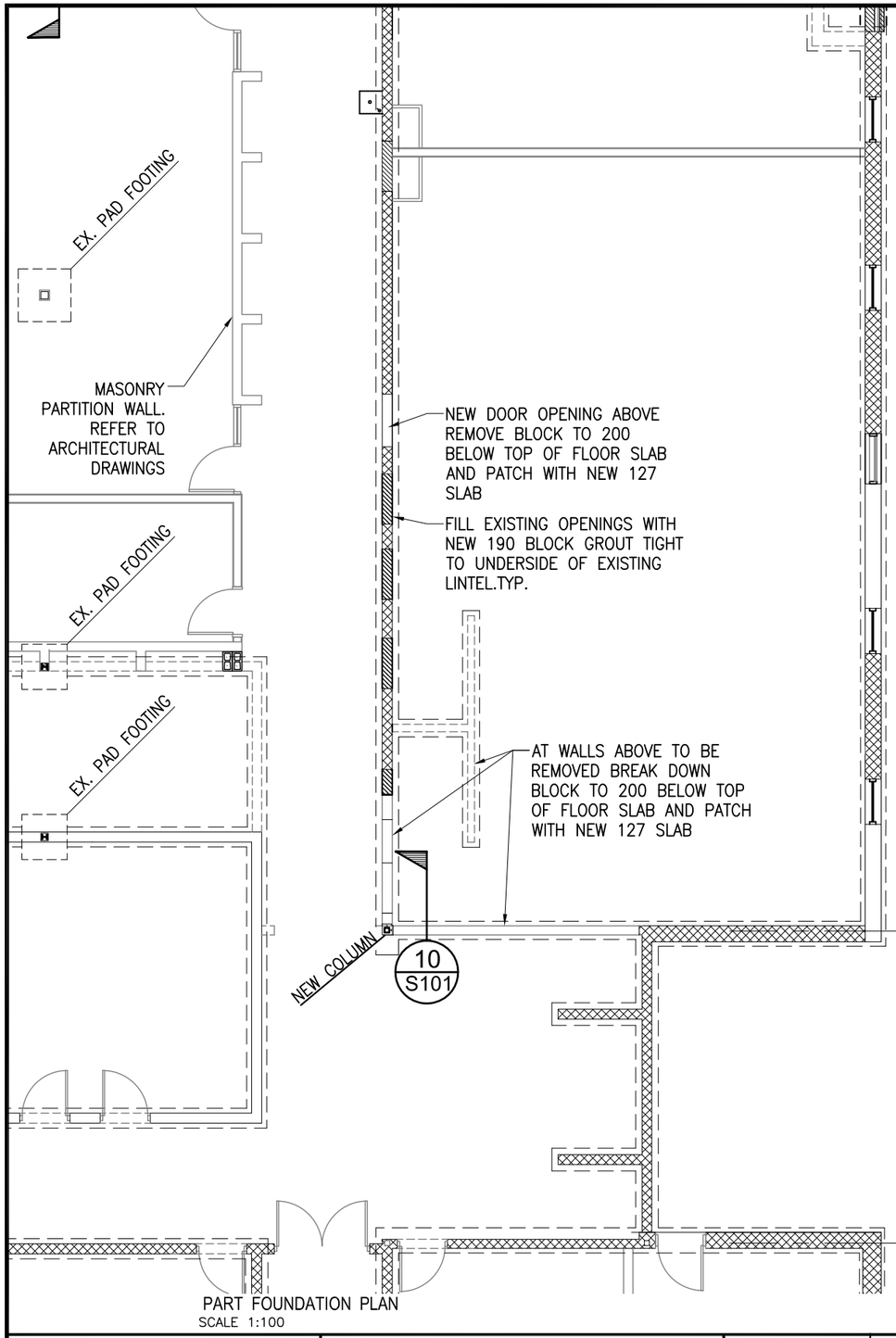
| DATE MM/DD/YYYY | DESCRIPTION | No. |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| 05/16/2017 | ISSUED FOR TENDER | 1 |

ONTARIO ASSOCIATION OF ARCHITECTS
RANDY R. WILSON
LICENCE
4000

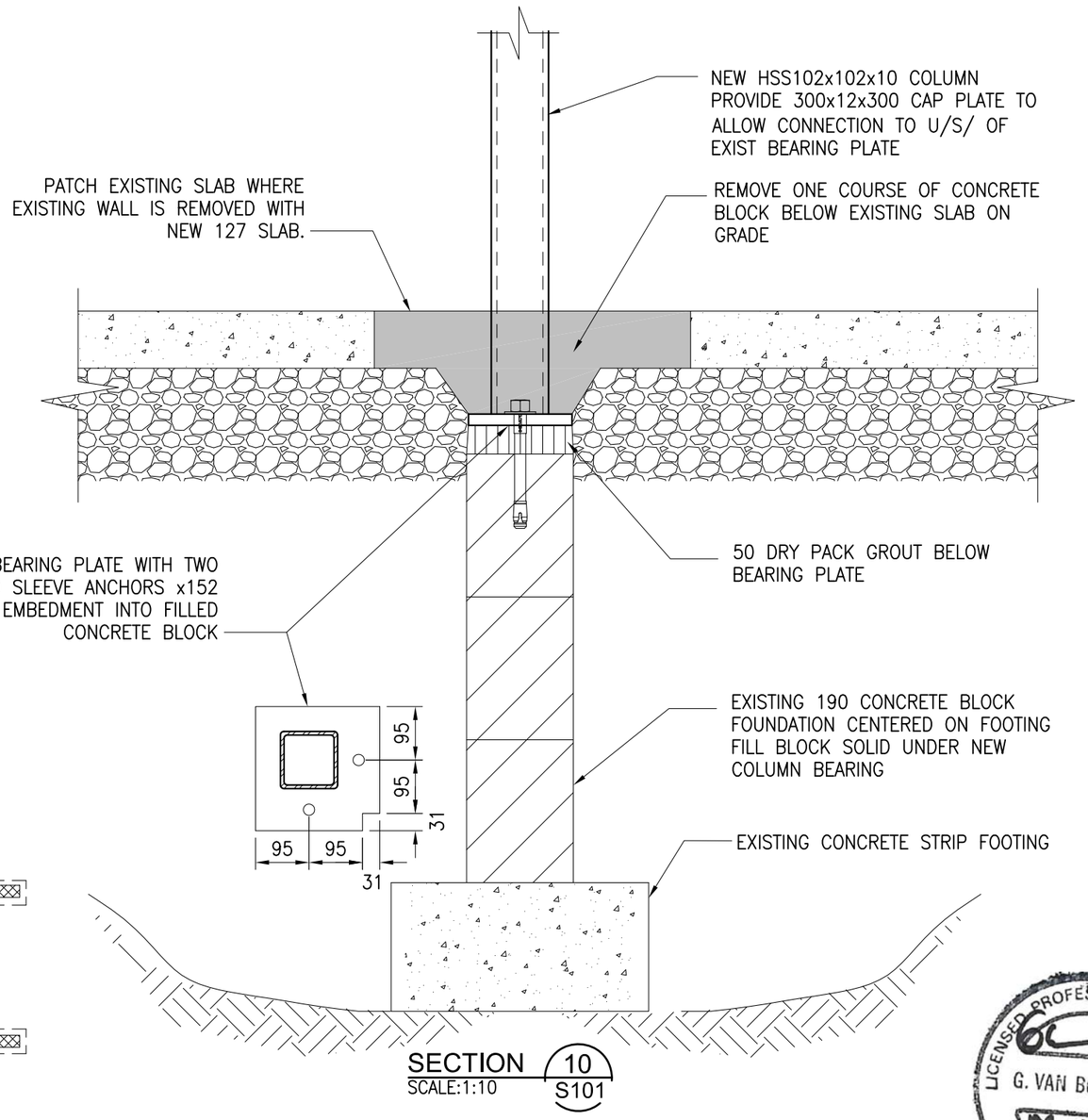
PROJECT TITLE:
GREGORY HOGAN CATHOLIC SCHOOL OFFICE RENOVATION

DRAWING TITLE:
MILLWORK DETAILS

| DATE PLOTTED: | DRAWN: | DRAWING No. |
|---|---|---|
| 05/16/2017 6:38 PM | MFPU | A900 |
| SCALE: AS NOTED | CHECKED: RW | |
| PROJECT No. 1717 | | |




PART FOUNDATION PLAN
SCALE 1:100




SECTION 10/S101
SCALE:1:10

LICENSED PROFESSIONAL ENGINEER
G. VAN BOXMEER
May 10/17
PROVINCE OF ONTARIO

VanBoxmeer & Stranges Ltd.
STRUCTURAL ENGINEERS
458 Queens Avenue, London, Ontario N6B 1X9
tel. (519) 433-4661 fax. (519) 433-6420

NOTES

NORTH

| DATE MM/DD/YYYY | DESCRIPTION | No. |
|---|---|---|
| | | |

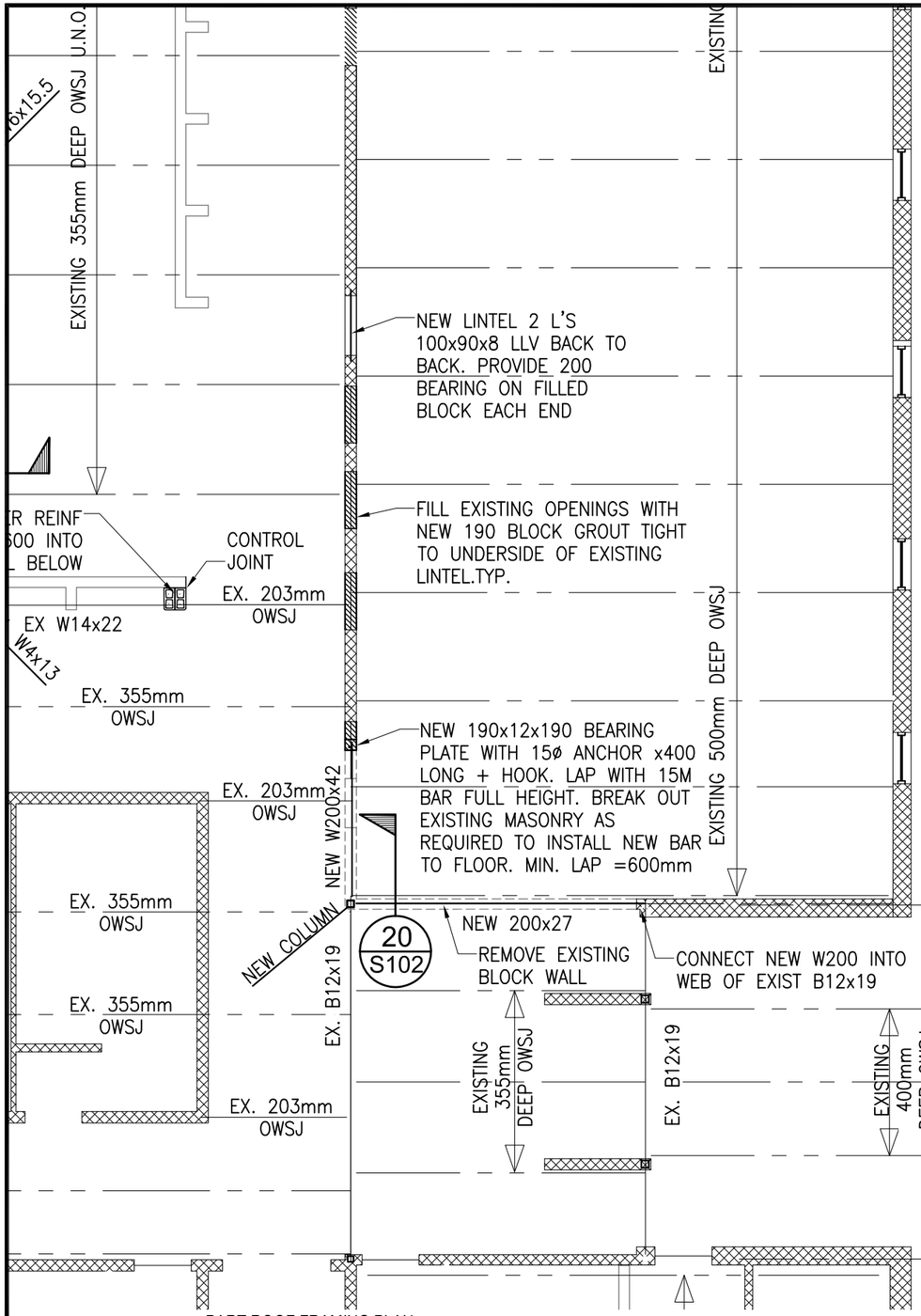
PROJECT TITLE:
GREGORY HOGAN
OFFICE RENOVATION

DRAWING TITLE:
PART FOUNDATION PLAN AND SECTION

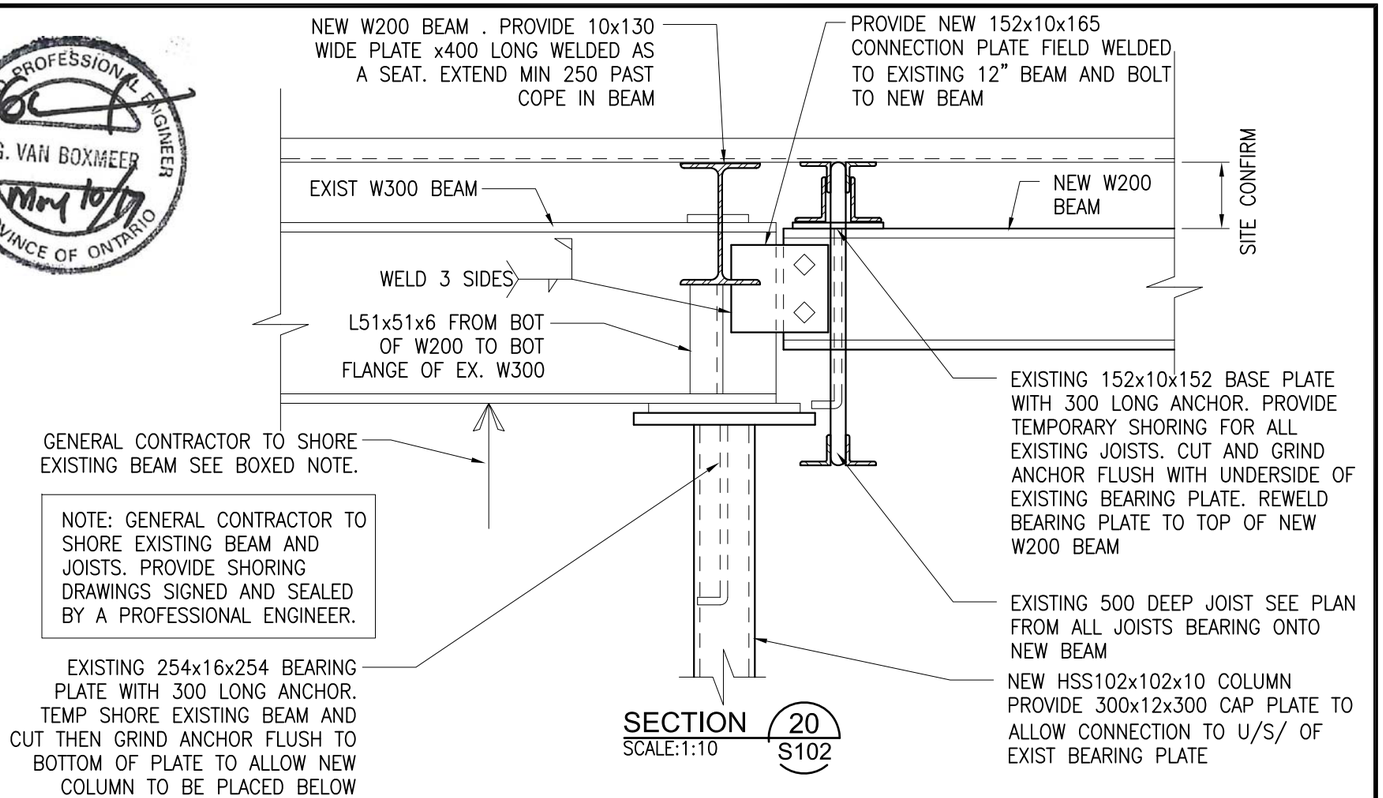
| SCALE: | DRAWN: | CHECKED: |
|---|---|---|
| AS NOTED | GVB | GVB |

DATE: May 10, 2017
PROJECT No: 1717 VB+S PROJECT 17154

S101




PART ROOF FRAMING PLAN
SCALE 1:100


SECTION 20/S102
SCALE:1:10

NOTES:

1. ALL CONSTRUCTION TO CONFORM TO THE MINIMUM STANDARDS PRESCRIBED IN THE LATEST EDITION OF THE ONTARIO BUILDING CODE.
2. NEW ROOF FRAMING DESIGNED FOR LIVE SNOW LOAD OF 1.472kPa AND A DEAD LOAD OF 1.1 kPa
3. EXISTING ROOF FRAMING AND STRUCTURE SHOWN ON ALL DRAWINGS HAS BEEN ASSUMED FROM EXISTING DRAWINGS. DISCREPANCIES SHALL BE REPORTED TO THE ENGINEER.
4. TOUCH UP ALL WELDS WITH 2 COATS OF PRIMER PAINT.
5. ALL NEW STRUCTURAL STEEL INCLUDING PLATES, BARS AND ANGLES TO BE G40.21 – GRADE 300W.
6. ALL WELDING TO CONFORM TO:
   i) CSA STANDARD W59–03 "WELDED STEEL CONSTRUCTION" (METAL ARC WELDING).
   ii) CSA STANDARD W55.3–1965(R2008) "RESISTANCE WELDING QUALIFICATION CODE".
   iii) CSA STANDARD W47.1–03 "CERTIFICATION OF COMPANIES FOR FUSION WELDING OF STEEL"
7. AS PER CSA W47.1–03, THE STRUCTURAL STEEL FABRICATOR TO BE CERTIFIED BY THE CANADIAN WELDING BUREAU – DIVISION 2.1. ALL STRUCTURAL FIELD WELDING TO BE REFORMED BY A CANADIAN WELDING BUREAU CERTIFIED WELDER.

VanBoxmeer & Stranges Ltd.
STRUCTURAL ENGINEERS
458 Queens Avenue, London, Ontario N6B 1X9
tel. (519) 433-4661 fax. (519) 433-6420

NOTES

NORTH

| DATE MM/DD/YYYY | DESCRIPTION | No. |
|---|---|---|
| | | |

PROJECT TITLE:
GREGORY HOGAN
OFFICE RENOVATION

DRAWING TITLE:
PART ROOF FRAMING
PLAN AND SECTION

| SCALE: | DRAWN: | CHECKED: |
|---|---|---|
| AS NOTED | GVB | GVB |

DATE: May 10, 2017
PROJECT No: 1717
VB+S PROJECT 17154

S102

## HEAT PUMPS

| DRAWING REFERENCE | MANUFACTURER | MODEL NUMBER | COOLING CAPACITY | | AIR QUANTITY [l/s] | EXTERNAL STATIC PRESSURE [Pa] | WATER FLOW [l/s] | MAX. WATER PRESSURE DROP [kPa] | HEATING CAPACITY [kW] | ELECTRICAL | | | MIN EER | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | TOTAL [kW] | SENSIBLE [kW] | | | | | | VOLTAGE | MCA | MOCP | | |
| HP-402 | McQUAY | WGSH0121 | 3.61 | 2.82 | 190 | 95 | 0.16 | 25 | 4.66 | 208/1/60 | 6.8 | 15 | 13.6 | SUPPLIED BY OWNER AND INSTALLED BY CONTRACTOR |
| HP-404 | McQUAY | WGSH0241 | 7.10 | 5.48 | 380 | 95 | 0.32 | 25 | 8.40 | 208/1/60 | 19.9 | 30 | 15.4 | SUPPLIED BY OWNER AND INSTALLED BY CONTRACTOR |

* COOLING SELECTIONS BASED ON 23.8/17.2°C ENTERING AIR, 32.2°C ENTERING WATER, 38.8°C LEAVING WATER
** MAXIMUM PRESSURE DROP INCLUDES LOSSES THROUGH SUPPLY AND RETURN HOSES
*** HEATING SELECTION BASED ON 21.1°C ENTERING AIR, 20.0°C ENTERING WATER

## GRILLES, REGISTERS AND DIFFUSERS

| DRAWING REFERENCE | MANUFACTURER | MODEL | PANEL SIZE mm | NECK SIZE mm | AIR VOLUME l/s | REMARKS |
|---|---|---|---|---|---|---|
| SD-1 | PRICE | SPD/31/B12 | 610x610 | 150ø | 0-65 | STEEL CONSTRUCTION SQUARE PLAQUE DIFFUSER, EQUALIZING GRID, WHITE FINISH |
| SD-2 | PRICE | SPD/31/B12 | 610x610 | 200ø | 66-110 | STEEL CONSTRUCTION SQUARE PLAQUE DIFFUSER, EQUALIZING GRID, WHITE FINISH |
| RG-1 | PRICE | PDDR/3/B12 | 610x610 | 560x560 | 0-790 | STEEL CONSTRUCTION PERFORATED FACE GRILLE, HINGED FACE, WHITE FINISH |
| EG-1 | PRICE | 80/TB/B12 | 300x300 | 250x250 | 0-225 | ALUMINUM CONSTRUCTION CEILING GRILLE, 15mm x 15mm x 15mm GRID CORE, T-BAR LAY-IN BORDER, WHITE FINISH |

## ABBREVIATIONS

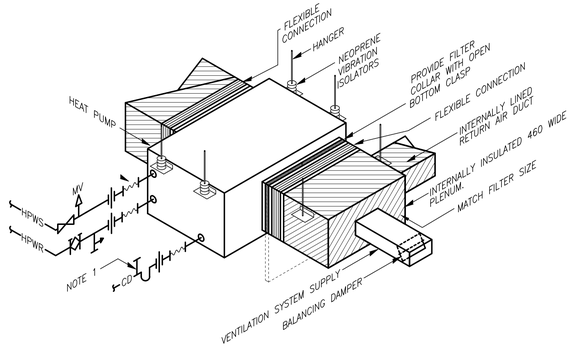
| | | | | | |
|---|---|---|---|---|---|
| AFF | ABOVE FINISHED FLOOR | HWRT | DOMESTIC HOT WATER RETURN | RA | RETURN AIR |
| APPROX | APPROXIMATE | HX | HEAT EXCHANGER | RG | RETURN AIR GRILLE |
| DB | DECIBEL | KW | KILOWATT | REM | REMOVE |
| D.B. | DRY-BULB TEMPERATURE | L/S | LITRES PER SECOND | REL | RELOCATE |
| E.A.T | ENTERING AIR TEMPERATURE | L.A.T. | LEAVING AIR TEMPERATURE | RPM | REVOLUTIONS PER MINUTE |
| EA | EXHAUST AIR | L.W.T. | LEAVING WATER TEMPERATURE | RR | RETURN AIR REGISTER |
| EF | EXHAUST FAN | MAX | MAXIMUM | SA | SUPPLY AIR |
| EG | EXHAUST AIR GRILLE | MCA | MINIMUM CIRCUIT AMPACITY | SD | SUPPLY AIR DIFFUSER |
| E.W.T. | ENTERING WATER TEMPERATURE | MIN | MINIMUM | SENS | SENSIBLE |
| ESP | EXTERNAL STATIC PRESSUREXXXX | NO | NUMBER | SG | SUPPLY AIR GRILLE |
| FA | FACE AREA | NTS | NOT TO SCALE | SP | STATIC PRESSURE |
| HP | HEAT PUMP | O/A | OUTSIDE AIR | TSP | TOTAL STATIC PRESSURE |
| HP | HORSEPOWER | Pa | PASCALS | W.B. | WET-BULB |

## MECHANICAL LEGEND

| SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION |
|---|---|---|---|---|---|
| — | DOMESTIC COLD WATER | | CONCENTRIC REDUCER | | INTERNALLY LINED DUCTWORK |
| — - — | DOMESTIC HOT WATER | | STRAINER | BD | BALANCING DAMPER |
| — - - — | DOMESTIC HOT WATER RECIRCULATING | | FLEXIBLE CONNECTOR | FD | FIRE DAMPER |
| SAN | SANITARY DRAIN | | CAP | | HORIZONTAL HEAT PUMP |
| ST | STORM DRAIN | AV | AUTOMATIC AIR VENT | | SUPPLY DIFFUSER/GRILLE/REGISTER |
| CD | CONDENSATE DRAIN | MV | MANUAL AIR VENT | | RETURN GRILLE/REGISTER |
| HPWS | HEAT PUMP WATER SUPPLY | FFD | FUNNEL FLOOR DRAIN | | EXHAUST GRILLE/REGISTER |
| HPWR | HEAT PUMP WATER RETURN | RD | ROOF DRAIN | A1 | PLUMBING FIXTURE DESIGNATION |
| SP | FIRE PROTECTION SPRINKLER SYSTEM | T | THERMOSTAT/TEMPERATURE SENSOR | HP 401 | HORIZONTAL HEAT PUMP UNIT DESIGNATOR |
| NAME | PIPING ABOVE FLOOR OR GRADE | FEX | FIRE EXTINGUISHER - SURFACE MOUNTED | SD-1 100 | DIFFUSER/REGISTER/GRILLE DESIGNATOR TYPE AND AIR QUANTITY |
| NAME | PIPING BELOW FLOOR OR GRADE | FEX | FIRE EXTINGUISHER CABINET - RECESSED | BAL 60 | BALANCE EXISTING DIFFUSER/REGISTER/GRILLE TO INDICATED AIR QUANTITY |
| NAME | PIPING TO BE REMOVED | | CONCEALED SPRINKLER HEAD | EX | EXISTING EQUIPMENT TO REMAIN |
| NAME | PIPING TO REMAIN | | EXISTING DUCTWORK (SINGLE LINE) | 160 | AIR BALANCING DESIGNATOR |
| | SHUT-OFF VALVE | | EXISTING DUCTWORK TO BE REMOVED (SINGLE LINE) | REL | EXISTING EQUIPMENT TO BE RELOCATED |
| | COMBINATION SHUT-OFF & BALANCING VALVE | | EXISTING DUCTWORK | REM | EXISTING EQUIPMENT TO BE REMOVED |
| | DRAIN WITH HOSE CONNECTION | | DUCTWORK TO BE REMOVED | | |
| FPWH | FREEZE PROOF WALL HYDRANT | | NEW DUCTWORK | | |
| | UNION | | EXTERNALLY INSULATED DUCTWORK | | |
| CO | CLEANOUT PLUG | | | | |
| CO | CLEANOUT IN FLOOR | | | | |

## MECHANICAL DRAWING LIST



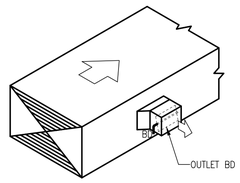



### HEAT PUMP INSTALLATION DETAIL WITH DUCTED RETURN

N.T.S.

NOTES:

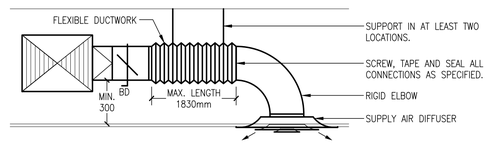
1. TRAP IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. PROVIDE LINE SIZE VERTICAL VENT MIN. 80mm LONG.




| OUTLET BD SIZES | |
|---|---|
| BRANCH SIZE (mm) | AIR VOLUME(L/S) |
| 200x150 | 0-95 |
| 200x200 | 96-150 |
| 250x200 | 151-190 |
| 250x250 | 191-265 |

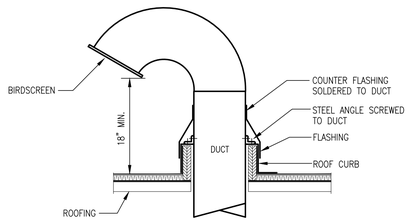
### TYPICAL VENTILATION SYSTEM SUPPLY OUTLET

N.T.S.



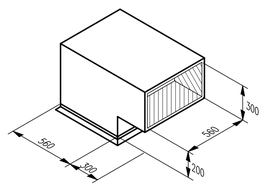

### TYPICAL RUNOUT TO SUPPLY DIFFUSER

SCALE: 1:100




### ROOF MOUNTED TURNED DOWN WEATHERHOOD

NTS

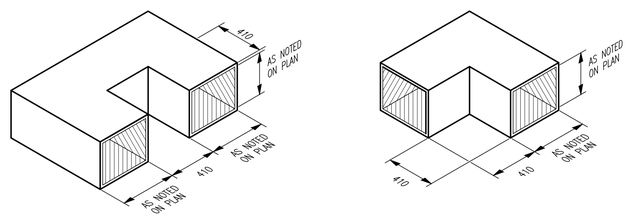



### CEILING RETURN GRILLE & BOOT DETAIL

N.T.S.

NOTE:

1. INTERNALLY LINE DUCTWORK.




### TRANSFER DUCT DETAILS

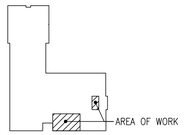
N.T.S.

NOTE:

1. INTERNALLY LINE DUCTWORK.


Chorley+Bisset
CONSULTING ENGINEERS
369 YORK ST., SUITE 2B, LONDON ON, CANADA N6B 3R4
P: 519-679-8660 F: 519-679-2145 chorley.com


ST. CLAIR CATHOLIC DISTRICT SCHOOL BOARD
*Lighting the Way ~ Rejoicing in Our Journey*




KEY PLAN

## NOTES

DO NOT SCALE THE DRAWINGS. ALL MEASUREMENTS ARE TO BE CHECKED AND VERIFIED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT BEFORE PROCEEDING WITH THE WORK.



## LEGEND

| | | |
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| | | |
| 05/17/2017 | ISSUED FOR TENDER | 1 |
| DATE MM/DD/YYYY | DESCRIPTION | No. |

LICENCED PROFESSIONAL ENGINEER
D. L. DAWE
PROVINCE OF ONTARIO

PROJECT TITLE:
GREGORY HOGAN CATHOLIC SCHOOL OFFICE RENOVATION

DRAWING TITLE:
MECHANICAL LEGEND, DRAWING LIST, SCHEDULES, ABBREVIATIONS AND DETAILS

| | | |
|---|---|---|
| DATE PLOTTED: 05/17/2017 2:07 PM | DRAWN: GDS | DRAWING No. M100 |
| SCALE: 1:100 | CHECKED: DLD | |
| PROJECT No. 8209 | | |

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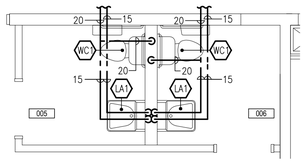
DATE PLOTTED: 17-May-2017 2:07 PM




DETAIL A M200 | M200

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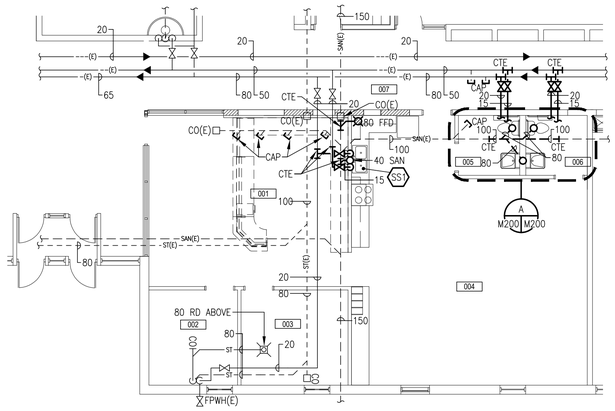
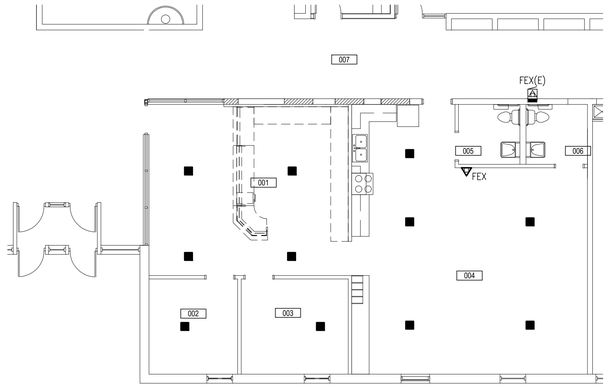


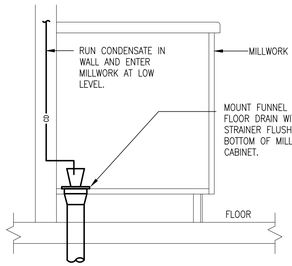

PART FLOOR PLAN
PLUMBING

SCALE: 1:100



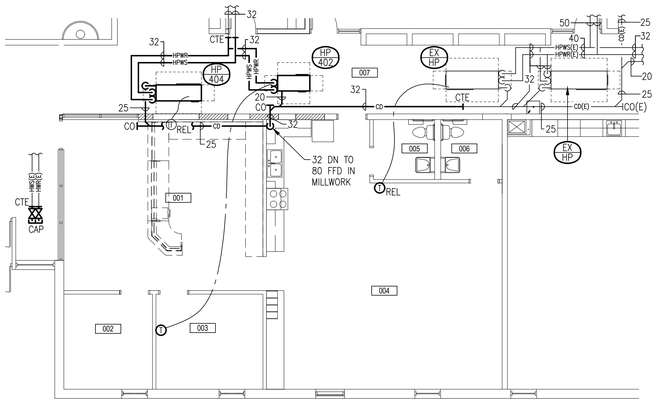

PART FLOOR PLAN
FIRE PROTECTION

SCALE: 1:100



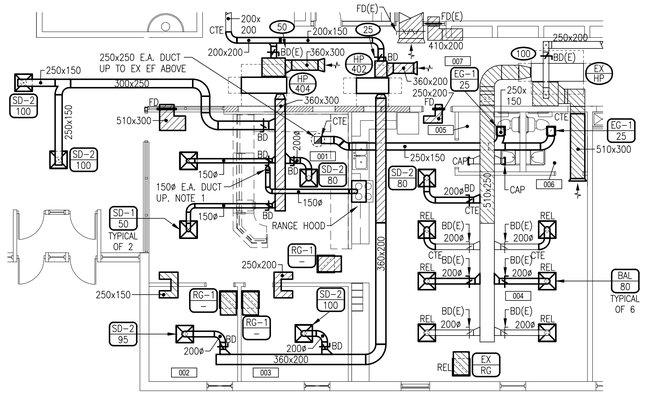

FUNNEL FLOOR DRAIN
MILLWORK MOUNTING DETAIL

NTS




PART FLOOR PLAN
HEATING

SCALE: 1:100

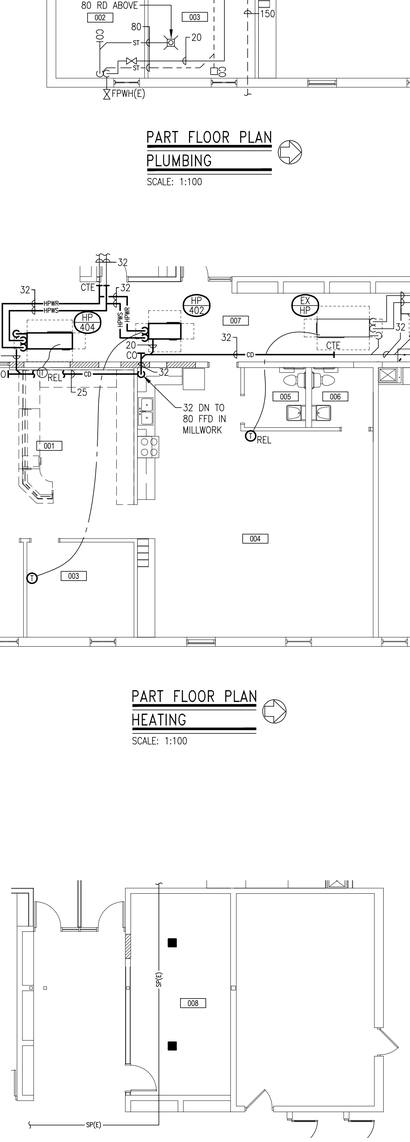



PART FLOOR PLAN
AIR DISTRIBUTION

SCALE: 1:100

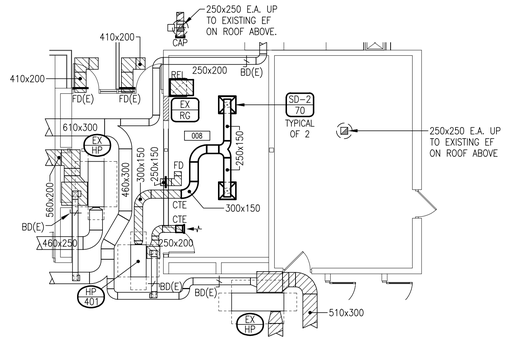
NOTES:

1. RUN NEW RANGE HOOD EXHAUST UP TO TURN DOWN ON ROOF ABOVE. REVISE EXISTING OPENING TO SUIT NEW DUCT SIZE. SEE DETAIL ON M100.




PART FLOOR PLAN
FIRE PROTECTION

SCALE: 1:100




PART FLOOR PLAN
AIR DISTRIBUTION

SCALE: 1:100

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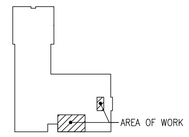


KEY PLAN

## NOTES

DO NOT SCALE THE DRAWINGS. ALL MEASUREMENTS ARE TO BE CHECKED AND VERIFIED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT BEFORE PROCEEDING WITH THE WORK.



## LEGEND

| DATE MM/DD/YYYY | DESCRIPTION | No. |
|---|---|---|
| 05/17/2017 | ISSUED FOR TENDER | 1 |

LICENCED PROFESSIONAL ENGINEER
D. L. DAWE
PROVINCE OF ONTARIO

PROJECT TITLE:
GREGORY HOGAN CATHOLIC SCHOOL OFFICE RENOVATION

DRAWING TITLE:
PART FLOOR PLANS MECHANICAL

| DATE PLOTTED: | DRAWN: | DRAWING No. |
|---|---|---|
| 05/17/2017 2:02 PM | GDS | M200 |
| SCALE: 1:100 | CHECKED: DLD | |
| PROJECT No. 8209 | | |

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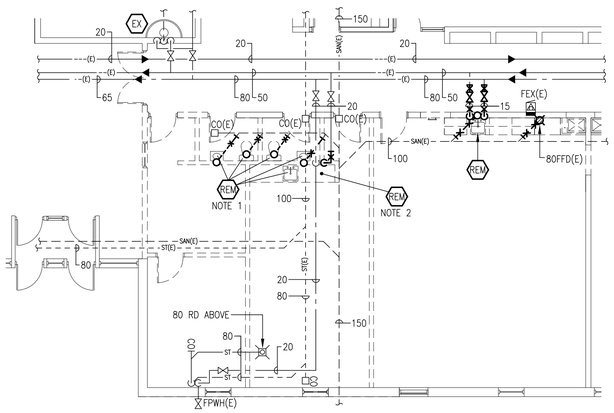
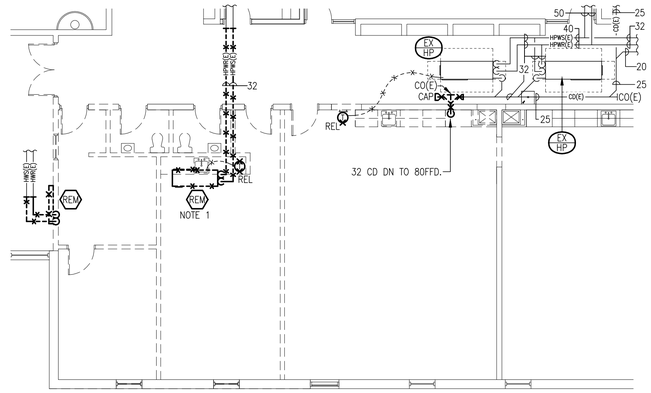



## PART FLOOR PLAN
## PLUMBING – DEMOLITION

SCALE: 1:100

NOTES:

1. REMOVE EXISTING FIXTURES. CAP SANITARY BELOW FLOOR. CUT BACK CW AND HW (NOT SHOWN) SERVING FIXTURE TO MAINS AND CAP.
2. REMOVE EXISTING DISHWASHER AND ALL ASSOCIATED PIPING.

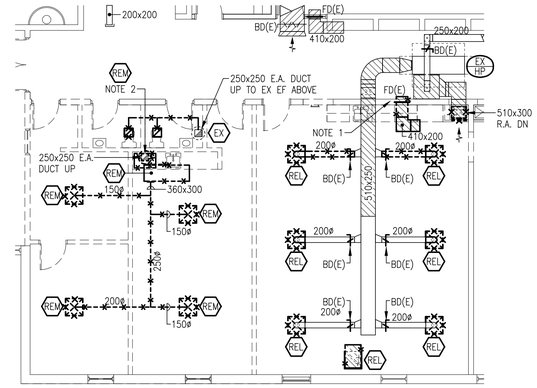



## PART FLOOR PLAN
## HEATING – DEMOLITION

SCALE: 1:100

NOTES:

1. REMOVE EXISTING CD PIPING ALL THE WAY BACK TO DRAIN LOCATION. REMOVE DRAIN AND CAP BELOW FLOOR. PATCH FLOOR TO MATCH EXISTING. (NOT SHOWN)
2. RELOCATE EXISTING THERMOSTATS. SEE DRAWING M200 FOR NEW LOCATIONS.

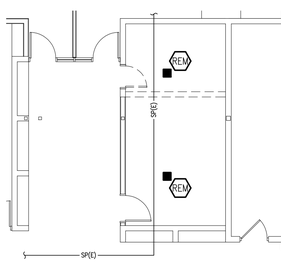



## PART FLOOR PLAN
## AIR DISTRIBUTION – DEMOLITION

SCALE: 1:100

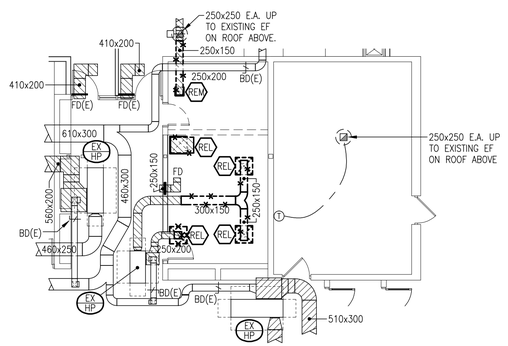
NOTES:

1. REMOVE EXISTING FIRE DAMPER AND PATCH OPENING.
2. REMOVE EXISTING RANGE HOOD, DUCTWORK AND EXISTING FAN ON ROOF ABOVE.




## PART FLOOR PLAN
## FIRE PROTECTION – DEMOLITION

SCALE: 1:100




## PART FLOOR PLAN
## AIR DISTRIBUTION – DEMOLITION

SCALE: 1:100

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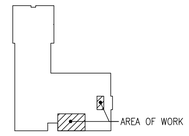
P: 519-679-8660 F: 519-679-2145 chorley.com

ST. CLAIR CATHOLIC DISTRICT SCHOOL BOARD
*Lighting the Way ~ Rejoicing in Our Journey*




KEY PLAN

## NOTES

DO NOT SCALE THE DRAWINGS. ALL MEASUREMENTS ARE TO BE CHECKED AND VERIFIED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT BEFORE PROCEEDING WITH THE WORK.



## LEGEND

| DATE MM/DD/YYYY | DESCRIPTION | No. |
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| 05/17/2017 | ISSUED FOR TENDER | 1 |

LICENCED PROFESSIONAL ENGINEER
D. L. DAWE
PROVINCE OF ONTARIO

PROJECT TITLE:
GREGORY HOGAN CATHOLIC SCHOOL OFFICE RENOVATION

DRAWING TITLE:
PART FLOOR PLANS MECHANICAL DEMOLITION

| DATE PLOTTED: | DRAWN: | DRAWING No. |
|---|---|---|
| 05/17/2017 2:12 PM | GDS | M300 |
| SCALE: 1:100 | CHECKED: DLD | |
| PROJECT No. 8209 | | |

FILE NAME: 8209M300.DWG
DATE SAVED: 17-May-2017 2:11 PM
DATE PLOTTED: 17-May-2017 2:12 PM

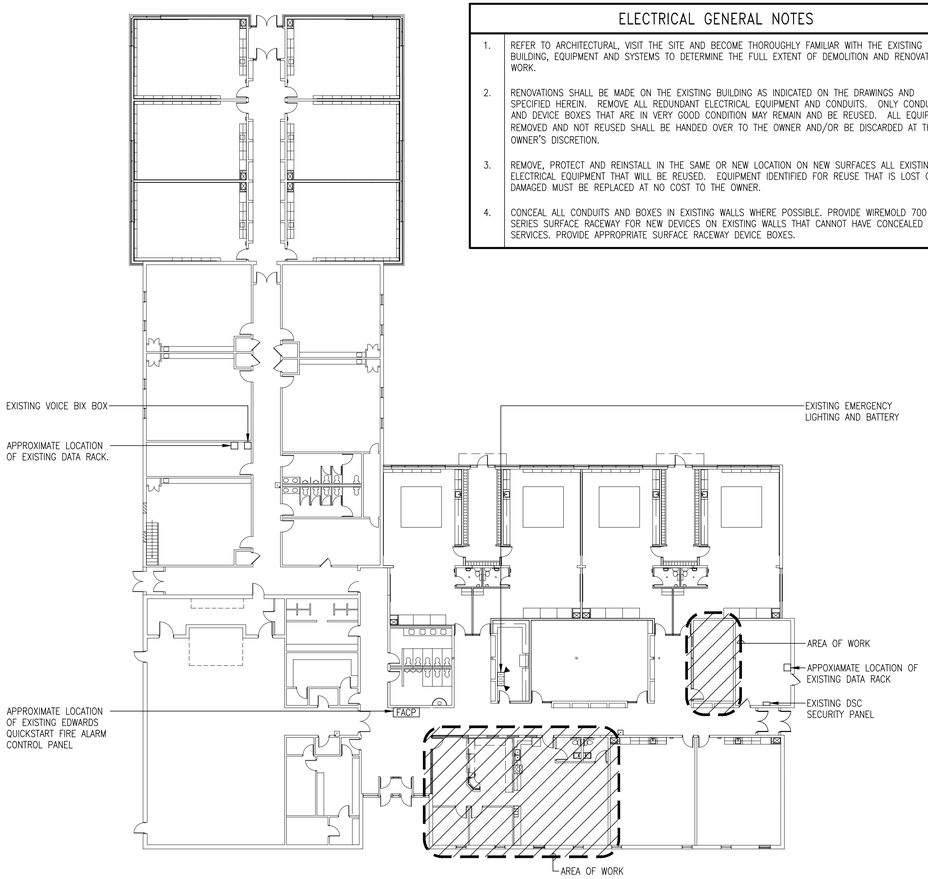
## ELECTRICAL LEGEND

| SYMBOL | DESCRIPTION | MOUNTING |
|---|---|---|
| A | LED LUMINAIRE – NORMAL POWER | SEE LUMINAIRE SCHEDULE |
| A | LED LUMINAIRE – NORMAL POWER | SEE LUMINAIRE SCHEDULE |
| A | LED LUMINAIRE – NORMAL POWER | SEE LUMINAIRE SCHEDULE |
| EX | EXIT SIGN | CEILING MOUNTED |
| | EMERGENCY BATTERY PACK c/w DUAL HEADS | WALL MOUNTED |
| | EMERGENCY LIGHT REMOTE HEAD | SURFACE MOUNTED |
| | EMERGENCY LIGHT REMOTE DUAL HEADS | CEILING MOUNTED |
| S | SINGLE POLE SWITCH | 1100mm (43") A.F.F. |
| S3 | THREE-WAY SWITCH | 1100mm (43") A.F.F. |
| | OCCUPANCY SENSOR. REFER TO SPECIFICATION | 1100mm (43") A.F.F. |
| | OCCUPANCY SENSOR | WALL MOUNTED AT CEILING |
| | OCCUPANCY SENSORS | CEILING |
| | 15/20 AMP 120 VOLT 3 WIRE GROUNDED DUPLEX RECEPTACLE CSA 5-20R | 460mm (18") A.F.F. |
| | 15/20 AMP 120 VOLT 3 WIRE GROUNDED DUPLEX RECEPTACLE CSA 5-20R | ABOVE COUNTER |
| R | 50 AMP 250 VOLT 4 WIRE GROUNDED RANGE RECEPTACLE | 200mm (8") A.F.F. |
| | TWO 15/20 AMP 120 VOLT 3 WIRE GROUNDED DUPLEX RECEPTACLES UNDER COMMON PLATE | 460mm (18") A.F.F. |
| | DIRECT POWER CONNECTION | AS NOTED |
| | MOTOR | |
| H | BARRIER FREE PUSH BUTTON | |
| D | DOOR POSITION SWITCH – CONCEALED | TOP OF FRAME |
| M | MOTION DETECTOR | WALL AT CEILING |
| KP | KEY PAD | 1070mm (42") A.F.F. |
| C | CARD READER | 1070mm (42") A.F.F. |
| SV | SUPERVISED VALVE | AS NOTED |

| SYMBOL | DESCRIPTION | MOUNTING |
|---|---|---|
| D | HAND DRYER | |
| | ELECTRICAL PANEL | SEE PANEL SCHEDULE |
| P | PROJECTOR | |
| | SHORT THROW PROJECTOR | |
| | DATA OUTLET | 460mm (18") A.F.F. |
| | DATA OUTLET – TWO JACKS | 460mm (18") A.F.F. |
| | DATA AND TELEPHONE OUTLET | 460mm (18") A.F.F. |
| W | TELEPHONE OUTLET (WALL MOUNTED PHONE) | 1220mm (48") A.F.F. |
| | SECURITY BUZZER AND CAMERA | |
| | SECURITY BUZZER AND CAMERA RECEIVER | |
| | EMERGENCY PUSH BUTTON | |
| IC | INTERCOM | 1100mm (43") A.F.F. |
| | CLOCK | WALL MOUNTED |
| RC | ROOM CONTROLLER | ABOVE CEILING |
| RC D | ROOM CONTROLLER – DIMMING | ABOVE CEILING |
| PS | PAGING SPEAKER | CEILING MOUNTED (SURFACE) |
| | SMOKE DETECTOR | CEILING MOUNTED |
| | HEAT DETECTOR | CEILING MOUNTED |
| | FIRE ALARM HORN c/w VISUAL STROBE | 2235mm (88") A.F.F. |
| FACP | FIRE ALARM CONTROL PANEL | WALL 1800mm (70" A.F.F.) TO TOP OF UNIT |
| EOLR | END OF LINE RESISTOR | WALL 1800mm (70" A.F.F.) |
| | GENERAL CIRCUIT CONDUIT | |

## ELECTRICAL GENERAL NOTES

1. REFER TO ARCHITECTURAL, VISIT THE SITE AND BECOME THOROUGHLY FAMILIAR WITH THE EXISTING BUILDING, EQUIPMENT AND SYSTEMS TO DETERMINE THE FULL EXTENT OF DEMOLITION AND RENOVATION WORK.
2. RENOVATIONS SHALL BE MADE ON THE EXISTING BUILDING AS INDICATED ON THE DRAWINGS AND SPECIFIED HEREIN. REMOVE ALL REDUNDANT ELECTRICAL EQUIPMENT AND CONDUITS. ONLY CONDUITS AND DEVICE BOXES THAT ARE IN VERY GOOD CONDITION MAY REMAIN AND BE REUSED. ALL EQUIPMENT REMOVED AND NOT REUSED SHALL BE HANDED OVER TO THE OWNER AND/OR BE DISCARDED AT THE OWNER'S DISCRETION.
3. REMOVE, PROTECT AND REINSTALL IN THE SAME OR NEW LOCATION ON NEW SURFACES ALL EXISTING ELECTRICAL EQUIPMENT THAT WILL BE REUSED. EQUIPMENT IDENTIFIED FOR REUSE THAT IS LOST OR DAMAGED MUST BE REPLACED AT NO COST TO THE OWNER.
4. CONCEAL ALL CONDUITS AND BOXES IN EXISTING WALLS WHERE POSSIBLE. PROVIDE WIREMOLD 700 SERIES SURFACE RACEWAY FOR NEW DEVICES ON EXISTING WALLS THAT CANNOT HAVE CONCEALED SERVICES. PROVIDE APPROPRIATE SURFACE RACEWAY DEVICE BOXES.




ELECTRICAL KEY PLAN

SCALE: 1:250

## MECHANICAL EQUIPMENT SCHEDULE

| EQUIPMENT SUPPLIED AND INSTALLED BY DIVISION 15, WIRED BY DIVISION 16 | | | | | | | CONTROL EQUIPMENT SUPPLED AND INSTALLED BY DIVISION 16 | | BREAKER SIZE | POLES | CONDUCTOR SIZE | CONDUIT SIZE | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ITEM | DESCRIPTION | LOCATION | hp | MCA | PHASE | VOLTS | STARTER / CONTROL TYPE | FED FROM | | | | | NOTES |
| HP-402 | HEAT PUMP | CORRIDOR | | 6.8 | 1 | 208 | DS | PANEL HP1 | 15 | 2 | 2 # 12 | 21mm | |
| HP-404 | HEAT PUMP | CORRIDOR | | 19.9 | 1 | 208 | DS | PANEL HP1 | 20 | 2 | 2 # 12 | 21mm | |

NOTES:

1. DIVISION 16 TO OBTAIN COPIES OF MECHANICAL EQUIPMENT SHOP DRAWINGS AND COORDINATE ELECTRICAL SERVICES.
2. PROVIDE LOCAL NON-FUSED DISCONNECT SWITCHES AT MOTORS IN ACCORDANCE WITH SECTION 28-604 OF THE ONTARIO ELECTRICAL SAFETY CODE.
3. UNLESS INDICATED OTHERWISE ALL CONTROL WIRING IS BY DIVISION 15.

## MOTOR CONTROL ABBREVIATIONS

| | | | |
|---|---|---|---|
| DC | DIRECT CONNECTION | CON | CONTACTOR |
| DS | UN-FUSED DISCONNECT SWITCH | MCA | MINIMUM CIRCUIT AMPACITY |
| FHP | FRACTIONAL HORSE POWER | MCC | MOTOR CONTROL CENTRE |
| FVNR | FULL VOLTAGE NON-REVERSING STARTER C/W H.O.A. SWITCH | SW | SWITCH |

## LUMINAIRE SCHEDULE

| TYPE | MANUFACTURER | MOUNTING | | LAMPS | VOLTS | SYSTEM WATTS | EQUAL MANUFACTURERS | NOTES |
|---|---|---|---|---|---|---|---|---|
| | | TYPE | HEIGHT | | | | | |
| RR1 | EXISTING 610 x 1220, 2-28W T8 TROFFER TO BE RE-LAMPED AND INSTALLED AT NEW LOCATION | RECESSED | CEILING | 2-28W T8 | 120V | 53W | – | NOTE 4 |
| A2 | LITHONIA CAT # 2GTL4-48L-EZ1-LP840 610mm x 1220mm SPECIFICATION GRADE TROFFER, PROVIDE 3mm (1/8") THICK ACRYLIC LENS | RECESSED | CEILING | 4800LU LED | 120 | 40W | CFI, COLUMBIA, METALUX, VISIONEERING | |
| A3 | LITHONIA CAT # 2GTL4-60L-EZ1-LP840 610mm x 1220mm SPECIFICATION GRADE TROFFER, PROVIDE 3mm (1/8") THICK ACRYLIC LENS | RECESSED | CEILING | 5600LU LED | 120 | 47W | CFI, COLUMBIA, METALUX, VISIONEERING | |
| B1 | LITHONIA CAT # GTL4-30L-EZ1-LP840 305mm x 1220mm SPECIFICATION GRADE TROFFER, PROVIDE 3mm (1/8") THICK ACRYLIC LENS | RECESSED | CEILING | 3200LU LED | 120 | 30W | CFI, COLUMBIA, METALUX, VISIONEERING | |

NOTES:

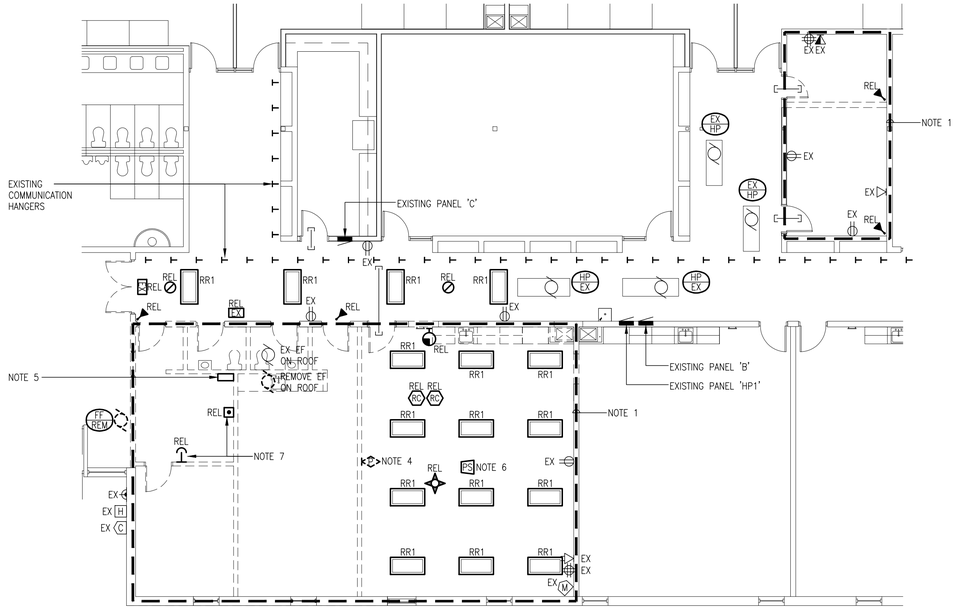
1. REFER TO ARCHITECTURAL REFLECTED CEILING DRAWINGS TO CONFIRM LUMINAIRE MOUNTING PRIOR TO ORDERING. SUPPLY APPROPRIATE MOUNTING CLIPS AND/OR TRIMS AS REQUIRED.
2. PROVIDE ALL ACCESSORIES AS REQUIRED.
3. LUMINAIRE TO COMPATIBLE WITH PROPOSED DIMMER.
4. PROVIDE NEW LAMPS TO SUIT EXISTING LUMINAIRS. REFER TO SPECIFICATIONS

## ELECTRICAL DRAWING LIST



## ABBREVIATIONS

| | | | |
|---|---|---|---|
| +XX | LOCATE XX ABOVE FINISHED FLOOR | REL | IF DASHED – EXISTING TO BE RELOCATED |
| AFF | ABOVE FINISHED FLOOR | REL | IF SOLID – EXISTING IN NEW LOCATION |
| C | CONDUIT | REM | EXISTING TO BE REMOVED |
| EX | EXISTING TO REMAIN | REP | EXISTING TO BE REPLACED WITH NEW |
| P | POLE | RR | REMOVE AND RELOCATE |
| | | WG | WIREGUARD |




ELECTRICAL – DEMOLITION PLAN

SCALE: 1:100

NOTES:

1. COMPLETELY REMOVE ALL LIGHTING, FIRE ALARM, POWER AND COMMUNICATIONS DEVICES WITHIN THE OUTLINED AREA UNLESS OTHERWISE NOTED. MAINTAIN SERVICES TO AREAS NOT UNDER CONSTRUCTION.
2. ALL DEVICES SHOWN ARE FOR REFERENCE PURPOSES ONLY, CONTRACTOR TO VERIFY EXTENT OF DEMOLITION WORK ON SITE.
3. DISCONNECT AND MAKE SAFE EXISTING MECHANICAL EQUIPMENT AS REQUIRED FOR REMOVAL BY DIVISION 15. COMPLETELY REMOVE ALL CONDUIT AND WIRING, AND ASSOCIATED ACCESSORIES BACK TO SOURCE. COORDINATE WITH DIVISION 15
4. EXISTING PROJECTOR TO BE REMOVED BY OWNER PRIOR TO CONSTRUCTION.
5. REMOVE EXISTING PA HEAD END. COORDINATE WITH OWNER'S PA CONTRACTOR. REFER TO CASH ALLOWANCE.
6. EXISTING PAGING SPEAKER TO BE REMOVED AND GIVEN TO OWNER'S PA CONTRACTOR. REFER TO CASH ALLOWANCE.
7. EXISTING ACCESS CONTROL DEVICE TO BE RELOCATED. REFER TO CASH ALLOWANCE.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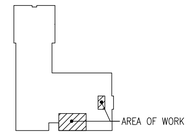


KEY PLAN

## NOTES

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## LEGEND

| DATE MM/DD/YYYY | DESCRIPTION | No. |
|---|---|---|
| 05/17/2017 | ISSUED FOR TENDER | 1 |

LICENCED PROFESSIONAL ENGINEER
R. D. ZOLNIERCZYK
100186455
PROVINCE OF ONTARIO

PROJECT TITLE:
GREGORY HOGAN CATHOLIC SCHOOL OFFICE RENOVATION

DRAWING TITLE:
DRAWING LIST, ELECTRICAL LEGEND, SCHEDULES AND PART ELECTRICAL PLAN DEMOLITION

| DATE PLOTTED: | DRAWN: | DRAWING No. |
|---|---|---|
| 05/17/2017 3:31 PM | TCH | E100 |
| SCALE: AS NOTED | CHECKED: RDZ | |
| PROJECT No. 8209 | | |

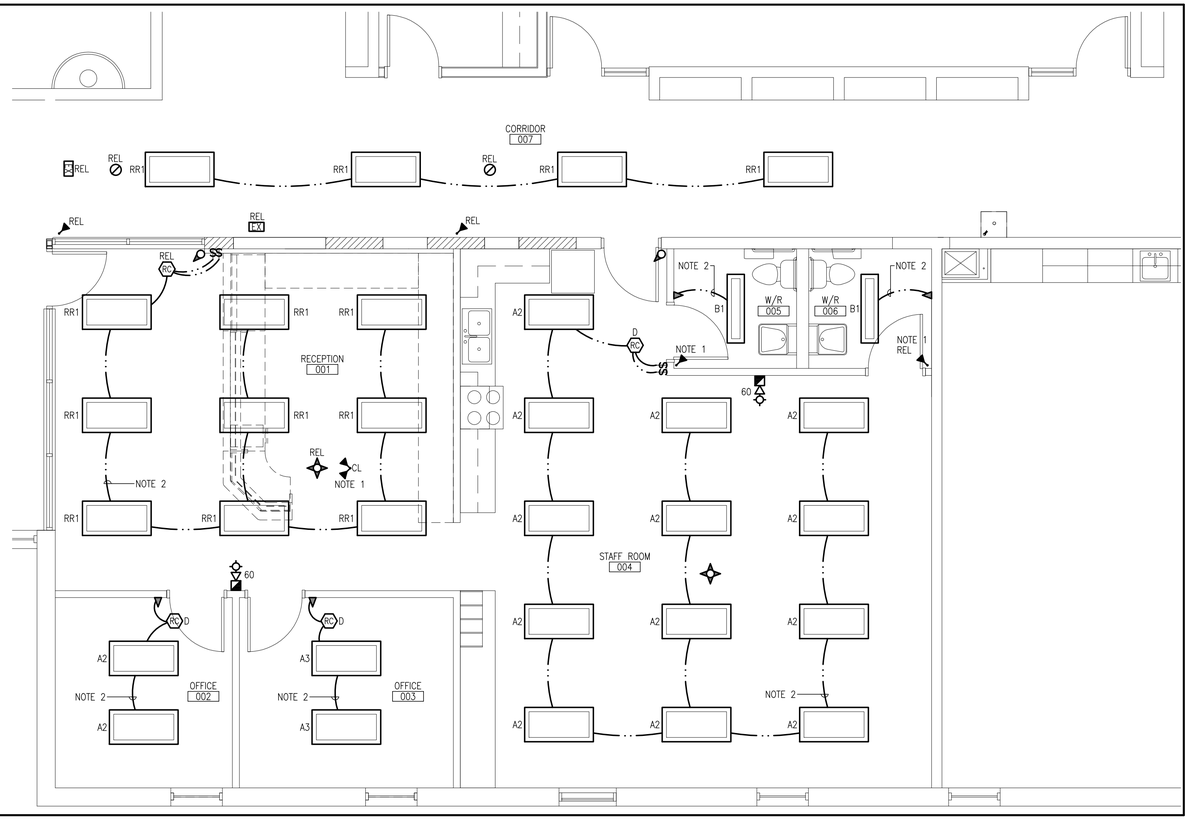
FILE NAME: 8209E001.DWG
TIME SAVED: 17-May-2017 3:15 PM
DATE PLOTTED: 17-May-2017 3:31 PM

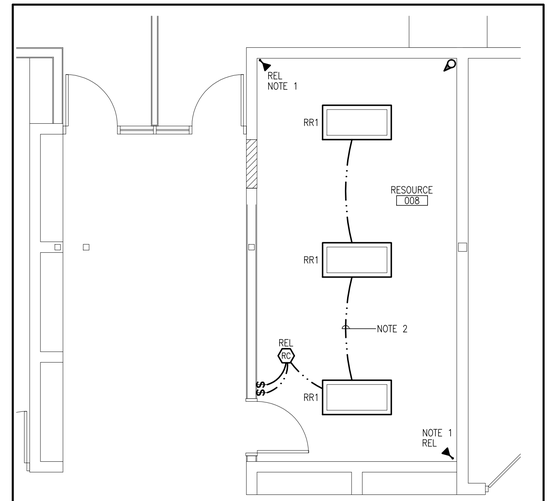
## PART GROUND FLOOR PLAN
## LIGHTING AND FIRE ALARM

SCALE: 1:50

NOTES:

1. CONNECT TO EXISTING EMERGENCY LIGHTING BATTERY. REFER TO ELECTRICAL KEY PLAN.
2. REWORK EXISTING LIGHTING CIRCUIT SERVING AREA AS REQUIRED TO ACCOMMODATE NEW LIGHTING.
3. PROVIDE SWITCHES SUITABLE FOR USE WITH RELOCATED ROOM CONTROLLERS. REUSE EXISTING SWITCHED AS PRACTICABLE.




## PART GROUND FLOOR PLAN
## LIGHTING AND FIRE ALARM

SCALE: 1:50

NOTES:

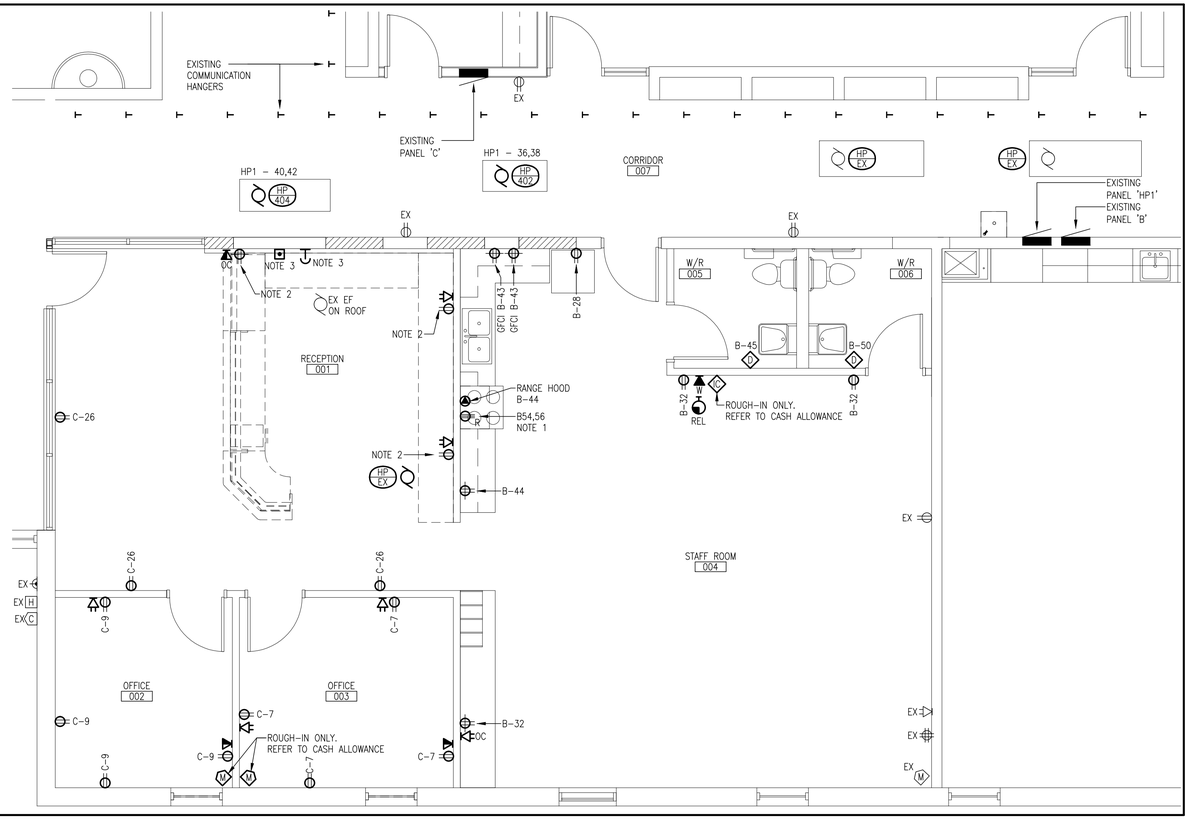
1. REWORK EXISTING EMERGENCY LIGHTING TO LOCATIONS SHOWN AS REQUIRED.
2. REWORK EXISTING LIGHTING CIRCUIT SERVING AREA AS REQUIRED TO ACCOMMODATE NEW LIGHTING.
3. PROVIDE SWITCHES SUITABLE FOR USE WITH RELOCATED ROOM CONTROLLERS. REUSE EXISTING SWITCHES AS PRACTICABLE.

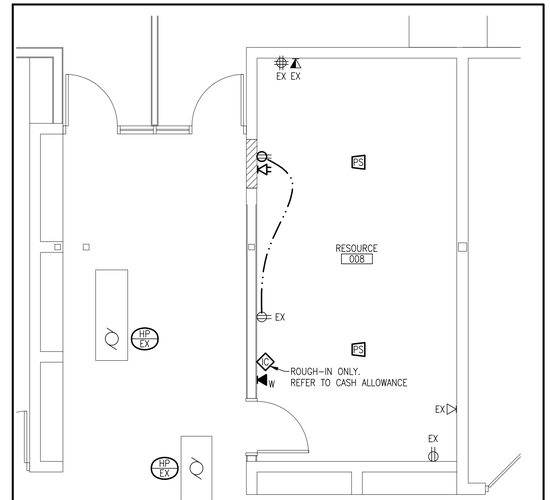
## PART GROUND FLOOR PLAN
## POWER AND SYSTEMS

SCALE: 1:50

NOTES:

1. REWORK EXISTING RANGE CIRCUIT TO NEW LOCATION
2. REWORK EXISTING OFFICE RECEPTACLE CIRCUITS AS REQUIRED TO SUPPLY NEW DEVICES AT NEW LOCATIONS
3. EXISTING DEVICES TO BE RELOCATED. PROVIDE ROUGH-IN AS REQUIRED. COORDINATE WITH ACCESS CONTROL CONTRACTOR. REFER TO CASH ALLOWANCE.




## PART GROUND FLOOR PLAN
## POWER AND SYSTEMS

SCALE: 1:50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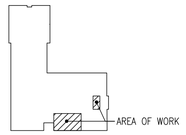


KEY PLAN

## NOTES

DO NOT SCALE THE DRAWINGS. ALL MEASUREMENTS ARE TO BE CHECKED AND VERIFIED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT BEFORE PROCEEDING WITH THE WORK.



## LEGEND

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| 05/17/2017 | ISSUED FOR TENDER | 1 |

LICENSED PROFESSIONAL ENGINEER
R. D. ZOLNIERCZYK
100186455
PROVINCE OF ONTARIO

PROJECT TITLE:
GREGORY HOGAN CATHOLIC SCHOOL OFFICE RENOVATION

DRAWING TITLE:
PART FLOOR PLANS ELECTRICAL

| DATE PLOTTED: | DRAWN: | DRAWING No. |
|---|---|---|
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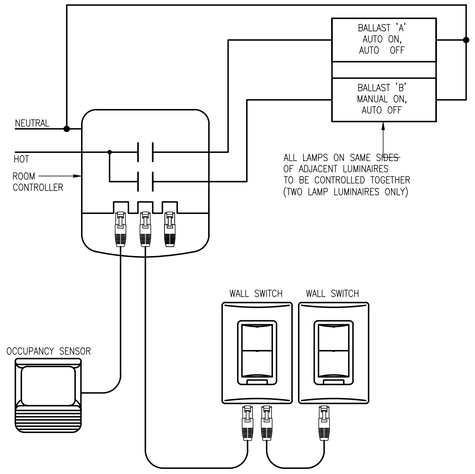
| SCALE: 1:50 | CHECKED: RDZ | |
| PROJECT No. 8209 | | |

FILE NAME: E200R000.DWG
PLOT DATE: 17-May-2017 3:30 PM
DATE PLOTTED: 17-May-2017 3:31 PM

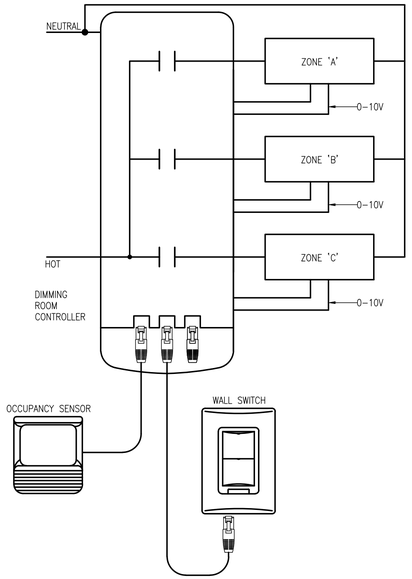



## OFFICE AND CLASSROOM OCCUPANCY SENSOR SCHEMATIC

N.T.S.

NOTES:

1. TYPICAL FOR ALL ROOMS WITH AN 'RC' CONTROLLER. REFER TO FLOOR PLANS.
2. ELECTRICAL CONTRACTOR TO INSTALL CONTROLLERS ABOVE SWITCH IN ACCESSIBLE CEILING SPACE. WHERE LOCATED IN EXPOSED CEILING, ELECTRICAL CONTRACTOR TO INSTALL CONTROLLER IN 305mm x 305mm D BOX.
3. ALL CONCEALED LOW VOLTAGE WIRING TO BE IN CONDUIT. CONDUIT AND WIRING SUPPLIED AND INSTALLED BY ELECTRICAL CONTRACTOR. REFER TO SPECIFICATION SECTION 16550 FOR PERMISSIBLE WIRING METHODS.
4. CONTRACTOR TO TEST ALL CIRCUITS WITH MANUAL ON/OFF BUTTONS ON RELAY PACKS PRIOR TO INSTALLATION OF LOW-VOLTAGE WIRING.




## DLM DETAIL

N.T.S.

NOTES:

1. TYPICAL FOR ALL ROOMS WITH AN 'RC' CONTROLLER. REFER TO FLOOR PLANS.
2. ELECTRICAL CONTRACTOR TO INSTALL CONTROLLERS ABOVE SWITCH IN ACCESSIBLE CEILING SPACE. WHERE LOCATED IN EXPOSED CEILING, ELECTRICAL CONTRACTOR TO INSTALL CONTROLLER IN 305mm x 305mm D BOX.
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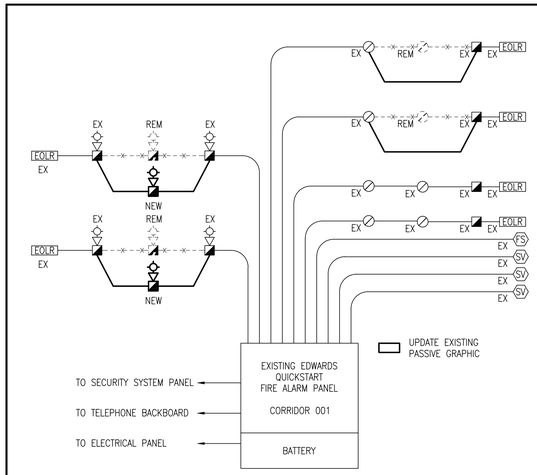
4. CONTRACTOR TO TEST ALL CIRCUITS WITH MANUAL ON/OFF BUTTONS ON RELAY PACKS PRIOR TO INSTALLATION OF LOW-VOLTAGE WIRING.




## FIRE ALARM RISER

N.T.S.

NOTES:

1. WIRE AND CONNECT ALTERNATE SIGNAL HORNS TO SEPARATE SIGNAL CIRCUITS SO ADJACENT HORN STROBES ARE NOT CONNECTED TO THE SAME CIRCUIT.
2. MOUNT END OF LINE RESISTORS BESIDE LAST DEVICE. DOCUMENT LOCATION OF END OF LINE RESISTORS AND PLACE INSIDE FIRE ALARM CONTROL PANEL.
3. WIRE AND CONNECT FIRE ALARM SYSTEM AS REQUIRED BY THE MANUFACTURER.
4. REFER TO FLOOR PLANS FOR DEVICE LOCATIONS AND QUANTITIES AND ZONE LOCATIONS AND QUANTITIES.
5. LABEL EXISTING END OF LINE RESISTORS WITH ZONE NUMBER.

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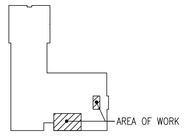


KEY PLAN

## NOTES

DO NOT SCALE THE DRAWINGS. ALL MEASUREMENTS ARE TO BE CHECKED AND VERIFIED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT BEFORE PROCEEDING WITH THE WORK.



## LEGEND

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| 05/17/2017 | ISSUED FOR TENDER | 1 |

LICENSED PROFESSIONAL ENGINEER
R. D. ZOLNIERCZYK
100186455
PROVINCE OF ONTARIO

PROJECT TITLE:
GREGORY HOGAN
CATHOLIC SCHOOL
OFFICE RENOVATION

DRAWING TITLE:
RISERS AND DETAILS

| DATE PLOTTED: | DRAWN: | DRAWING No. |
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| 05/17/2017 3:31 PM | TCH | E300 |
| SCALE: AS NOTED | CHECKED: RDZ | |
| PROJECT No. 8209 | | |

FILE NAME: R:\PROJECTS\8209 GREGORY HOGAN\CAD\E300.dwg
DATE PLOTTED: 17-May-2017 3:31 PM